CHAPTER 2

ROTIFERS OF RIVER VISHWAMITRI: A STUDY ON ITS MORPHOLOGY AND MORPHOMETRY

Rotifera are amongst the smallest of the extant metazoa, typically ranging from 0.1 to 1mm in length. When these animals were first observed under the microscope they were mistakenly thought to be ciliated protozoa! The study of rotifers began with the invention of the microscope by the microscopist Anthony van Leeuwenhoek (1632-1723); he is credited with their discovery (Dobell, 1960). He however, considered them as protozoans, Dutrochet was the first to regard them as a separate biological group distinct from Protozoa and called them rotifera (Dhanapathi, 2000). Other early works include that of Louis Joblot (1645-1723), Otto Friderich Müller (1730-1784), Bory de St. Vincent (1778-1846), Christian Gottfroed Ehrenberg (1795-1876), Thomas Henry Huxley (1825-1895), C.T Hudson (1828-1903) and P H. Gosse (1810-1888) the latter two published the important work 'The Rotifera or Wheeled Animalcules' in 1886. Rotifers have invariably been treated as a class of Phylum Aschelminthes or even as a distinct phylum by some authors and they exhibit many structural features common with Gastrotricha and Nematoda (Sharma, 1991). These fascinating creatures have long been called as Rotifera or 'Wheeled Animalcules' as their disc-like anterior end (corona) bears resemblance to a pair of revolving wheels owing to the synchronized beating of their coronal cilia. These are also characterised by a specialised pharynx called mastax, with its cuticular lining differentiated into trophi, which act as jaws. The trophi of rotifers are important systematic features used in separating classes, orders and families but some types of trophi vary in such a way that species can be recognised on the basis of the details of trophi alone (Edmondson, 1963; Shiel, 1995). Almost all rotifer trophi

consist of seven separate basic pieces (Figure 2.ii). Based on the relative development of these parts, different types of trophi are recognised. The main types are:

(1) Malleate (Figure 2.iv)

(2) Virgate (Figure 2.v)

(3) Cardate

(4) Forcipate (Figure 2.iii)

(5) Incudate (Figure 2.vi)

(6) Unicate (Figure 2.vii)

(7) Ramate (Figure 2.viii)

Despite their tiny size, rotifers constitute some of the most abundant and important members of the freshwater zoofauna, along with the protozoa and crustacea. Rotifers are typically transparent, but can appear to be green, brown, red, or orange, depending on the colouration of the digestive tract. They are found in many diverse and temporary habitats, including gutters and the water trapped within mosses. Whilst the vast majority of the rotifers are denizens of freshwater, a number of marine and semi-terrestrial species also occur. The rotifers show a worldwide distribution, possess striking ability to colonise diversified biotopes and indicate rapid turn over rates. Similarly the rotiferan lifestyle is diverse, with solitary, colonial, swimming, crawling, parasitic and sessile forms For most species, the males have never been discovered, and may not even exist. This is because many species reproduce asexually by parthenogenesis. Where male forms do occur they are typically smaller than the females and have a reduced longevity. An unusual feature of rotiferan reproduction is that a variety of different egg types may be produced. Parthenogenetic females produce only amictic eggs, which have a characteristically thin shell. Amictic eggs are already diploid, and cannot be fertilised. They develop and hatch rapidly. The mictic egg is also thin shelled, however, it is haploid, and can be fertilised. Should fertilisation occur, the egg secretes an additional, thick shell layer and becomes a dormant egg. The dormant egg is highly resistant to potentially lethal environmental changes, including absence of water, and is capable of remaining viable for long periods of time (several years). The amictic egg is produced when environmental conditions are favourable, for example during a wet season. These eggs rapidly boost the population of the rotifers. However, before the onset of a dry period a switch to producing mictic eggs is frequently observed, as these eggs will ensure the survival of the population until the next favourable period.

These organisms are regarded as valuable bioindicators to depict the trophic status of water quality of their environments within limnosaprobity and therefore these organisms are being widely used in environmental toxicological studies and bioassay experiments (Sharma, 1991).

Most Rotiferan classes are defined by their oral arrangement and coronal adaptations. There are three classes of Phylum Rotifera *viz.* (i) **Seisonida**: These are mainly marine rotifers (ii) **Digononta**: This speciose class of rotifers is characterised by the presence of paired ovaries and germovitellarium (Figure 2.i). They are active components of the freshwater zoofauna, and move by swimming or crawling. The body is capable of a considerable degree of extension and retraction. Males are unknown, all reproduction occurs by parthenogenesis. (iii) **Monogononta**: As the name suggests, this class of organisms is characterised by the presence of a single ovary (Figure 2.i), and the production of both mictic and amictic eggs.

Studies on this group from India date back to the later part of the 19th century. Anderson (1889) initiated faunistic studies on freshwater rotifers from India. Since then many more studies have been conducted on rotifers (Arora, 1962; 1963a; 1963b; 1965; 1966a; 1966b, 1966c; Brehm, 1950; 1951; Chandrasekhar and Kodarkar, 1994; 1995; Dhanapathi, 1973; 1974a, 1974b; 1975a; 1975b; 1976a; 1976b; 1976c; 1977; 1978a; 1978b; 1997; 2000; Dhanapathi and Rama Sarma, 2000; Naidu, 1967, Nair and Nayar, 1971; Nayar, 1964; 1965a; 1965b; 1968; Nayar and Nair, 1969; Pasha 1961; Rao and Chandra Mohan, 1976; 1977; 1982; 1984; Sharma, 1976; 1978a; 1978b; 1978c; 1979a; 1979b; 1979c; 1979d; 1979e; 1980; 1987; Tiwari and Sharma, 1977; Vasisht and Bathish 1969; 1970, 1971a; 1971b; 1971c; 1971d, Vasisht and Dawar, 1968; Wulfert, 1966; Wycliffe and Michael, 1968).

Globally around 2000 species of rotifers are known (Shiel, 1995). Sharma and Michael (1980) reported 241 species belonging to 21 Eurotatorian families and 48 in 'Synopsis of taxonomic studies on Indian Rotifera'. Sudzuki (1989) compiled a list of 575 taxa from the oriental region, which included 259 species from this country. A state of the art report by Sharma (1991) however, incorporated 310 species belonging to 24 families and 60 genera, while Sharma (1996) referred to 316 species spread over 24 families and 62 genera. The documented diversity has not significantly increased since then, and presently 325 species belonging to 25 families and 63 genera are known to occur in India. Thus the rotifer species from this country comprise about 13% of the global Rotifera (Sharma, 1998a).

A majority of the work on Rotifers from India are restricted to lentic systems (mainly ponds and lakes) but riverine rotifer communities are poorly examined (Sharma, 1998a). Additionally, very little work has been done on the rotifer fauna of Gujarat except for a single

study carried out by Wulfert in 1966. Hence it was thought necessary to carry out detailed taxonomic work on the rotifers of River Vishwamitri.

SAMPLING AND IDENTIFICATION

Sampling was done on a monthly basis during all the seasons except the monsoon. In the monsoon season the floodwater carries rotifers form the adjoining lentic systems and hence the rotifer community during this season will be vastly different and a comparison will be inappropriate. Hence sampling was not carried out in this season. For five continuous days every month water samples were collected from all five sampling stations during the morning hours. A bucket sample of 15L was collected. It was first passed through a coarse sieve with a mesh size of 0.5mm and then through plankton net made of bolting silk cloth of 76μm mesh size, one over the other. The residue so collected in the net was then carefully washed with distilled water and collected in a polypropylene bottle. These samples were then fixed by adding appropriate quantity of 3% Formalin. Subsequently, 5% Lugol's Iodine was added to the sample. The preserved samples were concentrated to 10mL by centrifugation at 1000g for 20 minutes. Smaller subsamples of 0.5mL were taken on glass slides for morphometric measurements and identification using a Leica DMBR Advanced Research Microscope fitted with a calibrated graticule. Identification was done by referring to standard publications (Pasha, 1961; Wulfert, 1966; Naidu, 1967; Nayar, 1968; Nair and Nayar, 1969; Dhanapathi, 1974b; Sharma, 1980; Saksena and Kulkarni 1986; Sharma, 1987; Sampathkumar, 1991, 1992; Shiel, 1995). In case of some rotifers, which require the trophi for identification upto the species level, extraction of the trophi was carried out by bleaching the animal with 5-10% Sodium Hypochlorite (De Smet, 1998). A small drop of Sodium Hypochlorite was placed at the edge of the coverslip using a microcapillary pipette. When the body was almost eroded, excess fluid from the edges of the coverslip was soaked up using lens tissue. Care was taken to ensure that the exposed trophus was not withdrawn. A small drop of water was added to the coverslip to re-centre the trophus. The details were then carefully observed for identification of species. Wherever possible, photographs were taken and sketches made. All five samples from each station were analysed separately and then the data was pooled to form the monthly data.

An annotated list of rotifers with their description, distribution and measurements is given in this chapter. At least five individuals were measured and the average has been given along with the range. In case a single individual was located measurements of the single animal have been given.

CLASS – SEISONIDEA: These are mainly marine rotifers and hence no species belonging to this class was encountered during the present study.

CLASS – DIGONONTA: Most of the species belonging to this group could not be identified in the preserved material, as these animals tend to become contracted into amorphous 'blobs'. Only one species could be identified.

Species – 1 *Rotaria neptunia* (Ehrenberg, 1832) **[Figure. 2.1]**

Synonym: *Actinurus neptunius* Ehrenberg, 1832; *Rotaria neptunia* Harring, 1913; *Rotifer actinurus* Janson, 1893; *Rotifer macrourus* Schrank, 1803; *Rotifer neptunius* Ehrenberg, Jennings, 1900, *Rotifer neptunius* Milne, 1886; *Rotaria neptunia* Harring, 1913; *Vorticella macroura* Herrmann, 1783

Distribution: Europe, Australia, India, Japan, and China
In India previously reported from:
Andhra Pradesh by Dhanapathi (1973)
West Bengal by Sharma (1979c)

Description: This species is long, slender and fusiform. The cuticle is smooth but stiff and inflexible. Corona has two trochal discs, which bear bristles. The rostrum bears the eyes and is provided with arched rostral lamella. The palp-like dorsal antenna is borne on the first neck segment just behind the rostrum. Germovitellaria is paired and present on either side of the intestine. Trunk is broad and narrows gradually. The foot is slender, very long; five jointed and is telescopically projected. The third foot joint has a pair of equal and pointed spurs. The foot has three slender long, equal and pointed toes.
The trophi is of the ramate type with dental formula 2/2.

This is a new record for Gujarat.

Measurements:
Total length: 1280µm (1250-1330µm)
Length of trunk: 550 µm (520-580µm)
Width of trunk: 55µm (50-60µm)
Length of foot: 600µm (575-650µm)
Length of toes: 60µm (55-70µm)
Length of spurs: 30µm (25-35µm)

During the present study reported from:
Station II: December 2000.

CLASS – MONOGONONTA: Specimen collected during the present study belonged to three orders namely, Collothecacea, Flosculariacea and Ploimida.

ORDER – 1 COLLOTHECACEA Remane, 1933

These are a predominantly sessile collection of animals. The oral margins may be extended to form a 'funnel' around the mouth itself.

This order is represented by two families of which only one family, Atrochidae having one genus and one species was found in the present study.

FAMILY – 1 ATROCHIDAE Bartos, 1959

Genera – 1 *Cupelopagis* Forbes, 1882

Synonym: *Apsilus* Metschnikov, 1866

Body sac-like, with a flat attachment disc on the ventral surface. Corona is a large concave chamber. Usually found on broad, flat leaves of aquatic plants.

Niche: Predatory on smaller rotifers.

Species – 2 *Cupelopagis vorax* (Leidy, 1857) **[Figure. 2.2]**

Synonym: *Apsilus bipera* Foulke, 1884; *Apsilus bucinedax* Foulke, 1884; *Apsilus lentiformis* Metschikov, 1866; *Apsilus vorax* Foulke, 1884; *Cupelopagis bipera* de Beauchamp, 1912; *Cupelopagis bucinedax* Forbes, 1882; *Cupelopagis bucinedax* de Beauchamp, 1912; Dictyophora vorax Leidy, 1857

Distribution: Cosmopolitan

In India previously reported from:

Andhra Pradesh by Dhanapathi (2000)

Kashmir by Edmondson and Hutchinson (1934)

Punjab by Edmondson and Hutchinson (1934), Vasisht and Dawar (1968)

Description: Body sac-like and broadly ovate. Corona is a large concave chamber. Foot modified as ventral attachment disc. Anus is posterior.

A single individual of this species was encountered during the study.

This is a new record for Gujarat.

Measurements:

Length of body: 500μm

Width of body: 240μm

During the present study reported from:

Station II: August-2000

ORDER – 2 FLOSCULARIACEA Remane, 1933

The Floscullariacea include sessile tube-dwelling forms, and active swimming species in which the foot has entirely degenerated. The double ring of cilia around the coronal margin is a characteristic feature, which is used for identification.

This order was represented by four families, viz, Hexarthridae Flosculariidae, Filiniidae and Testudinellidae each represented by single genera.

FAMILY – 1 HEXARTHRIDAE Bartos, 1959

Genera – 1 *Hexarthra*

Hexarthra is characterized by a mastax with malleoramate trophi and the number of teeth on the uncus is used in taxonomy. This genus is readily recognised by its characteristic pyriform body with six setose arms: 1 dorsal, 2 dorsolateral, 2 ventrolateral and 1 ventral Four species of Hexarthra have so far been reported from India.

Niche: Detritivorous/ Bacterivorous/ Algivorous

Species – 3 *Hexarthra mira* (Hudson) **[Figure. 2.3]**

Synonym: *Pedalia mira* Hudson, 1871

Distribution: Europe, Australia, Sri Lanka, and China

In India previously reported from:

Andhra Pradesh by Dhanapathi and Rama Sarma (2000)

Kashmir by Edmondson and Hutchinson (1934)

Northwest India by Sharma (1976)

Punjab by Vasisht and Gupta (1967)

Rajasthan by Nayar (1968)

West Bengal by Sharma (1979c)

Description: Body is large and transparent. The ventral arm has three pairs of hooks and eight filaments. It possesses paired caudal appendages. Trophus has three large and three small unci teeth (Figure 2.3a).

This is a new record for Gujarat.

Measurements:

Total length: 290 µm (280-300µm)

During the present study reported from:

Station I: September 2000, October 2000

Station II: August 2000

FAMILY – 2 FLOSCULARIIDAE Harring, 1913

Genera – 2 *Lacinularia* Schweigger, 1820

Colonial rotifers, commonly seen in plankton samples. The colonies may be found free swimming or attached to vegetation.

Niche: Bacterivorous/ Detritivorous/ Herbivorous

Species – 4 *Lacinularia* sp.1 [Figure. 2.4a, 2.4b]

Free floating colonies, ellipsoidal in shape, organised in an elongated gelatinous sheath along

a rod axis. Colonies made up of about 70-80 individuals. Individuals get easily detached while handling.

This genera has been previously reported in India from:
Andhra Pradesh by Dhanapathi and Rama Sarma (2000)
Maharashtra by Arora (1963b) and
Rajasthan by Nayar (1968)

This is a new record for Gujarat.

Measurements:
Total length: 266µm (216-386µm)
Maximum width: 69µm (60-72µm)

During the present study reported from:
Station I: August 2000, September 2000 and October 2000
Station II: September 2000 and October 2000

FAMILY – 3 FILINIIDAE Bory De St. Vincent, 1824
Genera – 1 *Filinia* Bory de St. Vincent, 1824
Synonym: *Fadeewella* Smirnow, 1928, *Pedetes* Gosse, 1886, *Triarthra* Ehrenberg, 1832
The genus is illoricate and bears two lateral skipping bristles of variable length and a caudal bristle; the trophi are malleoramate.

Niche: Bacterivorous/ Herbivorous

Species – 5 *Filinia longiseta* (Ehrenberg, 1834) [**Figure. 2.5**]
Synonym: *Filinia limnetica* Fadeew 1923; *Filinia longiseta* (Ehrenberg, 1834); *Triarthra longiseta* Ehrenberg, 1834; *Triarthra longiseta limnetica* Zacharias, 1893; *Triarthra terminalis* Plate, 1886

Distribution: Cosmopolitan.

In India previously reported from:
Gujarat by Wulfert (1966)
Madhya Pradesh by Saksena and Kulkarni (1986); Saksena *et al.* (1986); Dagonkar and Saksena (1992); Kaushik and Saksena (1995); Mishra and Saksena (1998)
Maharashtra by Arora (1962)
Punjab by Vashist and Gupta (1967)
Northwest India by Sharma (1976)
Rajasthan by Nayar (1968); Saxena (2001)
Tamil Nadu by Sampathkumar (1992)

Description: This species is a warm-stenotherm, found only in shallow areas. Body is illoricate, fairly broad, oval and transparent. Two long anterior setae and one short moveable

caudal seta are present. Caudal seta is ventrally situated and away from the terminal point. Base of the setae is not bulged. Trophi is with 21/21 unci teeth.

Measurements:

Body length: 147μm (130-155μm)

Length of Anterior setae: 450μm (420-510μm)

Length of caudal seta: 320μm (300-340 μm)

During the present study reported from:

Station II: August 2000, September 2000.

Station III: August 2000, September 2000 and October 2000

Station IV: August 2000, September 2000 and October 2000

Station V: September 2000 and October 2000

Species 6 *Filinia opoliensis* (Zacharias, 1898) **[Figure. 2.6]**

Synonym: *Tetramastix opoliensis* (Zacharias, 1898)

Distribution: Australia, N. America, China, Europe, India, Nigeria, Sri Lanka

In India previously reported from:

Andhra Pradesh by Dhanapathi and Rama Sarma (2000)

Gujarat by Wulfert (1966)

Madhya Pradesh by Kaushik and Saksena (1991); Dagonkar and Saksena (1992); Kaushik and Saksena (1995); Mishra and Saksena (1998)

Maharashtra by Arora (1962)

Rajasthan by Nayar (1968)

Description: Body is firm, elongated ovoid or cylindrical in shape. Anteriorly two long lateral setae of different lengths arise from broad paddle-like bases. Two caudal seta are present, of which one is very short measuring up to about one-sixth of the longer seta. The longer caudal seta is as long as the anterior seta.

Measurements:

Length of body: 200μm (190-210μm)

Anterior setae: 345μm (340-353μm) and 138μm (130-142μm)

Posterior setae: 230μm (225-235μm) and 40μm (38- 44μm)

During the present study reported from:

Station II: August 2000.

Station III: August 2000 and September 2000.

FAMILY –4 TESTUDINELLIDAE Bory De St. Vincent, 1826

Genera – 1 *Testudinella* Bory de St. Vincent, 1826

Synonym: *Pterodina* Ehrenberg, 1838

The dorsal and ventral plates of lorica are completely fused laterally. Additionally the lorica

is greatly flattened dorso-ventrally and sometimes is nearly circular. Two frontal eyes are present. Foot opening is ventral in most species and terminal in some. Foot is long, retractile, annulated, and terminating in a tuft of cilia. Mastax is of malleoramate type These are littoral species.

The species are distinguished on the basis of shape, size, and position of foot opening, position of lateral antennae, and outline of lorica in dorsal view and cross section.

Niche: Bacterivorous/ Herbivorous

Species – 7 *Testudinella patina* (Hermann, 1783) [**Figure. 2.7**]

Synonym: *Brachionus patina* Hermann, 1783; *Pterodina patina* Ehrenberg, 1830; *Petrodina valvata* Hudson and Gosse, 1871

Distribution: Cosmopolitan

In India previously reported from:

Andhra Pradesh by Naidu (1967); Dhanapathi and Rama Sarma (2000)

Gujarat by Wulfert (1966)

Madhya Pradesh by Saksena and Kulkarni (1986); Kaushik and Saksena (1995), Mishra and Saksena (1998)

Kashmir by Edmondson and Hutchinson (1934)

Northwest India by Sharma (1976)

Tamil Nadu by Sampathkumar (1992)

West Bengal by Anderson (1889); Sharma (1979c); Tiwari and Sharma (1977)

Description: Body is loricate. The lorica is circular, dorsoventrally flattened and very transparent. Antero-dorsal margin has a slight bow shaped convexity Circular foot opening is located at 1/3rd distance from posterior end. Foot is retractile and annulated terminating in a ciliated cap. Corona is in the form of a simple band of cilia.

This species has been described as the commonest hard-water rotifer.

Measurements:

Lorica length: 159µm (156 -166µm).

Maximum width: 140µm (138-143µm).

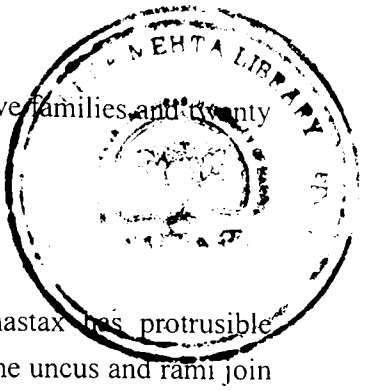
During the present study reported from:

Station I: August 2000, September 2000 and October 2000

Station III: October 2000

ORDER – 3 PLOIMIDA

This order contains the vast majority of rotifer species. These are barrel-shaped, swimming animals that may have a protective lorica surrounding the trunk.



In the present study area this was the largest order represented by twelve families and twenty genera.

FAMILY – 1 DICRANOPHORIDAE Remane, 1933

Genera – 1 *Dicranophorus* (Müller)

The members of this genus are usually partially loricated. The mastax has protrusible forcipate trophi. The manubrium is attached directly to the uncus and the uncus and rami join near their tips. There are two frontal eyespots. The foot, which ends in two strong toes, is shorter than the lorica. Toes are prominent and not fused. This is a very active predatory group.

Species – 8 *Dicranophorus australiensis* Koste and Shiel 1980. [**Figure. 2.8**]

Distribution: Australia

This is the first report of its occurrence from India.

Description: Body is moderately transparent and slender. The abdomen is slightly gibbous posteriorly. Trophi is of forcipate type. Ramus has median row of very small shearing teeth and it terminates in two teeth, each with bifurcate tip (Figure 2.8a). Toes are quite long and slender.

Measurements:

Average length: 97μm (90 -100μm).

Maximum width: 64μm (62 - 67μm).

Toe length: 51μm (49 -53μm).

During the present study reported from:

Station I: August 2000 and October 2000

Station II: August 2000 and September 2000

Station III: March 2000, April 2000, August 2000, December 2000, January 2001, and February 2001

Station IV: August 2000

Station V: August 2000

Genera – 2 *Encentrum* Ehrenberg, 1838

Synonym: Encentroides Sudzuki, 1960; Parencentrum Wiszniewski, 1953

The members of this genus are cylindrical and usually illoricate or only partially loricate. The mastax has protrusible forcipate trophi. There is a small, intercalating piece between the manubrium and each uncus. Eyes are not usually present. The foot ends in two small toes. This is a very active, predatory group.

This genus has previously been reported from India by Wulfert (1966)

Niche: Bacterivorous.

Species – 9 *Encentrum* sp. 1 [Figure. 2.9]

Single individual obtained.

Measurements:

Average length: 130μm

During the present study reported from:

Station III: January 2000

FAMILY – 2 ASPLANCHNIDAE Harring and Myers, 1926

Large transparent illoricate rotifers, usually 400 to 2000μm long. Sac-shaped, with an incudate trophi and corona as circumapical ring of cilia. Intestine, anus, foot and toes are lacking. Vitellarium is horseshoe-shaped or globose. They are often viviparous. Males are present. Several species are very common in plankton samples. They are predatory by nature

Niche: Carnivorous, which also feeds on algae.

This family was represented by single genus having two species.

Genera: 1 *Asplanchna*

Niche: Carnivorous, feeds on other rotifers and smaller microcrustaceans.

Species – 10 *Asplanchna brightwelli* (Gosse, 1850) [Figure. 2.10]

Synonym: *Apus anglica* Schoch, 1868; *Ascomorpha anglica* Perty, 1852; *Asplanchna amorpha* Hudson, 1889; *Asplanchna bowesii* Gosse, 1850; *Asplanchna brightwelli ceylonica* Daday, 1898; *Asplanchna ceylonica* Daday, 1898, *Asplanchna girodi* De Guerne, 1888; *Notommata anglica* Leydig, 1854

Distribution: Cosmopolitan.

In India previously reported from·

Andhra Pradesh by Dhanapathi (1975b)

West Bengal by Sharma (1979c)

Kashmir by Edmondson and Hutchinson (1934)

Description: Body is large, transparent and sacciform Foot and toes are absent. Germovitellarium is ribbon like with 32 nuclei. Trophi is incudate, having robust and curved apophyses. Rami have a large distinct tooth on its inner margin. Broad lamellae seen behind the rami apices are symmetric (Figure 2.10a). They are predatory and known to feed on other rotifers with a preference to *Brachionus* spp. (Beauchamp 1952 a; 1952 b; Gilbert 1967 and Green and Lan 1974). Saksena and Sharma (1985) have reported preferrence to *Keratella tropica.* Cannibalism has also been reported for this species by Hurlbert *et al.* (1972) and Green and Lan (1974).

This is a new record for Gujarat.

Measurements:

Length of body (contracted): 400μm (350 - 450μm)

Width of body: 220μm (200 - 250μm)

During the present study reported from:

Station II: August 2000.

Species – 11 *Asplanchna sieboldi* (Leydig) **[Figure. 2.11]**

Synonym: *Apus amphora* Hudson, 1889; *Apus ebbesborni* Hudson, 1883; *Apus sieboldi* Eyferth, 1878; *Apus sieboldi* Schoch, 1868; *Asplanchna ebbesborni* Hudson, 1883, *Asplanchna hungarica* Daday, 1891; *Notommata sieboldi* Leydig, 1854; *Notommata sieboldi* Leydig, 1854

Distribution: Cosmopolitan.

In India previously reported from:

Visakhapatnam (Andhra Pradesh) by Rao and Chandra Mohan (1976)

Description: Body is large transparent and sacciform. Foot and toes are absent. Germovitellarium ribbon like and with approximately 50 nuclei Trophi is incudate having robust and curved apophyses. Rami have a large distinct tooth on its inner margin. Rami apices are asymmetric with right being single and left bifurcate (Figure 2.11a). Known to feed on other rotifers. During the present study, the gut contents included *Lecane hamata*, *Brachionus angularis* and a smaller sized *Asplanchna sieboldi*.

This is a new record for Gujarat.

Measurement:

Length: 650μm (645 - 660μm)

During the present study reported from:

Station III: August 2000.

FAMILY – 3 TRICHOTRIIDAE Bartos, 1959

This family is represented by a single genus having a single species.

Genera: 1 *Trichotria* Bory de St. Vincent, 1827

Synonym: *Dinocharis* Ehrenberg, 1830

Lorica composed of one box-like piece, usually thick and with large facets. Usually it has two spines at base of foot, or rarely with two posterior dorso-lateral spines on the lorica. Trophi is malleate.

Niche: Algivorous and detritivorous

Species – 12 *Trichotria tetractis* (Ehrenberg) **[Figure. 2.12]**

Synonym: *Dinocharis tetractis* Ehrenberg, 1830; *Trichotria similis* (Stenroos, 1898); *Trichotria truncata* (Whitelegge, 1889)

Distribution: Cosmopolitan

In India previously reported from:

Andhra Pradesh by Dhanapathi (1974b)

Gujarat by Wulfert (1966)

Kashmir by Edmondson and Hutchinson (1934)

Kerala by Nayar and Nair (1969)

Maharashtra by Arora (1966d)

Northwest India by Sharma (1976)

Punjab by Edmondson and Hutchinson (1934)

Orissa by Sharma (1980)

West Bengal by Sharma (1979b)

Description: Lorica is vase-shaped, facetted, slightly narrowing posteriorly. Foot is long and three segmented with a pair of dorsal triangular spines, second foot segment is longer than others. Toes are long, slender and ending in points.

Single individual was located in the present study.

This is a new record for Gujarat.

Measurements:

Lorica length: 120µm

Lorica width: 90µm

Foot length: 65µm

Toe length: 90µm

During the present study reported from:

Station III: August 2000

FAMILY – 4 BRACHIONIDAE Wesenberg-Lund, 1899

This family had the largest number of genera (five) with fifteen species.

Genera – 1 *Platyias* Harring

Niche: Herbivorous.

A single species belonging to this genus was found during the present study.

Species – 13 *Platyias quadricornis* (Ehrenberg, 1832) **[Figure. 2.13]**

Synonym: *Brachionus quadricornis* Dujardin, 1841; *Noteus leydigii* Haeckel, 1900; *Noteus quadricornis* Ehrenberg, 1832; *Noteus quadricornis* var. *brevispinus* Daday, 1905; *Noteus quadricornis* var. *congolense* Van Oye, 1926; *Noteus stuhlmanni* Collin, 1897; *Platyias quadricornis* (Ehrenberg) Harring, 1913

Distribution: Cosmopolitan

In India reported from:

Andhra Pradesh by Dhanapathi (1974a)

West Bengal by Anderson (1889); Sharma (1979)
Jammu by Jyoti and Sehgal (1980)
Kashmir and Punjab by Edmondson and Hutchinson (1934)
Kerala by Nayar and Nair (1969)
Northwest India by Vashisht and Battish (1971b); Sharma (1976)
Punjab by Sharma (1980)

Description: Lorica is tuberculate, stippled with regular pattern of facets. Anterior margin has two stout median spines bluntly rounded at the tips. Posteriorly lorica has two short equal spines pointed at the tips.

Though this species is described as one of the most common species it has been recorded only once during the study period.

This is a new record for Gujarat.

Measurements:
Total length: 244µm
Lorica length: 193µm
Lorica width: 193µm
Anterior spine length: 41µm
Posterior spine length: 19µm

During the present study reported from:
Station III: May 2000

Genera – 2 *Plationus* Segers
Niche: Detritivorous/Algivorous
This genus was represented by a single species.

Species – 14 *Plationus patulus* (Müller 1786) **[Figure. 2.14]**
Some authors have designated this species as *Platyias patulus* (Green 1960, Arora 1966).
Synonym: *Brachionus conium* Atwood, 1881; or Attwood, 1881; *Brachionus militaris* Ehrenberg, 1834; *Brachionus patulus* O. F. Muller, 1786; *Noteus militaris* Daday, 1901; *Noteus militaris* var. *leopoldi* Van Oye, 1926; *Noteus patulus* Ehrenberg, 1833; *Platyias militaris* (Ehrenberg) Carlin, 1944; *Platyias patulus* (O. F. Muller) Hauer, 1937/38; *Platyias patulus* (O. F. Muller, 1786) Gillard, 1948

Distribution: Cosmopolitan
In India reported from:
Andhra Pradesh by Dhanpathi (1974b)
West Bengal by Tiwari and Sharma (1977); Sharma (1979b)
Madhya Pradesh by Saksena and Kulkarni (1986)
Kashmir by Edmondson and Hutchinson (1934)

Kerala by Nayar and Nair (1969); Nair and Nayar (1971)
Maharashtra by Arora (1966b)
Northwest India by Sharma (1976)
Punjab by Edmondson and Hutchinson (1934); Vasisht and Battish (1971) and Sharma (1980)
Rajasthan by Nayar (1968)

Description: It is described as a littoral inhabitant of shallow waters (Shiel, 1995). Lorica is firm and well developed, broader than long. Anterior margin is with ten spines, of which the median pair is the longest and curved outwards. Posteriorly the lorica narrows a little and ends in a pair of two stout spines. The postero-median spines, which border the foot opening are longer than the postero-lateral spines.

This is a new record for Gujarat.

Measurements:
Total length: 160μm (116 - 207μm)
Greatest width: 124μm (106 - 133μm)

During the present study reported from:
Station I: September 2000, October 2000.
Station II: August 2000, September 2000 October 2000.
Station IV: August 2000.

Genera – 3 *Brachionus* Pallas, 1766

Dorsal and ventral plate of lorica are completely fused laterally. Antero-dorsal margin of lorica is usually with four or six spines. Posterior margin is with or without spines. Body moderately flattened dorso-ventrally. Foot is long, annulated, retractile, not segmented. Two toes are present. The structure of the trophi within the genus *Brachionus* is remarkably constant and is of malleate type. These are planktonic species. Some species are common and highly variable, especially in hard waters. Sometimes dense populations are seen.
Niche: Bacterivorous/Herbivorous
This genus was represented by nine species during the present study.

Species – 15 *Brachionus angularis* Gosse, 1851 **[Figure. 2.15]**

Synonym: *Brachionus angularis* var. *rotundata* Seligo, 1907; *Brachionus bidens* Plate, 1886; *Brachionus minimus* Bartsch, 1877; *Brachionus papuanus* Daday, 1897; *Brachionus syenesis* Schmarda, 1859; *Brachionus testudo* Ehrenberg, 1853; *Brachionus urceolaris* f. *angularis* Seligo, 1900

Distribution: Cosmopolitan
In India previously reported from:
Andhra Pradesh by Dhanapathi (1974)

Gujarat by Wulfert (1966)
Bhagalpur by Nasar (1973)
Madhya Pradesh by Saksena and Kulkarni (1986); Kaushik and Saksena (1991); Kaushik and Saksena (1995); Mishra and Saksena (1998)
Chandigarh by Vasisht and Gupta (1967)
Kashmir by Edmondson and Hutchinson (1934)
Kerala by Nayar and Nair (1969) Nair and Nayar (1971)
Maharashtra by Arora (1963a)
Northwest India by Vasisht and Battish (1971a); Sharma (1976)
Punjab by Edmondson and Hutchinson (1934) and Sharma (1980)
Rajasthan by Nayar (1968)
Tamil Nadu by Sampathkumar (1991)
West Bengal by Sharma (1979b)

Description: It is a loricate species. The lorica is oval in shape. The stippled lorica is composed of dorsal and ventral plates. Antero-dorsal margin is with two short acute median spines flanking a V-shaped sinus, lateral and submedian spines are absent. Antero-ventral margin is undulate, elevated and without sinus. Posteriorly a pair of short blunt convergent spines are present near the foot opening.

Measurements:

Total length: 115μm (98 - 120μm)

Maximum width: 91μm (81-108μm)

Posterior spine: 9μm (8-10μm)

During the present study reported from:

Station I: March 2000, April 2000, August 2000, September 2000, October 2000, December 2000, January 2001 and February 2001.

Station II: August 2000, September 2000, October 2000 and December 2000.

Station III: March 2000, April 2000, May 2000, August 2000, September 2000, October 2000, January 2001 and February 2001.

Station IV: March 2000, April 2000, May 2000, September 2000, October 2000, December 2000, January 2001 and February 2001.

Station V: March 2000, April 2000, September 2000, October 2000 and February 2001.

Species – 16 *Brachionus bidentatus,* Anderson 1889 **[Figure. 2.16a, 2.16 b]**

Synonym: *Brachionus bakeri* var. *areolata* Daday, 1902; *Brachionus bakeri* var. *inermis* Daday, 1908; *Brachionus furculatus* Thorpe, 1891; *Brachionus furculatus* var. *inermis* Rousselet, 1906; *Brachionus furculatus* var. *jarovci* Bartos, 1947; *Brachionus furculatus* var. *testudinarius* Jacubski, 1912

Distribution: America, Africa, Australia, China, Europe, India and Japan.

In India previously reported from:
Andhra Pradesh by Dhanapathi (1974b)
Gujarat by Wulfert (1966)
Punjab by Edmondson and Hutchinson (1934)
West Bengal by Anderson (1889)
Chandigarh by Vasishta and Gupta (1967)
Madhya Pradesh by Saksena and Kulkarni (1986); Saksena *et al.* (1986); Kaushik and Saksena (1995); Mishra and Saksena (1998)
Kashmir by Edmondson and Hutchinson (1934)
Northwest India by Sharma (1976)
Punjab by Vasisht and Battish (1971 a) and Sharma (1980)
Rajasthan by Saxena (2001)
West Bengal by Sharma (1979b)

Description: Lorica is subcircular to moderately oval, covered by a granulose pattern The lorica is composed of a basal plate, in addition to the ventral and dorsal plates. Antero-ventral margin is slightly concave to straight. Anteriorly six stout, short spines are present, of which laterals are longer than medians and medians are longer than inter-medians. The greatest width of lorica is a little below the middle of the body. Posteriorly two spines are present.

In the present study two morphological variants have been found in this species.

Form I: In this form the postero-lateral spines are very short [**Figure. 2.16a**].

Measurements:
Total length: 184μm (180 - 192μm)
Lorica Length: 138μm (134 - 140μm)
Maximum width: 138μm (134 - 140μm)
Length of Antero-lateral spine: 24μm (23 - 24μm)
Length of Anterior intermedian spine: 14μm (13 -14μm)
Length of Antero-median spine: 23μm (22 - 23μm)
Length of Postero-lateral spine: 4μm

Form II: This form has very long postero-lateral spines [**Figure. 2.16b**].

Measurements:
Total length: 222 (218-228) μm
Lorica Length: 144μm (140 - 150μm)
Maximum width: 150μm (146 - 152μm)
Length of Antero-lateral spine: 32μm (31 - 33μm)
Length of Anterior intermedian spine: 10μm (11 - 13μm)
Length of Antero-median spine: 21μm (19 - 22μm)

Length of Postero-lateral spine: 92μm (86 - 98μm)

During the present study reported from:

Station I: March 2000 and February 2001.

Station II: October 2000.

Species – 17 *Brachionus calyciflorus* Pallas, 1766 **[Figure. 2.17a, 2.17b, 2.17c]**

Synonym: *Brachionus amphiceros* Ehrenberg, 1838; *Brachionus amphiceros borgerti* Apstein, 1907; *Brachionus decipiens* Plate, 1886; *Brachionus dorcas* Gosse, 1851; *Brachionus dorcas* var. *spinosus* Wierzejski, 1891; *Brachionus oon* Gosse, 1851; *Brachionus pala* Ehrenberg, 1838; *Brachionus pala brycei* de Beauchamp, 1932; *Brachionus pala mucronatus* Spandl, 1922; *Brachionus pala willeyi* Apstein, 1907; *Brachionus tridens* Hood, 1893

Distribution: Cosmopolitan in alkaline habitats

In India previously reported from:

Andhra Pradesh by Naidu (1967); Dhanapathi (1974b, 1977)

Gujarat by Wulfert (1966)

Madhya Pradesh by Saksena and Kulkarni (1986); Kasuhik and Saksena (1991); Kasuhik and Saksena (1995); Mishra and Saksena (1998)

Delhi by George (1961)

Kashmir by Edmondson and Hutchinson (1934)

Kerala by Nayar and Nair (1969); Nair and Nayar (1971)

Maharashtra by Arora (1966a)

Northwest India (Sharma 1976)

Punjab by Edmondson and Hutchinson (1934); Sharma (1980)

Rajasthan by Nayar (1968)

Tamil Nadu by Sampathkumar (1991)

Description: Lorica is oval to suboval, flexible and smooth. Antero-dorsal margin is with four stout spines formed on a broad base. The median spines are longer than the lateral spines. Antero-ventral margin is elevated, slightly notched medially. Posterior end bears four spines but in some individuals the postero-lateral spines may be absent.

Three different morphological forms of *B. calyciflorus* were obtained in the present study.

Form I: In one form the posterior spines were absent. Antero-median spines were much longer than lateral spines [**Figure. 2.17a**].

Measurements:

Total length: 322μm

Lorica length: 253μm

Maximum width: 204μm

Antero-median spines: 60μm

Antero-lateral spines: 41μm

Postero-lateral spines: absent

Form II: The postero-lateral spines were absent. The postero-median spines were present but reduced. The anterior spines were of unequal length of which the median pair was slightly longer than the lateral pair **[Figure. 2.17b]**.

Measurements:

Total length: 285μm

Lorica length: 216μm

Maximum width: 193μm

Antero-median spines: 55μm

Anterioro-lateral spines: 35μm

Postero-median spines: 9μm

Postero-lateral spines: absent

Form III: In another form the postero-lateral spines were present and the anterior spines were marginally equal. Antero median spines were longer than the lateral ones **[Figure. 2.17c]**.

Measurements: Total length: 253μm (246-258μm)

Lorica length: 179μm (175 - 186μm)

Maximum width: 138μm (135 - 142μm)

Antero-median spines: 41μm (40 - 43μm)

Antero-lateral spines: 32μm (30 - 34μm)

Postero-median spines: 46μm (44 - 47μm)

Postero-lateral spines: 14μm (13 - 15μm)

During the present study reported from:

Station I: August 2000.

Station II: August 2000, September 2000 and October 2000.

Station III: August 2000, September 2000 and October 2000.

Species – 18 *Brachionus caudatus* Barrois and Daday, 1894 **[Figure. 2.18]**

Brachionus angularis var. *bidens* Hempel, 1899; *Brachionus tetracanthus* Collin, 1897

Distribution: Cosmotropical

In India previously reported from:

Gujarat by Wulfert (1966)

Andhra Pradesh by Dhanapathi (1974b)

Madhya Pradesh by Saksena and Mishra (1990); Dagonkar and Saksena (1992); Kaushik and Saksena (1995)

Kerala by Nayar and Nair (1969); Nair and Nayar (1971)
Maharashtra by Arora (1963)
Northwest India by Sharma (1976)
Punjab by Sharma (1980)
Rajasthan by Nayar (1968)
Tamil Nadu by Sampathkumar (1991)

Description: It is a polymorphic and highly variable species. Anterior margin is with four spines. Intermedian spines are absent. The lateral spines are longer than the median spines A V-shaped sinus separates median spines. Ventral margin is undulate. Posteriorly the lorica terminates in a pair of stout spines separated from each other by a V-shaped extension of the lorica. In some individuals foot has been observed between the bases of the posterior spines in the ventral plate.

Measurements:
Total length: 188μm (164 - 204μm).
Lorica length: 130μm (118 - 144μm)
Maximum width: 126μm (99 - 134μm)
Antero-median spines: 11μm (9 - 14μm)
Antero-lateral spine: 17μm (16 - 18μm)
Posterior spine: 35μm (41 - 69μm)

During the present study reported from:
Station II: September 2000, October 2000.
Station III: September 2000 and October 2000.

Species – 19 *Brachionus diversicornis* (Daday, 1883) **[Figure. 2.19]**
Synonym: *Brachionus amphifurcatus* Imhof, 1887; *Brachionus diversicornis* Remane, 1929; *Schizocerca diversicornis* Daday, 1883; *Schizocerca diversicornis* var. *homoceros* Wierzejski, 1891

Distribution: Cosmopolitan.
In India reported from:
Andhra Pradesh by Dhanapathi (1974)
Gujarat by Wulfert (1966)
North-West India by Sharma (1976)
Punjab by Sharma (1980)
Rajasthan by Nayar (1968)

Description: Lorica is elongate, broad anteriorly, and narrows down towards the posterior end. Four anterior spines are present, of which the lateral pair is much longer than the median

pair. At the posterior end two spines of unequal length are present, right spines being much longer than the left.

Single specimen was found.

Measurements:

Total length: 368μm

Lorica length: 210μm

Maximum width: 134μm

Antero-median spine: 14μm

Antero-lateral spine: 80μm

Left posterior spine: 23μm

Right posterior spine: 80μm

During the present study reported from:

Station III: October 2000.

Species – 20 *Brachionus falcatus* Zacharias 1898 **[Figure. 2.20]**

Distribution: Cosmotropical

In India previously reported from:

Andhra Pradesh by Dhanapathi (1974)

Gujarat by Wulfert (1966)

Madhya Pradesh by Mishra and Saksena (1990); Dagonkar and Saksena (1992); Kaushik and Saksena (1995); Mishra and Saksena (1998)

Kerala by Nayar and Nair (1969); Nair and Nayar (1971)

Maharashtra by Arora (1966)

Maharashtra by Arora (1963)

Northwest India by Vasisht and Battish (1971a); Sharma (1976)

Rajasthan by Nayar (1968)

Tamil Nadu by Brehm (1950) and Sampathkumar (1991)

West Bengal by Tiwari and Sharma (1977), Sharma (1979)

Description: Lorica is composed of dorsal and ventral plate and is compressed dorso-ventrally. Antero-dorsal margin is with six unequal spines. Submedian spines are much longer than the laterals and medians, and are curved outwards. Antero-lateral and median spines are of nearly equal length. Posterior spines are long and curved inwards.

Measurements:

Lorica length: 129μm (115 - 142μm)

Maximum width: 129μm (99 - 144μm)

Antero-median spine: 15μm (9 - 15μm)

Anterior intermediate spine: 70μm (61 - 74μm)

Antero-lateral spine: 17μm (16 - 18μm)

Posterior spines: 74μm (41 - 79μm)

During the present study reported from:

Station III- September 2000 and October 2000.

Species – 21 *Brachionus forficula* Wierzejski **[Figure. 2.21a, 2.21b]**

Distribution: Cosmotropical

In India previously reported from:

Andhra Pradesh by Dhanapathi (1974b)

Gujarat by Wulfert (1966)

Madhya Pradesh by Kaushik and Saksena (1991); Dagonkar and Saksena (1992); Kaushik and Saksena (1995)

Kerala by Nayar and Nair (1969); Nair and Nayar (1971)

Punjab by Sharma (1980)

Rajasthan by Nayar (1968)

Description: Lorica is thick and stippled. Anterior margin is with four spines, of which the laterals are longer than the medians. Posteriorly a pair of stout convergent spines is present with characteristic knee-like swelling on inner side of the bases.

Morphological variation in the length of the postero-lateral spine was observed, on the basis of which two variants are being described:

Form I: This form has short postero-lateral spines and the characteristic knee-like swelling on the inner side is absent **[Figure. 2.21a]**.

Measurements:

Lorica length: 92μm (81 - 101μm)

Maximum width: 88μm (67 - 106μm)

Antero-median spine: 10μm (8 - 12μm)

Antero-lateral spine: 17μm (15 - 18μm)

Posterior spines: 32μm (28 - 34μm)

Form II: This form has long postero-lateral spines with very prominent knee-like swellings on its inner-side **[Figure. 2.21b]**.

Measurements:

Lorica length: 92μm (81 - 101μm)

Maximum width: 88μm (67 - 106μm)

Antero-median spine: 10 μm (8 - 12μm)

Antero-lateral spine: 17μm (15 - 18μm)

Posterior spines: 59μm (32 - 87μm)

During the present study reported from:
Station II: September 2000.
Station III: September 2000.

Species – 22 *Brachionus quadridentatus* Hermann, 1783[**Figure. 2.22a, 2.22b, 2.22c**]
Synonym: *Brachionus ancylognathus* Schmarda, 1859; *Brachionus bakeri* O. F. Muller, 1786 or Ehrenberg; *Brachionus bakeri anisitsi* Daday, 1905; *Brachionus bakeri areolata* Daday, 1902; *Brachionus bakeri fulleborni* Daday, 1908, var. *fulleborni* Daday, 1901; *Brachionus bakeri inermis* Daday, 1908; *Brachionus bakeri michaelseni* Daday, 1908; *Brachionus bakeri rectangularis* Lucks, 1912, var. *rectangularis* Lucks, 1912; *Brachionus bakeri* var. *congolense* Van Oye, 1926; *Brachionus bakeri* var. *cornutus (anisitsi)* Daday, 1905; *Brachionus bakeri* var. *hyphalmyros* Tschugunoff, 1921; *Brachionus bakeri* var. *longispinae* Thorpe, 1889; *Brachionus bakeri* var. *michalseni* Daday, 1910; *Brachionus bakeri zernowi* Voronkov, 1907; *Brachionus bidentata* Anderson, 1889; *Brachionus brevispinus* Ehrenberg, 1832 Wierzejski, 1893; *Brachionus bursarius* Barrois and Daday, 1894; *Brachionus capsuliflorus* Pallas, 1766; *Brachionus chavesi* Barrois, 1896; *Brachionus chilensis* Schmarda, 1859; *Brachionus cluniorbicularis* Skorikov, 1894; *Brachionus costulatus* Eichwald, 1844; *Brachionus entzii* France, 1894; *Brachionus granulatus* Kertesz, 1894; *Brachionus jamaicensis* Schmarda, 1859; *Brachionus latissimus* Schmarda, 1854; *Brachionus longipes* Anderson, 1889; Schmarda, 1859; *Brachionus lyra* Costa, 1838 ; *Brachionus melheni (melhemi)* Barrois and Daday, 1894; *Brachionus melhemi minor* Barrois and Daday, 1894; *Brachionus melhoni* Barrois and Daday, 1894; *Brachionus neglectus* Bory de St. Vincent, 1831; *Brachionus nicaraguensis* Schmarda, 1859; *Brachionus obesus* Barrois and Daday, 1894; *Brachionus octodentatus* Bory de St. Vincent, 1826; *Brachionus ontzii* France, 1894; *Brachionus polonskii* Alenitzin, 1874; *Brachionus polyceros* Schmarda, 1859; *Brachionus pustulatus* Schmarda, 1859; *Brachionus quadridentatus* var. *splendidus* Donner, 1964; *Brachionus quadricornis* Schrank, 1803; *Brachionus tuberculus* Turner, 1892; *Brachionus rhenanus* Lauterborn, 1893; *Brachionus rubens* Gosse, 1886; *Brachionus urceolaris* O. F. Muller, 1786; *Brachionus urceolaris armatus* Seligo, 1900; *Brachionus utricularis* Bory de St. Vincent, 1831; *Brachionus variabilis* Hempel, 1896; *Noteus bakeri* Ehrenberg, 1830

Distribution: Cosmopolitan
In India previously reported from:
Andhra Pradesh by Naidu (1964) and Dhanapathi (1974b)
Gujarat by Wulfert (1966)
West Bengal by Sharma (1979b)
Delhi by George (1961)
Madhya Pradesh by Saksena *et al.* (1986); Mishra and Saksena (1998)
Kerala by Nayar and Nair (1969); Nair and Nayar (1971)
Northwest India by Sharma (1976)

Punjab by Sharma (1980)
Tamil Nadu by Sampathkumar (1991)
Rajasthan by Nayar (1968); Saxena (2001)

Description: *B. quadridentatus* is a very common, widely cosmopolitan and highly variable species. Lorica is firm, stippled and compressed dorsoventrally. Antero-dorsal margin is with six well-developed spines of which the median pair is longest and bent outwards, lateral spines are slightly divergent. Antero-ventral margin is undulate, somewhat elevated towards the centre, with a median sinus. Lorica terminates posteriorly in two lateral spines, which are variable in length in different individuals.

Morphological variation in the size of the lorica, length of the antero-median spines as well as in the length of the posterior spine was observed, on the basis of which three variants are being described:

Form I: In this form the posterior spines are almost rudimentary [**Figure 2.22a**].
Measurements:
Total length: 212μm (206 - 221μm)
Maximum width: 187μm (180 - 196μm)
Antero-median spine: 37μm (32 - 39μm)
Antero-intermedian spine: 14μm
Antero-lateral spine: 18μm (16 - 23μm)

Form II: This form has short postero-lateral spines [**Figure 2.22b**].
Measurements:
Total length: 184μm (178 - 188μm)
Maximum width: 168μm (164 - 174μm)
Antero-median spine: 32μm (31 - 33μm)
Antero-intermedian spine: 14μm
Antero-lateral spine: 18μm (17 - 19μm)
Postero-lateral spine: 9μm (8 - 10μm)

Form III: The postero-lateral spines were long and the length of the antero-median spines also increased [**Figure 2.22c**].
Measurements:
Total length: 360μm
Maximum width: 209μm
Antero-median spine: 92 μm
Postero-median spine: 139μm

During the present study reported from:
Station I: March 2000, April 2000, August 2000, September 2000, October 2000 and December 2000.
Station II: September 2000.

Station III: March 2000, April 2000, May 2000, September 2000 and October 2000
Station IV: March 2000, October 2000 and February 2001.
Station V: October 2000 and February 2001.

Species – 23 *Brachionus rubens* Ehrenberg, 1838 [**Figure. 2.23**]

Synonym: *Brachionus bidentatus* Kertesz, 1894; *Brachionus macracanthus* Jakubski, 1912; *Brachionus urceolaris* var. *rubens* Ehrenberg, 1838

Distribution: Cosmopolitan
In India previously reported from:
West Bengal by Sewell (1935); Tiwari and Sharma (1977)
Madhya Pradesh by Saksena and Kulkarni (1986)
Northwest India by Sharma (1976)
Punjab by Vasisht and Battish (1971 a); Sharma (1980)
Rajasthan by Nayar (1968); Saxsena (2001)
West Bengal by Sharma (1979b)

Description: Lorica is flexible, oval and smooth. Antero-dorsal margin is with six short spines. The spines are formed on broad bases but become pointed towards the anterior end. Antero-ventral margin is markedly elevated towards the centre and notched medially. Posterior spines are absent.

This is a new record for Gujarat.

Measurements:
Total length: 168µm (165 - 170µm)
Length of lorica: 149µm (148 - 150µm)
Maximum width: 130µm
Antero-lateral spine: 15µm
Antero-median spine: 18µm (17 - 18µm)
Antero-intermedian spine: 10 µm

During the present study reported from:
Station III: August 2000.

Genera – 4 *Keratella* Bory de St. Vincent, 1822

Synonym: *Anuraea* Ehrenberg

Dorsal surface of lorica has a pattern of polygonal facets. It has one, two or no posterior spine and six short to medium anterior spines. It is a highly variable plankton and limnetic species. These form some of the very common species.

Niche: Bacterivorous/ Herbivorous
During the present study this genera was represented by two species.

Species – 24 *Keratella procurva* (Thorpe, 1891) **[Figure. 2.24]**

Synonym: *Anuraea procurva* Thorpe, 1891; *Keratella valga* f. *valga* Edmondson and Hutchinson, 1934; *Keratella valga* var. *procurva* Ahlstrom, 1943; *Keratella procurva* Berzins, 1953

Distribution: Cosmotropical

In India previously reported from:
Madhya Pradesh by Kaushik and Saksena (1995)
Kerala by Nayar and Nair (1969); Nair and Nayar (1971)
Punjab by Sharma (1980)
Orissa by Sharma (1980)
Rajasthan by Nayar (1968)
Northwest India by Sharma (1976)
West Bengal by Sharma (1979b)

Description: Body is loricate, ornamented with a median row of plaques on dorsum. The postero-median plaque is pentagonal and terminates in a short median line. Lorica is not rounded caudally and is narrow as compared to the anterior end. Two posterior spines are generally present. At the anterior end, three pairs of unequal spines are present.

This is a new record for Gujarat.

Measurements:
Total length: 120μm (113 - 140μm)
Lorica length: 80μm (87 - 104μm)
Maximum width: 67μm (66 - 69μm)
Length of antero-lateral spine: 16μm (14 - 20μm)
Length of antero-intermedian spine: 12μm (12 - 13μm)
Length of antero-median spine: 28μm (21 - 29μm)
Length of posterior spine 1: 9μm (3 - 9μm)
Length of posterior spine 2: 6μm (1 - 7μm)

During the present study reported from:
Station I: March 2000, April 2000, August 2000, September 2000 and February 2001.
Station II: August 2000.
Station III: March 2000 April 2000 and February 2001.

Species – 25 *Keratella tropica* (Apstein, 1907) **[Figure. 2.25]**

Synonym: *Anuraea valga f tropica* Apstein, 1907; *Anuraea aculeata* var. tropica Tschugunov, 1921; *Keratella quadrata* Spandl, 1926; *Keratella quadrata valga f asymmetrica* Ueno, 1938; *Keratella valga f. brehmi* Ahlstrom, 1943; *Keratella valga f. tropica* Edmondson and Hutchinson, 1934

Distribution: Cosmotropical

In India previously reported from:

Andhra Pradesh by Dhanapathi (1974b)

Gujarat by Wulfert (1966)

Bahgalpur by Nasar (1973)

Madhya Pradesh by Mishra and Saksena (1990); Kaushik and Saksena (1991); Dagonkar and Saksena (1992); Kaushik and Saksena (1995); Mishra and Saksena (1998)

Delhi by George (1961)

Kerala by Nayar and Nair (1969); Nair and Nayar (1971)

Tamil Nadu by Brehm (1950); Sampathkumar (1992)

Maharashtra by Arora (1966b)

Northwest India by Vasisht and Battish (1971a); Sharma (1976)

Punjab by Edmondson and Hutchinson (1934); Vasisht and Gupta (1967); Sharma (1980);

Rajasthan by Nayar (1968); Saxena (2001)

West Bengal by Sharma (1979b)

Description: Body is loricate, compressed dorso-ventrally and ornamented with a median row of plaques on the dorsal surface. Ventral surface is smooth. Anterior margin is with three pairs of unequal spines, of which the median spines are the longest and curved. Posteriorly a pair of unequal spines is present, of which the right spine is longer than the left. The left spine is absent in some specimen.

Measurements:

Total length: 207µm (173 - 210µm)

Lorica length: 105µm (103 - 108µm)

Maximum width: 69µm

Length of antero-lateral spine: 23µm (20 - 25µm)

Length of antero-median spine: 29µm (20 - 32µm)

Length of posterior spine 1: 81µm (64 - 85µm)

Length of posterior spine 2: 23µm (20 - 25µm)

During the present study reported from:

Station I: August 2000, September 2000 and October 2000.

Station II: August 2000, September 2000 and October 2000.

Station III: August 2000, September 2000 and October 2000.

Genera – 5 *Anuraeopsis* Lauterben

All these species are warm stenotherms. They show great variability in shape, size, keel and surface structures of the lorica.

Niche: Bacterivorous/ Herbivorous

This genus was represented by two species during the present study.

Species – 26 *Anueropsis coelata* De Beauchamp, 1932 **[Figure. 2.26]**

Synonym: *Anuraeopsis fissa beauchampi*, 1962; *Anuraeopsis fissa coelata* Berzins, 1962; *Anuraeopsis fissa punctata* Evens, 1947; *Anuraopsis navicula* Green, 1960; *Anuraopsis navicula* var. *coelata* De Beauchamp, 1932

Distribution: Tropics and subtropics

In India previously reported from·

Gujarat by Wulfert (1966)

Northwest India by Sharma (1976)

West Bengal by Sharma (1979b)

Description: Lorica is navicular in shape and is granulated. Anterior margin is with a U-shaped sinus. Dorsal plate has ribs along the lorica edge.

Measurements:

Lorica length: 92μm (91 - 93μm)

Maximum width: 46μm

During the present study reported from:

Station I: September 2000 and October 2000

Station II: August 2000, September 2000 and October 2000

Species – 27 *Anuraeopsis fissa* (Gosse, 1851) **[Figure. 2.27]**

Synonym: *Anuraea fissa* Gosse, 1851; *Anuraea hypelasma* Gosse, 1886 or Hudson and Gosse, 1886; *Anuraeopsis congolensis* Evens, 1947; *Anuraeopsis fissa* Donner, 1943; *Anuraeopsis fissa* Wulfert, 1965; *Anuraeopsis hypelasma* Lauterborn, 1900

Distribution: Cosmopolitan

In India previously reported from:

Andhra Pradesh by Dhanapathi (1978)

Gujarat by Wulfert (1966)

Madhya Pradesh by Dagonkar and Saksena (1992) and Kaushik and Saksena (1995)

Punjab by Edmondson and Hutchinson (1934) and Sharma (1980)

Kerala by Nayar and Nair (1969) and Nair and Nayar (1971)

Northwest India by Vasisht and Gupta (1967) and Vasisht and Battish (1971b)

Rajasthan by Nayar (1968)

West Bengal by Sharma (1979b)

Description: Lorica is finely stippled, more or less cylindrical and obtusely pointed Dorsal and ventral plates of lorica are with lateral sulci. Dorsal plate is arched while ventral plate is flat. Anterior margin is smooth. Caudal extremity of lorica is truncate

Measurements:

Lorica length 76μm (69 - 83μm)

Maximum width 52μm (46 - 53μm)

During the present study reported from:

Station I: August 2000, September 2000, October 2000 and December 2000

Station II: August 2000, September 2000 and October 2000

Station III: August 2000.

Station IV: August 2000 and October 2000

FAMILY – 5 COLURELLIDAE Bartos, 1959

Genera –1 ***Colurella*** Bory de St. Vincent, 1824

Synonym: *Colurus* Ehrenberg, 1830

Lorica is composed of two lateral plates, which are strongly compressed laterally. Frontal head hood is present. Lorica is open along anterior, ventral and posterior margins. Terminal foot segment is short. Toes are generally long and tapering. These are small species, which are very common.

This family was represented by two genera Colurella and Lepadella.

Species – 28 *Colurella obtusa* Gosse 1886 **[Figure. 2.28]**

Synonym: *Colurella obtusa* van Hofsten, 1909; *Colurus amblytelus* Gosse, 1886; *Colurus obtusa* Gosse, 1886; *Colurus obtusus* Gosse, 1886, Hudson and Gosse, 1886

Distribution:

It has been previously reported from India (Sharma and Michael, 1980).

Description: Lorica surface is smooth without longitudinal furrows. The lorica valve is rounded and plump. Toes are short.

Measurements:

Length of lorica: 56μm (50 - 60μm)

Width of lorica: 34μm (32 - 38μm)

Length of toes: 16 μm (14 - 20μm)

During the present study reported from:

Station I: September 2000, October 2000 and December 2000

Station II: September 2000, and October 2000.

Station IV: September 2000.

Species – 29 *Colurella uncinata* O. F. Muller, 1773 **[Figure. 2.29]**

Synonym: *Brachionus uncinatus* O. F. Muller, 1773; *Colurella uncinata* Bory de St. Vincent, 1824; *Colurus dactylotus* Gosse, 1886; *Colurus micromela* Gosse, 1887; *Colurus uncinatus* Ehrenberg, 1830; *Monura micromela* Gosse, 1887

Distribution:
In India previously reported from:
Gujarat by Wulfert (1966)

Description: Lorica surface is smooth without longitudinal furrows. Lorica valve is slender. The posterior end of lorica is with raised lines, which terminate in tapering and downward curving spines. Toes are short.

Measurements:
Length of lorica: 74μm (70 - 80μm)
Width of lorica: 44μm (40 - 48μm)
Length of toe 23μm (20 - 25μm)

During the present study reported from:
Station I: March 2000, April 2000, August 2000, September 2000, October 2000, and December 2000
Station III: August 2000

Genera – 2 *Lepadella* Bory De St. Vincent
Lepadella species are benthic, occasionally collected in the plankton of rivers Lorica is composed of a dorsal and a ventral plate that are compressed dorsoventrally. The dorsal and ventral plates are rigidly united at the edges. Anteriorly there is an opening for the protrusion of the head and a posterior opening through which the foot projects. Foot is well developed, with 3-4 segments. Toes are present, which are moderately long Body length is about 60 to 180μm. These are mostly littoral species.

Niche: Bacterivorous

This genus was represented by four species during the present study.

Species – 30. *Lepadella acuminata* (Ehrenberg, 1834) **[Figure. 2.30]**
Synonym: *Lepadella acuminata* Dujardin, 1841; *Metopidia acuminata* Ehrenberg, 1834

Distribution:
In India previously reported from:
Tamil Nadu by Edmondson and Hutchinson (1934)
West Bengal by Sharma (1979)

Description: Lorica is oval in shape. Head aperture is not circular. The antero-dorsal sinus is not very deep. The dorsal plate bears a granulated collar. The ventral plate is nearly flat and the ventral sinus is deep. Posteriorly, the lorica ends in a pointed apex. The foot groove is oval in shape. The foot is stout with long and straight toes.

This is a new record for Gujarat.

Measurements:
Length of lorica: 92μm (90 - 96μm)
Width of lorica: 64μm (60 - 70μm)

Length of foot: 32μm (30 - 33μm)

Length of toes: 24μm (22 - 27μm)

During the present study found at:

Station III: May 2000

Station V: March 2000 and February 2001.

Species – 31 *Lepadella ovalis* (O. F. Muller, 1786) **[Figure. 2.31]**

Synonym: *Brachionus ovalis* O. F. Muller, 1786; *Metopidia lepadella* Ehrenberg, 1832; *Metopidia solidus* Gosse, 1851; *Squamella oblonga* Ehrenberg, 1834

Distribution: Cosmopolitan

In India previously reported from:

Kerala by Nair and Nayar (1971)

Northwest India by Sharma (1976)

Rajasthan by Saxena (2001)

Description: Lorica is subcircular to oval in shape and is compressed dorso-ventrally. The dorsal plate is slightly convex while the ventral plate is flat. The dorsal sinus is U-shaped and the ventral sinus is large and deep. A stippled collar is present on the anterior side of the dorsal plate. Foot groove is almost parallel sided. The toes are short and pointed.

This is a new record for Gujarat.

Measurements:

Body length: 144μm (140 - 155μm)

Maximum Width: 122μm (115 - 125μm)

Toes length: 26μm (24 - 28μm)

During the present study reported from:

Station I: October 2000

Station III: December 2000

Species – 32 *Lepadella patella* (Muller, 1786) **[Figure. 2.32]**

Synonym: *Brachionus patella* O. F. Muller, 1786; *Lepadella parvula* Harring, 1913; *Lepadella similis* Lucks: Naidu, 1967; *Metopidia collaris* Stokes, 1896; *Metopidia lepadella* Hudson and Gosse, 1889; *Squamella bractea* Eckstein, 1883

Distribution: Cosmopolitan

In India previously reported from:

Assam by Sharma (1998b)

Gujarat by Wulfert (1966)

Madhya Pradesh by Kaushik and Saksena (1991); Dagonkar and Saksena (1992); Mishra and Saksena (1998); Kaushik and Saksena (1995)

Kerala by Nair and Nayar (1971)

Northwest India by Sharma (1976)

Rajasthan by Nayar (1968) and Saxena (2001)

Description: This species is common and is also highly variable. Lorica is almost circular and is widest at the posterior part. The dorsal plate is strongly convex and the ventral plate is nearly flat. The dorsal sinus varies from shallow to U-shaped while the ventral sinus is deep. The foot groove is parallel-sided and the edges of the foot groove invariably project slightly below the surface of the ventral plate. The last foot joint is longer than the rest of the foot joints. The toes are straight and pointed. Foot opening is broad. Toes are short and pointed

Measurements:

Body length: 86μm (80 - 90μm)

Maximum width: 69μm (64 - 72μm)

Toes length: 23μm (22 - 26μm)

During the present study reported from:

Station I: March 2000, September 2000 October 2000 and February 2001

Station II: September 2000 and October 2000.

Station III: March 2000, April 2000, May 2000, August 2000.

Station V: August 2000, September 2000, and October 2000.

Species – 33 *Lepadella rhomboides* (Gosse, 1884) **[Figure. 2.33]**

Synonym: *Metopidia rhomboids* 1886 Gosse, 1886

Distribution:

In India previously reported from:

Gujarat by Wulfert (1966)

Tamil Nadu by Edmondson and Hutchinson (1934)

West Bengal by Sharma (1979)

Description: Lorica is rhomboid-ovate. The dorsal plate is moderately convex with a wide and high keel, running from the anterior margin to the end of the lorica. The ventral plate is more or less flat. The dorsal sinus is shallow and the ventral sinus is deep and V-shaped. A stippled collar is present on the dorsal plate. Posteriorly, the lorica is rounded and bordered by lateral grooves. The foot groove is parallel-sided and the foot is long, about one-third the length of the lorica. Toes are slender and pointed.

Measurements:

Length of lorica 89μm (86 - 92μm)

Width of lorica: 56μm (54 - 60μm)

Length of foot: 30μm (28 - 36μm)

Length of toes: 23μm (22 - 28μm)

During the present study reported from:
Station I: August 2000.

FAMILY – 6 MYTILINIDAE Baros, 1959
This family was represented by a single genus.

Genus: *Mytilina* Bory de St. Vincent, 1826
Synonym: *Diplax* Gosse, 1851, *Salpina* Ehrenberg, 1830
Lorica is composed of a ventral plate and two lateral plates, the edges of the latter forming two dorsal ridges. Anterior and posterior spines are often present. Foot is short. Toes are short to long. These are littoral species, usually found in hard waters.

Niche: Herbivorous

Species – 34 *Mytilina ventralis* Ehrenberg, 1832) **[Figure. 2.34]**

Synonym: *Mytilina macracantha* Gosse; *Salpina cortina* Thorpe, 1891; *Salpina eustala* Gosse, 1886; *Salpina macracantha* Gosse, 1886; *Salpina macrocantha* Gosse, 1886; *Salpina ventralis* Ehrenberg, 1832
Distribution: Cosmopolitan
In India previously reported from:
Andhra Pradesh by Dhanapathi (1974b)
Gujarat by Wulfert (1966)
Madhya Pradesh by Kaushik and Saksena (1991); Dagonkar and Saksena (1992); Saksena and Kulkarni (1986); Kaushik and Saksena (1995)
Kerala by Nayar and Nair (1969); Nair and Nayar (1971)
West Bengal by Anderson (1889); Sharma (1979b)
Rajasthan by Nayar (1968)
Northwest India by Sharma (1976)

Description: Body is cylindrical and laterally compressed. Lorica is stout, stiff and well built with a dorsal sulcus. Anterior end is granulated and with two curved, short ventral spine. Posterior end has a single dorsal and two ventral spines. Foot has two sword shaped toes ending in blunt points.

Measurements:
Total length: 206µm (195 - 220µm)
Maximum width: 95µm (90 - 98µm)
Length of anterior spine: 8µm (6 - 10µm)
Length of postero-ventral spine: 45µm (43 - 48µm)
Length of postero-dorsal spine: 32µm (28 - 36µm)
Length of toe: 63µm (56 - 70µm)

During the present study reported from:
Station I: September 2000, October 2000
Station II: October 2000

FAMILY – 7 EUCHLANIDAE Bartos, 1959
This family was represented by a single genus.

Genera – 1 *Euchlanis*
Niche: Algivorous/ Detritivorous
This genus was represented by three species in River Vishwamitri.

Species – 35 *Euchlanis dilatata* Ehrenberg 1832 **[Figure. 2.35]**
Synonym: *Euchlanis dilatata* var. *hipposideros* Manfredi, 1927; *Euchlanis hipposideros* Gosse, 1851

Distribution: Cosmopolitan
In India previously reported from:
Andhra Pradesh by Dhanapathi (1976)
Gujarat by Wulfert (1966)
West Bengal by Sharma (1979b)
Kashmir by Edmondson and Hutchinson (1934)
Northwest India by Das and Akhtar (1976); Sharma (1976)
Rajasthan by Saxena (2001)
Tibet by Stewart (1908)

Description: Body is ovoid, truncate anteriorly and rounded posteriorly. Ventral plate is nearly as large as the dorsal plate and joined to it laterally by membranous, longitudinal sulci. The rounded posterior end of the dorsal plate is divided medially by a deep elongate notch, shaped like an inverted 'U'. Foot is slender and with two joints. Toes are blade-like and fusiform.

The trophi is modified malleate type. It has four opposing club shaped teeth in each uncus, resting in depressions between the ridges of the rami. The rami are triangular and the basal apophysis is large. The tips of the rami are abruptly reduced to very acute points, on the inner side of which is present minute denticulate comb-like process. The fulcrum is short, stout and plow-shaped with a pair of setae at the distal end of first foot joint (Figure 2.35a).

Measurements:
Length of dorsal plate: 220μm (210 - 230μm)
Length of ventral plate: 192μm (185 - 198μm)
Width of dorsal plate: 117μm (115 - 120μm)
Width of ventral plate: 112μm (110 - 114μm)
Length of toes: 64μm (60 - 68μm)

During the present study reported from:
Station III: October 2000.

Species – 36 *Euchlanis oropha* Gosse 1887 **[Figure. 2.36]**
Distribution: Cosmopolitan
In India previously reported from:
Andhra Pradesh by Dhanapathi (1974b)
Gujarat by Wulfert (1966)
West Bengal by Sharma (1979b)
Tamil Nadu by Dhanapathi (1976)

Description: The body is ovate in shape, truncate in front, rounded behind. The dorsal plate is with a deep inverted U-shaped notch in the posterior region. The ventral plate is nearly as large as the dorsal and is joined to it by a pair of longitudinal sulci, which extend the entire length of the body. The foot is stout and two-jointed. The toes are short, stout and are about one-fourth the length of the dorsal plate. Before terminating, the toes narrow down to acute points.

Measurements:
Length of dorsal plate: 210μm (205 - 220μm)
Length of ventral plate: 195μm (190 - 105μm)
Width of dorsal plate: 150μm (140 - 160μm)
Width of ventral plate: 110μm (108 - 120μm)
Length of toes: 75μm (69 - 80μm)

During the present study reported from:

Station I: August 2000

Species – 37 *Euchlanis meneta* Myers **[Figure. 2.37]**
Distribution: America, Canada, India, and China
In India previously reported from:
Kashmir by Edmondson and Hutchinson (1934)
Description: Lorica is ovoid. Dorsal plate rises from neck and falls abruptly near foot, with a deep inverted U-shaped posterior notch. The width of the ventral plate is roughly about two-fifths of the dorsal plate and is connected to the dorsal plate by longitudinal sulci. The foot is two-jointed and very slender. The toes are very long, slender and nearly straight, with a slight swelling near the tips; their length is nearly one-half the length of the dorsal plate. The trophi is modified malleate type. There are four, opposed, clubshaped, functional teeth in each uncus and the usual pair of denticulate, fan-shaped, comb-like processes, one on the inside of each ramus tip (Figure 2.37a).

This is a new record for Gujarat.

Measurements:

Length of dorsal plate: 154μm (148 - 160μm)

Length of ventral plate: 130μm (125 - 138μm)

Width of dorsal plate: 135μm (130 -139μm)

Width of ventral plate: 108μm (98 - 120μm)

Length of toes: 66μm (62 - 68μm)

During the present study reported from:

Station I: September 2000 and October 2000

Station II: December 2000

Station III: October 2000

FAMILY – 8 LECANIDAE Bartos, 1959

This is a family with characteristic shield-shaped loricate rotifers possessing one or two long toes. It is one of the most important families of India represented by 70% species of the *Lecane*-complex, which includes three subgenera i.e. *Lecane* (s.str.), *Lecane (Monostyla)* and *Lecane (Hemimonostyla)*. This family has been revised globally by Segers (1995), who argued for fusion of the three subgenera into a single genus, *Lecane*. However, in the following account the three subgenera have been given separately for convenience.

This family was represented by a single genus with seventeen species.

Genera – 1 *Lecane*

Niche: Bacterivorous/ Herbivorous

Sub genera –1 *L. (Hemimonostyla)* Bartos, 1959

Species – 38. *Lecane (Hemimonostyla) inopinata* Harring and Myers, 1926 **[Figure. 2.38]**

Synonym: *Lecane inopinata sympoda* Wisznewski, 1954; *Lecane sympoda* Hauer, 1929 and 1938; *Lecane sympoda* Wiszniewski, 1931; *Lecane sympoda* Wulfert, 1966

Distribution:

In India previously reported from:

Andhra Pradesh by Dhanapathi (1976)

West Bengal by Sharma (1978)

Description: Lorica is ovate. Antero-dorsal and ventral margins are coincident. Dorsal plate is slightly truncate posteriorly, without any surface markings. Ventral plate is nearly of the same size as dorsal with several longitudinal and two transverse ridges. Postero-ventral segment is small and projects a little beyond the dorsal. Toes are short, straight and fused nearly 1/3 of their length, ending in claw.

A single individual was found.

This is a new record for Gujarat.

Measurements:

Total length: 85μm

Length of dorsal plate: 64μm

Length of ventral plate: 70μm

Width of dorsal plate: 64μm

Width of ventral plate: 55μm

Length of toe: 26μm

Length of claw: 6μm

During the present study reported from:

Station III: May 2000

Sub Genera – 2 *L. (Monostyla)* Ehrenberg, 1830

Species 39 *Lecane (Monostyla) bulla* (Gosse, 1851) **[Figure. 2.39]**

Distribution: Cosmopolitan

Synonym: *Lecane bipes* (Stokes, 1896); *Lecane bulla constricta* (Sudzuki, 1992); *Lecane bulla dentata* (Sudzuki, 1992) *Lecane bulla diana* (Abdullaev, 1989) *Lecane bulla* (kutikovae Naberezhniyi and Irmasheva, 1975); *Lecane goniata* (Harring and Myers, 1926) *Lecane incisa* (Daday, 1897); *Lecane ozolini* (Berzins, 1943) *Kutikova, 1970; Lecane physalis* Wulfert, 1939; *Lecane styrax* (Harring and Myers, 1926) Wiszniewski, 1954; *Lecane styrax longistyla* (Weisig, 1928) Kutikova, 1970; *Monostyla bipes* Stokes, 1896 ; *Monostyla bulla* Gosse, 1851; *Monostyla bulla longistyla* Weisig, 1928 ; *Monostyla goniata* Harring and Myers, 1926; *Monostyla incisa* Daday, 1897 *Monostyla styrax* Harring and Myers, 1926

Distrubution: Cosmopolitan

In India previously reported from:

Assam by Sharma (1998b)

Gujarat by Wulfert (1966)

Madhya Pradesh by Kaushik and Saksena (1991); Dagonkar and Saksena (1992); Kaushik and Saksena (1995)

Northwest India by Sharma (1976)

Rajasthan by Nayar (1968); Saxena (2001)

Tamil Nadu by Pasha (1961); Sampathkumar (1992)

Description: Lorica is firm, elongated and ovate, with narrow anterior and posterior end. Antero-dorsal margin is with a shallow V-shaped sinus, which has a large median notch. Ventral margin has a deep rounded sinus. Posterior end is small, rounded and projects beyond dorsal plate. Single toe is present, which is long, slender, slightly enlarged in the middle and ending in acute claw with basal spicules. Claw is divided.

Measurements:

Total length: 170μm (170 - 180μm)

Length of dorsal plate: 104μm (100 - 110μm)

Length of ventral plate: 115μm (112 - 117μm)

Width of dorsal plate: 85μm

Width of ventral plate: 81μm (80 - 84μm)

Length of toe: 55μm (52 - 58μm)

Length of claw: 16μm (14 - 18μm)

During the present study reported from:

Station I: March 2000, April 2000 and October 2000.

Station II: September 2000, and October 2000.

Station III: March 2000, April 2000, May 2000, October 2000, January 2001, February 2001.

Station IV: October 2000, December 2000, January 2001, and February 2001.

Station V: October 2000, December 2000 and January 2001.

Species 40 *Lecane* (*Monostyla*) *closterocerca* (Schmarda, 1853) **[Figure. 2.40]**

Synonym: *Lecane brodskii* (Muraveisky, 1937) Wiszniewski, 1954; *Lecane closterocerca amazonica* Koste, 1978; *Lecane closterocerca* Wulfert, 1939; *Lecane cornuta* f. *anglica* (Bryce, 1924); *Lecane eichsfeldica* (Kunne, 1926); *Lecane latvica* (Berzins, 1943) Voigt, 1957; *Lecane wulferti* Hauer, 1956; *Monostyla brodskii* Muraveisky, 1937; *Monostyla closterocerca* Harring and Myers, 1926; *Monostyla closterocerca* Schmarda, 1859); *Monostyla cornuta* f. *anglica* Bryce, 1924; *Monostyla eichsfeldica* Kunne, 1926; *Monostyla latvica* Berzins, 1943

Distribution: Cosmopolitan

In India previously reported from

Andhra Pradesh by Rao and Chandra Mohan (1982)

Assam by Sharma (1998b)

Gujarat by Wulfert (1966)

Kashmir by Edmondson and Hutchinson (1934)

Northwest India by Vasisht and Battish (1971); Sharma (1976)

Rajsthan by Nayar (1968)

Tamil Nadu by Edmondson and Hutchinson (1934)

West Bengal by Sharma (1978)

Description: Lorica is subcircular. Antero-dorsal and ventral margins are coincident and have large frontal corners. The anterior margin forms a broad V-shaped sinus. Posterior segment is broad and semicircular and projects slightly beyond the dorsal plate. A single toe is present, which is long, parallel-sided for more than half its length and tapering to an acute point

Measurements:

Length of dorsal plate: 60μm (58 - 63μm)

Length of ventral plate: 64μm (61 - 65μm)

Width of dorsal plate: 55μm (51 - 56μm)

Width of ventral plate: 50μm (49 - 53μm)

Length of toe: 24μm (23 - 25μm)

During the present study recorded from:

Station I: March 2000 and April 2000.

Station III: May 2000, October 2000 and January 2001.

Species 41 *Lecane* (*Monostyla*) *crenata* Harring **[Figure. 2.41]**

Synonym: *Monostyla crenata* Harring, 1913

Distribution:

It has been previously reported from India

Description: Lorica is subcircular to elongate oval. The antero-dorsal margin of the lorica is only slightly concave while the ventral margin is with deep U-shaped sinus with convex side. Toe is long, thin, parallel sided and more than half the body length.

Single individual obtained.

Measurements:

Length of dorsal plate: 89μm

Length of ventral plate: 101μm

Width of dorsal plate: 84μm

Width of ventral plate: 72μm

Length of toe: 55μm

Length of claw: 9μm

During the present study reported from:

Station I: September 2000.

Species - 42 *Lecane* (*Monostyla*) *elachis* (Harring and Myers, 1926) **[Figure. 2.42]**

Synonym: *Monostyla elachis* Harring and Myers, 1926

Distribution:

In India previously reported from:

Gujarat by Wulfert (1966)

Description: Lorica is broadly oval. Antero-dorsal and ventral margins are straight and coincident. Lorica has a distinct pattern. Dorsal plate is similar to the ventral and is truncate posteriorly. Posterior segment is small and rounded. Toe is straight with a slender, long acutely pointed claw.

Single individual observed.

Measurements:

Total length: 92μm

Length of dorsal plate: 69μm

Length of ventral plate: 65μm

Width of dorsal plate: 60μm

Width of ventral plate: 54μm

Length of toe: 20μm

Length of claw: 5μm

During the present study reported from:

Station III: May 2000

Species - 43 *Lecane (Monostyla) hamata* (Stokes 1896) **[Figure. 2.43]**

Synonym: *Lecane arcuata* f. *magna* Koste, 1978; *Lecane fernandoi* Chengalath and Mulamoottil, 1974; *Lecane hamata victoriensis* Koste and Shiel, 1980; *Lecane sinuata* (Hauer, 1938) Voigt, 195); *Monostyla hamata* Stokes, 1896; *Monostyla sinuata* Hauer, 1938

Distribution: Cosmopolitan

In India previously recorded from:

Andhra Pradesh by Dhanapathi (1976b)

Assam by Sharma (1998b)

Gujarat by Wulfert (1966)

Madhya Pradesh by Kaushik and Saksena (1995)

Kashmir and Punjab by Edmondson and Hutchinson (1934)

Tamil Nadu by Pasha (1961)

Northwest India by Sharma (1976)

Rajasthan by Nayar (1968)

West Bengal by Sharma (1978)

Description: Lorica is oval. Head aperture has dorsal and ventral sinuses of different size. Dorsal margin is concave while ventral has a deeper V-shaped sinus. Ventral plate is broader than dorsal plate. Dorsal lorica has regular well-marked facets. Corner cusps are large and triangular. It has a single toe that is slender, parallel sided and tapering to an acute point.

Measurements:

Total length: 101μm (92 - 105 μm)

Length of dorsal plate: 74μm (70 - 77μm)

Length of ventral plate: 78μm (75 - 82 μm)

Width of dorsal plate: 55μm (54 - 58μm)

Width of Ventral plate: 46μm (44 - 49μm)

Length of toe: 28μm (27 - 29μm)

During the present study recorded from:

Station I: August 2000, September 2000 and October 2000.

Station III: April 2000, May 2000, August 2000, September 2000, October 2000 and December 2000.

Species 44 *Lecane (Monostyla) pyriformis* (Daday, 1905) **[Figure. 2.44]**

Synonym: *Lecane paraclosterocerca* (Pennak, 1939) Voigt, 1957; *Lecane pomiformis* Edmondson, 1938; *Monostyla pyriformis* Daday, 1905; *Monostyla truncata* Murray, 1913

Distribution: Cosmopolitan

In India previously recorded from:

Assam by Sharma (1998b)

Madhya Pradesh by Kaushik and Saksena (1995)

West Bengal (Dhanapathi 2000)

Description: Lorica is oval. Anterior margins are coincident and nearly straight except at the corners where they are strongly rounded towards the edge of the lorica. Dorsal plate is broader than ventral plate. No surface markings are present. It has a single toe, which is slender, long, parallel-sided for half its length and finally tapering to fine point.

This is a new record for Gujarat.

Measurements:

Total length: 70μm (66 - 74μm)

Length of dorsal plate: 50μm (48 - 53μm)

Length of ventral plate: 55μm (52 - 57μm)

Width of dorsal plate: 54μm (52 - 57μm)

Width of ventral plate: 52μm (49 - 55μm)

Toe length: 21μm

During the present study recorded from:

Station I: September 2000, and October 2000.

Station V: December 2000.

Species – 45 *Lecane (Monostyla) quadridentata* (Ehrenberg, 1832) **[Figure. 2.45]**

Synonym: *Lecane bicornis* (Daday, 1897); *Lecane quadridentata* Edmondson, 1935; *Lecane quadridentata arthrodactyla* Berzins, 1982; *Lecane sexidentata* (Van Oye, 1926) Wiszniewski, 1954; *Lepadella cornuta* (Schmarda, 1859); *Metopidia cornuta* (Hudson and Gosse, 1889); *Monostyla bicornis* Daday, 1897; *Monostyla quadridentata* Ehrenberg, 1832; *Monostyla sexidentata* Van Oye, 1926

Distribution: Cosmopolitan

In India previously reported from:

Gujarat by Wulfert (1966)

Madhya Pradesh by Kaushik and Saksena (1995) and Saksena and Kulkarni (1986)
Rajasthan by Nayar (1968)

Description: Lorica is oval. Anterior margin of dorsal lorica has a median pyriform sinus, flanked by two stout curved spines. Antero-ventral margin has a deep V-shaped sinus and two frontal spines. Posterior segment is small rounded and not covered by dorsal plate. Single toe present, which is long, slender and ends in long acutely, pointed claw with basal spicules.

Measurements:

Total length: 195μm (185 - 200μm)
Length of dorsal plate: 96μm (90 - 99μm)
Length of ventral plate: 116μm (110 - 119μm)
Width of dorsal plate: 82μm (79 - 85μm)
Width of ventral plate: 76μm (73 - 79μm)
Toe length: 42μm (40 - 44μm)
Length of claw: 19μm (18 - 20μm)

During the present study reported from:
Station I: September 2000 and October 2000
Station II: October 2000

Species 46 *Lecane* (*Monostyla*) *stenroosi* (Meissner, 1908) **[Figure. 2.46]**

Synonym: *Lecane bicornis* (Stenroos, 1898); *Lecane stenroosi* Wiszniewski, 1953; *Monostyla bicornis* Stenroos, 1898; *Monostyla stenroosi* Meissner, 1908

Distribution: Cosmopolitan
In India previously reported from:
Gujarat by Wulfert (1966)

Description: Lorica is oval. Antero-dorsal margin is straight. Ventral margin is with shallow sinus and strongly convex sides with two-incurved stout hook-like frontal spines. Posterior segment is broad and rounded. Toe is long, stout and tapers to short, stout acutely pointed claw having two basal spicules.

Measurement:

Total length: 162μm (156 - 170μm)
Length of dorsal plate: 110μm (105 - 115μm)
Length of ventral plate: 115μm (110 - 120μm)
Width of dorsal plate: 85μm (83 - 88μm)
Width of ventral plate: 85μm (83 - 88μm)
Toe length: 37μm (36 - 40μm)
Length of claw: 8.6μm (7 - 9μm)

During the present study reported from:

Station III: May 2000.

Sub Genera –3 *Lecane* (S.Str)

Species - 47 *Lecane arcula* Harring 1914 **[Figure. 2.47]**

Synonym: *Cathypna aculeata* Murray, 1913; *Lecane strandi* Berzins, 1943

Distribution: Cosmotropical

In India previously reported from:

Gujarat by Wulfert (1966)

West Bengal by Sharma (1976b)

Description: Lorica is ovate. Antero-dorsal and ventral margins are straight and coincident Frontal corners of lorica have acute cusps or spines. Posterior segment is rounded and extends beyond the dorsal plate. Two long slender toes present, which end in sharp pointed claws

Measurements:

Total length: 94µm (92 - 115µm)

Length of dorsal plate: 57µm (5 - 59µm)

Length of ventral plate: 66µm (65 - 68µm)

Width of dorsal plate: 53µm (50 - 54µm)

Width of ventral plate: 46µm (44 - 47µm)

Length of toe: 20µm (19 - 23µm)

Length of claw: 5µm (4 - 5µm)

During the present study reported from:

Station II: August 2000

Station III: May 2000

Species - 48 *Lecane* (*L.*) *crepida* Harring, 1914 **[Figure. 2.48]**

Synonym: *Lecane crepida longidactyla* Koste, 1972; *Lecane neali* Wulfert, 1966; *Lecane vasishti* Sharma, 1980

In India found from:

Gujarat by Wulfert in (1966)

Tamil Nadu by Pasha (1961)

Description: The lorica is parallel-sided in the anterior half and subsequently tapers towards the foot. The antero-dorsal margin is slightly convex and the ventral a little concave. At the external angles of the anterior end are two curved spines. The dorsal plate is convex and smaller than the ventral. The ventral plate has a conspicuous transverse fold in front of the foot. The toes are long and slender, straight for more than one fourth of the total length and

slightly tapering. They terminate in long, slender, acutely pointed claws that are sharply constricted at base.

Measurements:

Total length: 116μm (110 - 120 μm)

Length of dorsal plate: 72μm (70 - 75μm)

Length of ventral plate: 90μm (89 - 92μm)

Width of dorsal plate: 55μm (52 - 56μm)

Width of ventral plate: 59μm (56 - 90μm)

Length of toe: 33μm (32 - 33μm)

Length of claw: 9μm

During the present study reported from:

Station I: October 2000

Species 49 *Lecane* (*L.*) *curvicornis* (Murray, 1913) **[Figure. 2.49]**

Synonym: *Cathypna curvicornis* Murray, 1913; *Cathypna lofuana* Murray, 1913; *Cathypna nitida* Murray, 1913; *Lecane curvicornis* Harring, 1914; *Lecane acronycha* Harring and Myers, 1926; *Lecane bondi* Edmondson, 1934; *Lecane chankensis* Bogoslovsky, 1958; *Lecane curvilinealis* Arora, 1965; *Lecane lofuana* (Murray, 1913) Harring, 1914; *Lecane longidactylus* Arora, 1965; *Lecane nitida* (Murray, 1913) Harring, 1914; *Lecane tesselata* Arora, 1965: *Lecane triloba* Yamamoto, 1951; *Lecane ungulata curvicornis* Berzins, 1959, *Lecane zwaiensis* Bryce, 1931

Distribution: Cosmopolitan

In India previously recorded from:

Gujarat by Wulfert (1966)

Description: Lorica is pyriform in shape. Anterior margin coincident and forms a broad V-shaped sinus. At the external angle are two large prominent spines. Dorsal plate is oval and projects beyond the ventral plate. Posteriorly the lorica becomes narrow and rounded. Two long, slender, parallel-sided toes are present that terminate in short claws with basal spicules.

Measurements:

Length of dorsal plate: 124μm (120 - 126μm)

Length of ventral plate: 130μm (124 - 132μm)

Width of dorsal plate: 104μm (100 - 106μm)

Width of ventral plate: 110μm (105 - 112μm)

Length of toe: 45μm (43 - 46μm)

Length of claw: 10μm (9 -10μm)

During the present study reported from:

Station I: September 2000 and October 2000.

Station III: May 2000.

Species - 50 *Lecane* (*L.*) *inermis* (Bryce, 1892) **[Figure. 2.50]**

Synonym: *Cathypna inermis* Murray, 1913; *Distyla inermis* Bryce, 1892; *Lecane amorpha* Harring, 1914; *Lecane inermis* Harring, 1913; *Lecane supinoi* Manfredi, 1929

In India previously reported from:

Assam by Sharma (1998b)

Description: Lorica is elongated and narrow with its sides parallel in the anterior half, bulging slightly in the middle and tapering slightly towards the foot. The anterior margin is straight The toes are long, parallel-sided, extending beyond the footplate and finally terminating in claws

This is a new record for Gujarat.

Measurements:

Length: 69µm (67 - 78µm)

Width: 46µm (40 - 52µm)

Length of toes: 23µm (23 - 24µm)

During the present study reported from:

Station I: September 2000 and October 2000.

Station II: September.

Station III: May 2000 and December 2000.

Station IV: October.

Station V: September.

Species - 51 *Lecane* (*L.*). *leontina* (Turner, 1892) [Figure. 2.51]

Synonym: *Cathypna biloba* Daday, 1905; *Cathypna incisa* Daday, 1905; *Cathypna leontina* Turner, 1892; *Cathypna leontina bisinuata* Daday, 1905; *Cathypna leontina* var. *bisinuata* Daday, 1905; *Cathypna macrodactyla* Daday, 1898; *Cathypna scutaria* Stokes, 1897; *Lecane biloba* (Daday, 1905; *Lecane incisa* (Daday, 1905); *Lecane leontina* Harring, 1913; *Lecane leontina bisinuata* (Daday, 1905); *Lecane macrodactyla* (Daday, 1898); *Lecane scutaria* (Stokes, 1897); *Lecane thomassoni* Wulfert, 1965

Distribution: Cosmotropical

In India previously reported from:

Andhra Pradesh by Dhanapathi (1976)

Madhya Pradesh by Kaushik and Saksena (1995)

Maharashtra by Arora (1965)

West Bengal by Sharma (1979)

Description: Lorica is pyriform. Antero-ventral margin is with a broad V shaped sinus while the dorsal margin has slight concavity. Dorsal and ventral plates are of nearly same width.

Posterior segment extends over the foot projection, which has two long divergent spines. Frontal corners of lorica have acute triangular spines. Two toes are present which are very long, straight. The toes terminate in claws, which have basal spicules.

This is a new record for Gujarat.

Measurements:
Total length: 240µm (239 - 267µm)
Length of dorsal plate: 138µm (128 - 142µm)
Length of ventral plate: 158µm (151 - 164µm)
Width of dorsal plate: 103µm (98 - 109µm)
Width of ventral plate: 105µm (100 - 112µm)
Length of toe: 97µm (92 - 101µm)
Length of claw: 10µm (9 -11µm)

During the present study reported from:
Station I: October 2000
Station II: October 2000

Species - 52 *Lecane (L.) luna* (O. F. Müller) **[Figure. 2.52]**

Synonym: *Brachionus luna* Blainville, 1830; *Cathypna latifrons* Gosse, 1887; *Cathypna luna* Gosse, 1886; *Cercaria luna* O. F. Muller, 1776; *Euchlanis emarginata* Eichwald, 1847; *Euchlanis luna* Ehrenberg, 1832; *Furcocerca luna* Lauterborn, 1815; *Furcularia jobloti* Bory de St. Vincent, 1827; *Lecane dorsicalis* Arora, 1965; *Lecane emarginata* (Eichwald, 1847); *Lecane jobloti* (Bory de St. Vincent, 1827; *Lecane luna balatonica* Varga, 1945; *Lecane luna* Harring, 1913; *Lecane luna* Nitzsch, 1827; *Lecane submagna* De Ridder, 1960; *Trichocerca luna* Bory de St. Vincent, 1826

Distribution: Cosmopolitan
In India previously recorded from:
Andhra Pradesh by Dhanapathi (2000)
Assam by Sharma (1998b)
Gujarat by Wulfert (1966)
Madhya Pradesh by Kaushik and Saksena (1991); Kaushik and Saksena (1995)
Kashmir by Edmondonson and Hutchinson (1934)
Northwest India by Sharma (1976)
West Bengal by Sharma (1978)
Rajasthan by Nayar (1968)
Punjab by Edmondonson and Hutchinson (1934)

Description: Lorica is broadly oval to subcircular. Anterior margin forms a deep lunate sinus with cusps at the external angles. Posterior segment is rounded. Toes are slender, which terminate in claws.

Measurements:

Total length: 176μm (166 - 185μm)

Length of dorsal plate: 122μm (118 - 130μm)

Length of ventral plate: 133μm (125 - 140μm)

Width of dorsal plate: 110μm (105 - 115μm)

Width of ventral plate: 104μm (100 - 110μm)

Length of toe: 43μm (40 - 45μm)

Length of claw: 7μm (7 - 9μm)

During the present study it was reported from:

Station I: August 2000.

Station II: August 2000.

Station III: March 2000, April 2000, May 2000, August 2000, September 2000 and January 2001.

Species – 53 *Lecane* (*L.*) nana (Murray 1913) **[Figure. 2.53]**

Synonym: *Cathypna nana* Murray

Distribution: Cosmopolitan

In India previously reported from:

Gujarat by Wulfert (1966)

Rajasthan by Nayar (1968)

West Bengal by Sharma (1978)

Description: Lorica is broad anteriorly and the dorsal and ventral margins are straight and coincident. The dorsal plate is smooth and shorter than the ventral plate. Second foot segment lies beneath the lorica margin. Two slender toes present which measures 1/3rd the body length. Claws are absent but the toes taper to fine points.

Measurements:

Total length: 80μm (78-85μm)

Length of dorsal plate: 52μm (51 - 54μm)

Length of ventral plate: 56μm (54 - 57μm)

Width of dorsal plate: 50μm (48 - 53μm)

Width of ventral plate: 48μm (46 - 50μm)

Toe length: 19μm (18-21μm)

During the present study reported from:

Station III: May 2000

Species- 54 *Lecane* (*L.*). *papuana* (Murray) **[Figure. 2.54]**

Synonym: *Cathypna papuana* Murray, 1913; *Lecane luna* var. *presumpta* Ahlstrom, 1938;

Lecane papuana Harring and Myers, 1926; *Lecane yamunensis* Novotna-Dvorakova, 1962

Distribution: Cosmotropical

In India previously reported from:

Andhra Pradesh by Dhanapathi (1976)

Gujarat by Wulfert (1966)

Madhya Pradesh by Kaushik and Saksena (1995)

Kashmir by Edmondson and Hutchinson (1934)

Tamil Nadu by Pasha (1961)

Rajasthan by Nayar (1968)

West Bengal by Sharma (1979)

Description: Lorica is nearly subcircular. Antero-dorsal margin is straight while ventral margin has a shallow V-shaped sinus and undulate sides. Anterior corners of lorica have rounded projections. Ventral plate is slightly narrower than dorsal. Posterior segment is small and rounded. It has two toes, which are parallel sided and ending in claws with basal spines.

Measurements:

Length of dorsal plate: 110µm (100 - 115µm)

Length of ventral plate: 116µm (110 - 118µm)

Width of dorsal plate: 92µm (88 - 98µm)

Width of ventral plate: 87µm (80 - 90µm)

Length of toe: 25µm (23 - 27µm)

Length of claw: 9µm (9 - 10µm)

During the present study reported from:

Station II: August 2000.

Station III: April 2000, May 2000 and December 2000.

Species - 55 *Lecane ungulata* (Gosse 1887) **[Figure. 2.55]**

Synonym: *Cathypna glandulosa* Stokes, 1897; *Cathypna magna* Lucks, 1912; *Cathypna magna* Stenroos, 1898; *Cathypna magna tenuior* Stenroos, 1898; *Cathypna minnesotensis* Murray, 1913; *Cathypna ungulata* Gosse, 1887; *Cathypna ungulata* var. *magna* Sachse, 1912; *Lecane donnerianus* Dhanapathi, 1976; *Lecane grandulosa* (Stokes, 1897); *Lecane fracida* Berzins, 1982; *Lecane sverigis* Ahlstrom, 1934; *Lecane ungulata* Harring, 1913; *Lecane ungulata* var. *australiensis* Koste and Shiel, 1990

Distribution: Cosmopolitan

In India previously reported from:

Gujarat by Wulfert (1966)

Northwest India by Sharma (1976)

Description: Lorica is broadly ovate. Antero-dorsal margin is straight while ventral margin is slightly concave. Frontal corners have large triangular cusps at the external angle. Dorsal plate is without surface markings; ventral plate has irregular transverse folds. Posterior segment is broad, slightly truncate and projects beyond the foot. Two toes are present which are long, parallel sided and ending in very long pointed claws.

Measurements:

Total length: 272μm (267 - 280μm)

Length of dorsal plate: 225μm (218 - 228μm)

Length of ventral plate: 267μm (254 -263μm)

Width of dorsal plate: 175μm (171 - 178μm)

Width of ventral plate: 194μm (190 - 199μm)

Length of toe: 69μm (65 - 74μm)

Length of claw: 46μm (44 - 47μm)

During the present study reported from:

Station I: October 2000

Station III: May 2000

FAMILY – 9 TRICHORCERCIDAE Remane, 1933

Genera – 1 Trichocerca

Synonym: *Mastigocerca* Ehrenberg, 1830; *Monocerca* Bory de St Vincent, 1826; *Rattulus* Lamarck, 1816

Species – 56 *Trichocerca brazieliensis* (Murray, 1913) **[Figure. 2.56]**

Synonym: *Rattulus braziliensis* Murray, 1913; *Trichocerca elongata braziliensis* (Murray, 1913

Distribution: Australia

This species has been previously reported from India (Sharma and Micheal, 1980)

Description: The body is short and slightly squat. Anterior margin of lorica is without projections. Two striated dorsal keels are present on the body that extend less than one-third of the body length. Right toe is considerably reduced. Left toe is distinct being longer than the length of lorica. Trophi is of virgate type. The left manubrium is smaller than the right and has a small spoon shaped projection outwards. There is a small spine-like extension from the right side of the rami-uncus complex (Figure 2.56a).

Measurements:

Length of lorica: 151μm (144 - 158μm)

Maximum width: 69μm (68 - 71μm)

Length of main toe: 156μm (150 - 160μm)

Trohpi: 49μm (47-51μm)

During the present study reported from:
Station I: October 2000
Station IV: December 2000

FAMILY – 10 NOTOMMATIDAE Remane, 1933

Subfamily- Notommatinae

Genera – 1 *Cephallodella* Bory de St. Vincent, 1826
Synonym: *Diaschiza* Gosse, 1886; *Diglena* Ehrenberg, 1830
Lorica is composed of dorsal and ventral plates not united at the edges, but thin and poorly developed. Body is prismatic or spindle-shaped. Two toes present, which are tapering, usually curved. Foot is rudimentary and unjointed. Mastax is if virgate type. Both rami and unci are of very simple construction. Retrocerebral sac is absent.

Niche: Herbivorous/ Omnivorous/ Carnivorous

Species – 57 *Cephalodella misgurunus* Wulfert **[Figure. 2.57]**
Distribution: Australia, India
Gujarat by Wulfert (1966)

Description: Body is slender and elongated. The head is moderately large. Paired eyespots with crystalline lens are present. Trophus (figure 2.57a) is probably species specific in 3-dimensional structure (Shiel, 1995). The neck is well marked. The abdomen increases gradually in depth for about two-thirds of its length and from there tapers rapidly towards the toes. The toes are straight and taper evenly from base to tip. Toes are more than one-third the body length

Measurements:
Total length: 154µm
Maximum width: 60µm
Toe length: 59µm

During the present study reported from
Station I: August 2000, October 2000
Station II: October 2000
Station III: December 2000

Genera – 2 *Scaridium* Ehrenberg, 1830
Lorica is vase-shaped, cylindrical, thin and without the bulging dorsum. Foot long, toes shorter than rest of body. Trophi is modified virgate type. These are littoral species.
Niche: Herbivorous

Species – 58 *Scaridium longicaudum* (O. F. Müller, 1786) **[Figure. 2.58]**
Synonym: *Eudactylota eudactylota* (Gosse, 1886); *Scaridium bostjani* after Dartnall and

Hollowday, 1985 *Scaridium eudactylotum* Gosse, 1886; *Scaridium longicaudatum* Ehrenberg, 1830, *Scaridium longicaudum* Ehrenberg, 1830 *Scaridium longicaudatum maculatum* Bergendal, 1892 *Trichoda longicaudata* O. F. Muller, 1786

Distribution: Cosmopolitan

In India previously reported from:
Andhra Pradesh by Dhanapathi (1978)
Gujarat by Wulfert (1966)
West Bengal by Sharma (1979)
Punjab by Edmondson and Hutchinson (1934); Vasisth and Battish (1969)

Description: Body is cylindrical or fusiform, very thin and transparent, partially loricate both dorsally and ventrally. Foot is very long, three segmented, not retractable with short basal and long distal segments. It also has prominent striated muscle strands and very long straight toes ending in points.

Measurements:
Total length: 290μm (277 - 300μm)
Body length: 119μm (110 - 125μm)
Maximum width: 64μm (62 - 67μm)
Length of basal foot segment: 37μm (34 - 39μm)
Length of distal foot segment: 60μm (55 - 63μm)
Length of toes: 115μm (110 - 118 μm)

In the present study reported from:
Station I: August 2000, September 2000 and October 2000.
Station II: September 2000.

FAMILY – 11 SYNCHAETIDAE Remane, 1933

Genera – 1 Polyarthra Ehrenberg, 1834

Species – 59 *Polyarthra* sp. [Figure. 2.59]

This genus has been reported from India. Six species have so far been described from here.

Description: The body is more or less rectangular, with 12 transparent, movable, sword- or blade-shaped lateral appendages. They can be distinguished only by the relative body/paddle length ratio that is highly variable, and the length/width ratio of the pectoral fins that are visible only with great difficulty. The pectoral fins can be seen in the living animals as they swim and turn, but only momentarily.

Measurements:
Average body length: 109μm (97-115μm)
Width of body: 72μm (69-78μm)
Length of fin: 66μm (60-69μm)

During the present study reported from:
Station I: August 2000, September 2000 and October 2000.
Station II: September 2000 and October 2000.
Station III: August 2000, September 2000, October 2000 and December 2000.
Station IV: September 2000.

DISCUSSION

Taxonomic investigations, on Indian rotifers, were initiated by Anderson (1889), who studied 47 species, collected from Calcutta and its environs in West Bengal. Since then, there have been over 100 publications dealing with Indian rotifers (Sharma, 1996). Earlier, Sharma and Michael (1980) listed 241 species reported from India. Sudzuki in 1989 has listed 260 species that are reported from India. This status was reasonably augmented by various contributions during the last decade (1981-1990). As a result, 325 species spread over 25 families and 63 genera have been documented and these represent 13% of the world's rotifer fauna (Sharma, 1998a). The Indian rotifer fauna seems to be cosmotropical and comparable to the rotifer faunas of Indonesia (Hauer, 1937; 1938) and Sri Lanka (Chengalath *et al.*, 1974). A large number of cosmopolitan species are also represented in the Indian rotifer fauna. In the present study majority of the species are cosmopolitan, while only a few are cosmotropical.

The Rotifer fauna of River Vishwamitri is represented by 59 species, belonging to 23 genera and 17 families. Out of the 17 families, sixteen (94%) are monogononts while only one family belongs to the class Digononta, thus representing just 6% of the total rotifer population. All three orders of Monogononts are represented in the present study. However, the bulk of these belong to order Ploimida. Out of the sixteen-monogonont families eleven belong to order Ploimida, four to order Flosculariacea and a single family belongs to order Collothecea. The order Bdelloidea is represented by a single family and a single species. This is in accordance with Sharma and Michael (1980) who reported that the rotifer taxa from India belongs to 24 Eurotatorian families spread over 62 genera. The bulk of these belong to class Monogononts, of which the order Ploimida is represented by the highest number of families (Sharma and Michael, 1980).

Sharma and Michael (1980) described *Brachionus angularis*, *B. caudatus*, *B. falcatus*, *B forficula*, *B. quadridentatus*, *Anueropsis fissa*, *Keratella tropica*, *K. procurva*, *Euchlanis diltata*, *Mytilina ventralis*, *Lepadella patella*, *L ovalis*, *L luna*, *L crepida*, *L. papuana*, *L bulla*, *L. closterocerca*, *Filinia opoliensis*, *F. longiseta* and *Testudinella patina* as the commonest species of this country. All of the above mentioned species have been recorded during the present study.

The Lecane complex has been described as having the maximum number of representatives, with a total of 59 species reported from India (Sharma and Michael, 1980). In this study too family Lecanidae had the maximum representation, a total of eighteen species. A predominance of this group has been ascribed to their ability to live in varied habitats (Sharma and Michael, 1980). Out of the total 33 *Lecane* (S. str.) reported from India 8 are found in River Vishwamitri, out of the total 23 species of *Lecane* (*Monostyla*) reported from India 9 are found in Vishwamitri and from the 3 species of *Lecane* (*Hemimonostyla*) reported, one species is found during the present study.

The Brachionidae with six genera and 31 species is reported to be next in order of abundance after the Lecanidae (Sharma and Michael, 1980). In River Vishwamitri, the Brachionidae, having five genera and 15 species forms the second largest group in River Vishwamitri. An abundance of Brachionus species, which is characteristic of many tropical waters has been reported by Green (1972), Chengalath *et al.* (1974), Pejler (1977), Fernando (1980a, 1980b), Sharma and Michael (1980) and Sharma (1983). Edmondson and Hutchinson (1934) have also described Brachionid species as common in India. Sharma (1987) reports that various species of this genus dominate plankton samples in warmer parts of peninsular India. Similar results have been obtained during the present study. Nine species of *Brachionus* during the current studies have been recorded from River Vishwamitri. *Brachionus* has been described as one of the most ancient genus of monogonont rotifers and includes about 46 species (Sharma, 1987). Brachionus is of Gondwanian origin and has invaded Eurasia and North America secondarily by dispersal from India and Africa (Dumont, 1983). The *Brachionid* genus *Keratella* is represented by two species out of a total of 7 species reported from India. *Keratella tropica*, which appears to be the most widely distributed species in this country (Sharma, 1987) is also reported from River Vishwamitri. *Keratella procurva*, the other species reported from River Vishwamitri has been previously collected from Punjab, Kerala, Rajasthan, West Bengal and Orissa (Sharma, 1987). *Platyias quadricornis*, another Brachionid species, which is widely distributed from India has been reported only once from River Vishwamitri. Both the species of *Anueropisis fissa* and *A. coelata* were found frequently in River Vishwamitri, though amongst the two *A. fissa* is reported with a wider distribution as compared to *A. coelata*. Sharma (1996) has described various non-planktonic taxa like Epiphanidae, Proalidae, Notommatidae, Trichotridae, Synchaetidae and Dicranophoridae, which represents about one-fourth of the total Indian taxa, as poorly studied. In River Vishwamitri four of the above mentioned families are recorded. One species each of Notommatidae, Trichotridae, Synchaetidae and Dicranophoridae have been recorded.

Except for the studies by Anderson (1889), Murray (1906), Edmondson and Hutchinson (1934), Wycliffe and Michael, (1968), there is very little information on the Bdelloids of India. Of the five families of Order Bdelloidea only Philodinidae has been recorded from India. *Rotatoria neptunia* was the only species of Bdelloid rotifer identified from River Vishwamitri.

An overall assessment of the rotifer fauna of river Vishwamitri indicates that the Rotifer group is quite rich and varied. While many species are ubiquitous, some are restricted to particular habitats.

MORPHOLOGICAL VARIATIONS

Changes in rotifer growth form include elongation in relation to body width, enlargement, reduction in size, and production of lateral spines. Seasonal changes in the body shape of successive generations have been described for a number of Temperate Zone rotifers (Wesenber-Lund, 1908; 1930; Ruttner-Kolisko, 1949; Gallagher, 1957). As far as the tropical zone is concerned Green (1960), Nayar (1964) and Arora (1966c) have made observations on this aspect. Green (1960) has described the changes occurring in *Keratella tropica* and *Brachionus caudatus*. Nayar (1965a) reported on the cyclomorphic changes in *Brachionus calyciflorus*. Arora (1966c) described the morphological variations in *B. calyciflorus*.

During the present study morphological variations were observed in a few *Brachionid* species.

Ahlstrom (1940) states that *B. calyciflorus* is an exceedingly variable species. Especially this is true of size, length of anterior spines and presence or absence of anterior spines. On this basis earlier workers have referred to the various forms as separate varieties.

Ahlstrom (1940) observed that in *B. calyciflorus* forms lacking postero-lateral spines were larger than those with postero-lateral spines. In the present study too such an observation was made in regards to *B. calyciflorus*. Nayar (1964) however, reported that no correlation exists between the size of the lorica and the postero-lateral spines. Buchner *et al.* (1957) suggests that poor feeding enhance the spine growth in *B. calyciflorus*. Wolterreck (1928) also suggested that seasonal change in the food of the animal cause the morphological variations. However, Nayar (1964) reported that the increase in number of individuals as well as the production of additional structures depends on the quantity of food available. Wesenberg Lund (1900, 1926) suggested that the seasonal morphological changes are due to the changes in the density of water arising from the seasonal change in temperature as adaptation for

floatation. Nayar (1965 a) from his studies suggested that the physicochemical factors might not have a direct influence on the rotifers. Indirectly they together may create an environment providing the required type of food on which they can flourish. Gilbert (1967) found that development of lateral spines in *B. calyciflorus* can be induced by predator *Asplanchna*. Dhanpathi (1974b, 1977) suggested that the unstable critical period in summer is responsible for unusual morphological character. Further Nayar (1965a) stated that pH and dissolved oxygen influence the growth.

During the present study different morphological forms were present in the same samples suggesting that food and physicochemical parameters may not be influencing the rotifer morphology within a species. Probably as suggested by Arora (1966c) the size variations in a single species can be attributed to the stage of growth.

FIGURE 2.i Anatomy of rotifer species

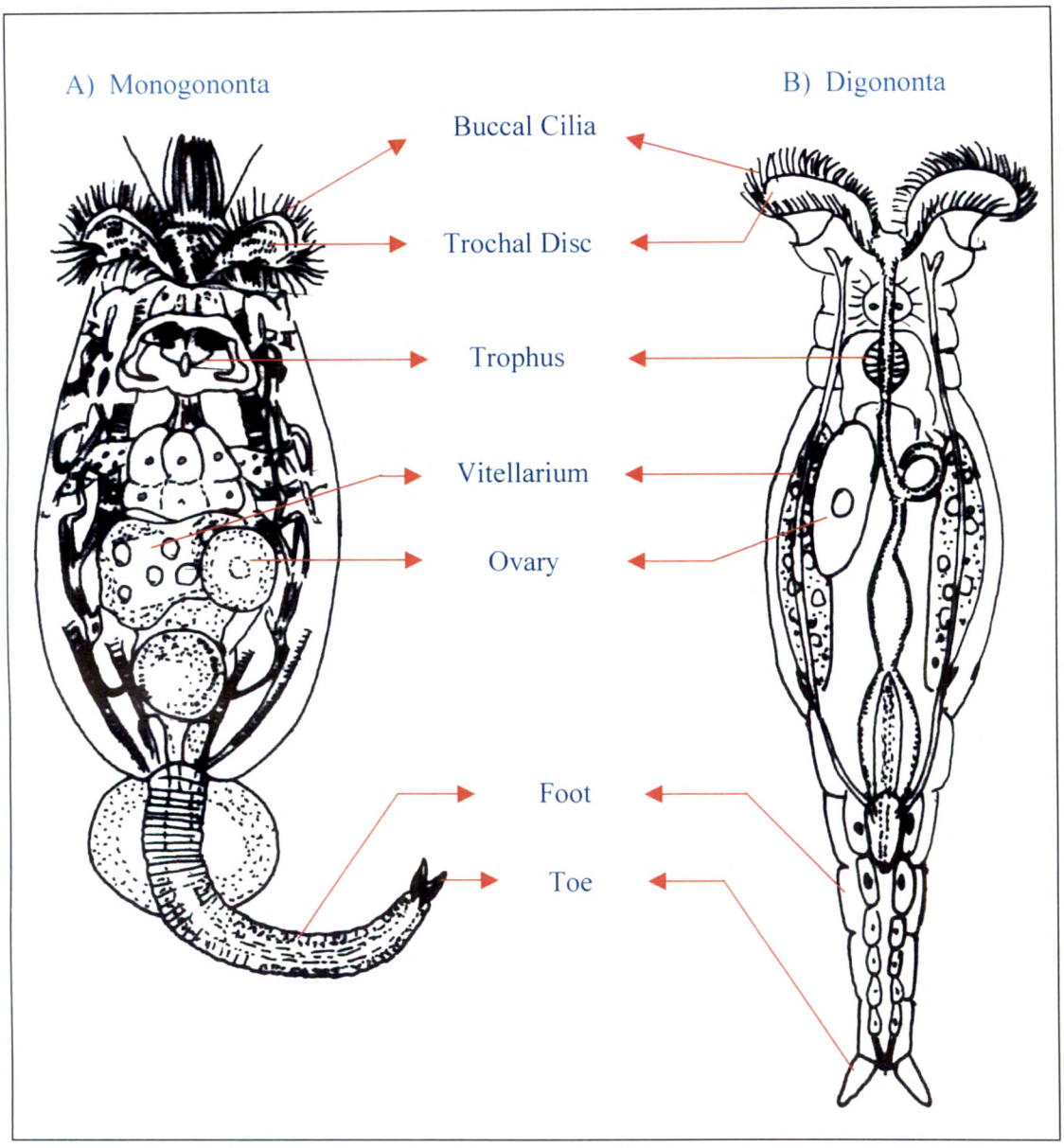


FIGURE 2.ii Diagrammatic representation of trophus showing various parts

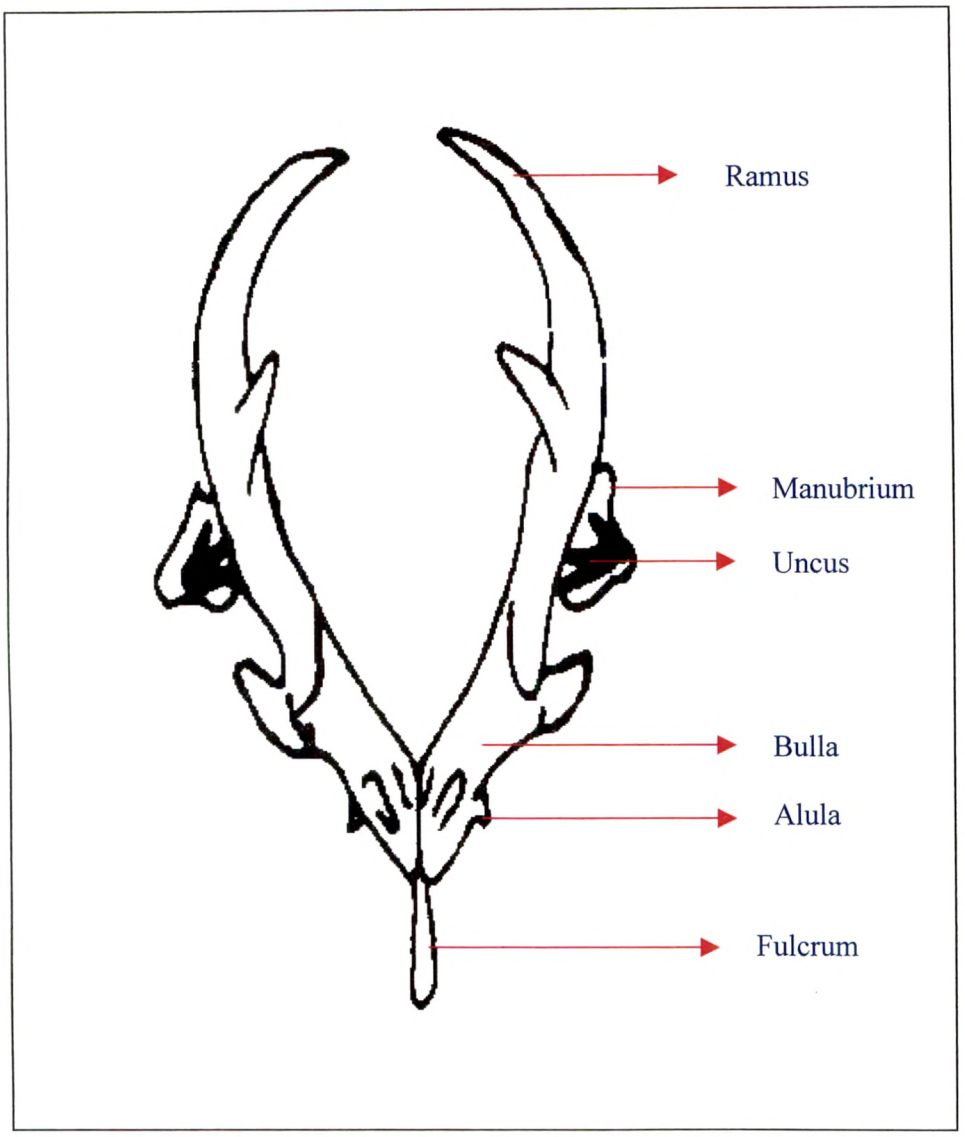


FIGURE 2.iii Forcipate

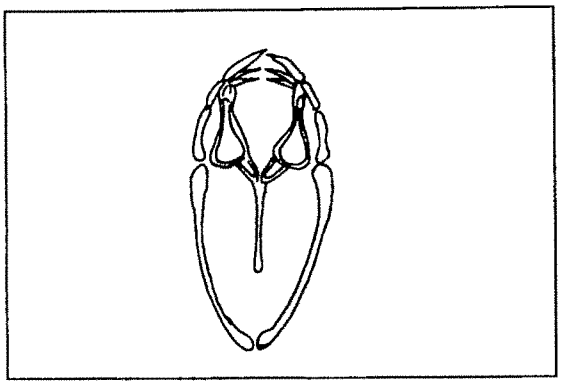


FIGURE 2.iv Malleate

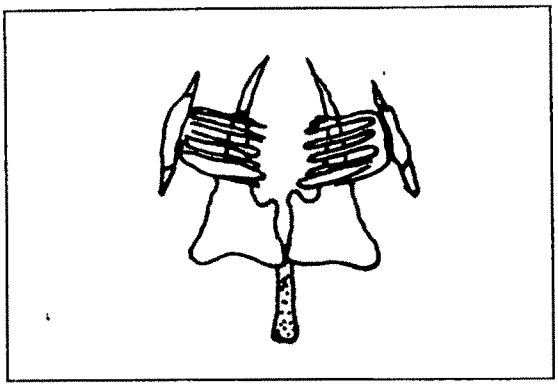


FIGURE 2.v Virgate

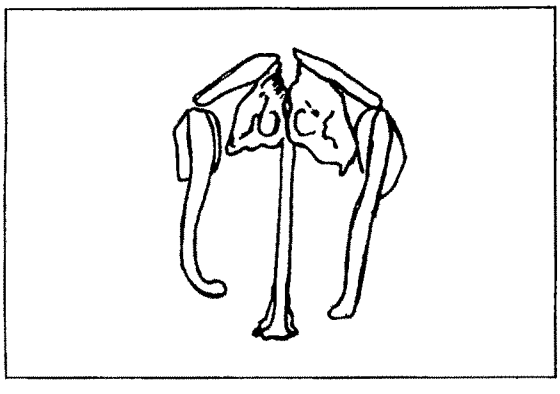


FIGURE 2.vi Incudate

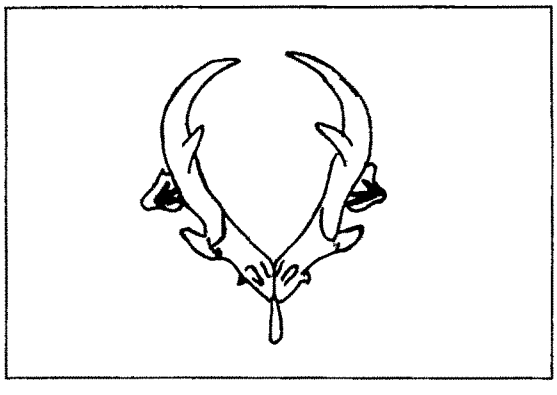


FIGURE 2.vii Uncinate

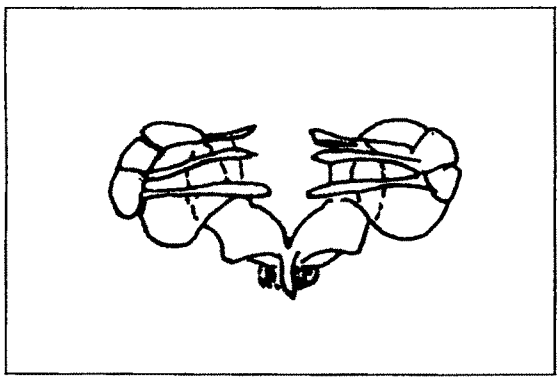


FIGURE 2.viii Ramate

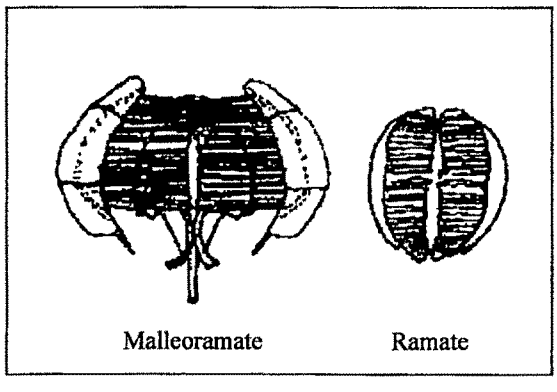


FIGURE 2.1 *Rotaria neptunia* (65x)

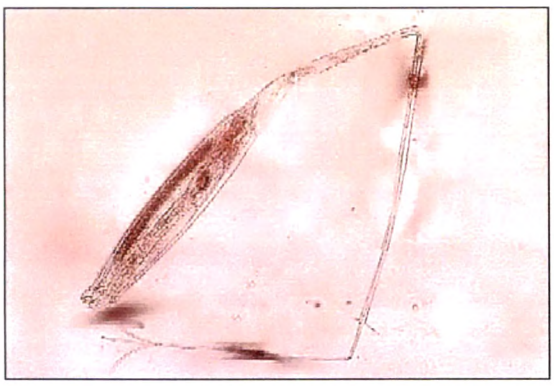


FIGURE 2.2 *Cupelopagis vorax* (110x)

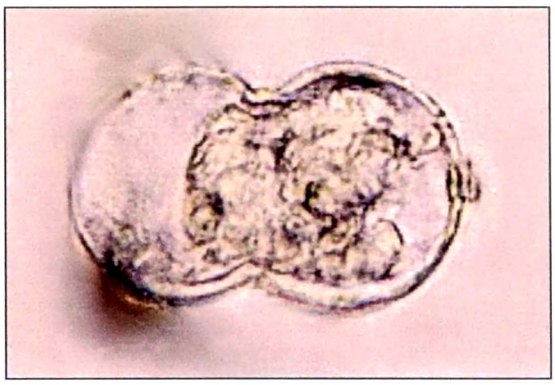


FIGURE 2.3 *Hexarthra mira*

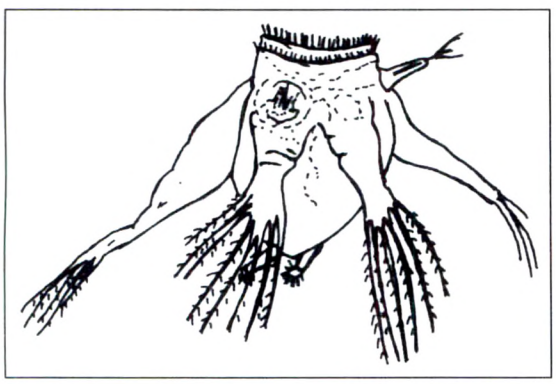


FIGURE 2.3a *Hexarthra mira* - Trophus

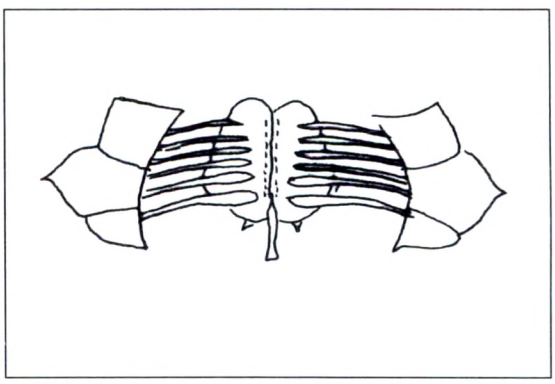


FIGURE 2.4a *Lacinularia sp.*-Colony

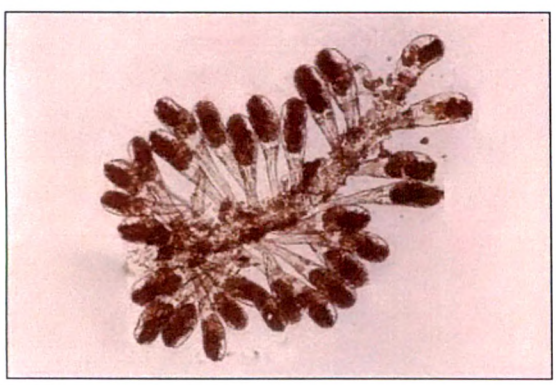


FIGURE 2.4b *Lacinularia* sp.-Individual (255 x)

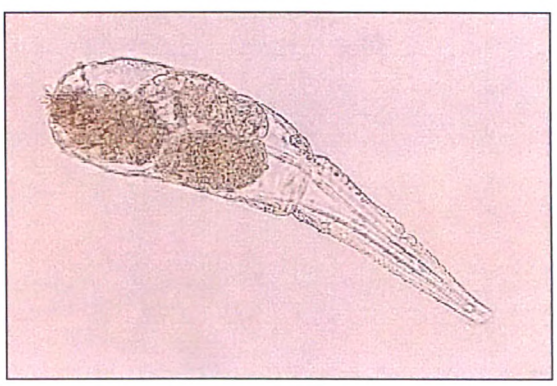


FIGURE 2.5 *Filinia longiseta* (102x)

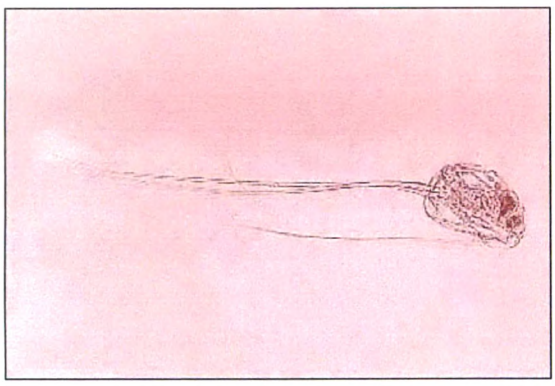


FIGURE 2.6 *Filinia opoliensis* (145x)

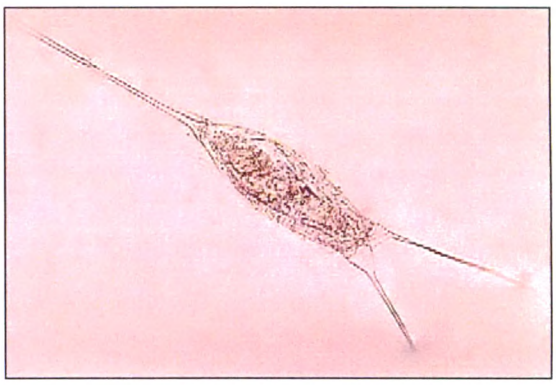


FIGURE 2.7 *Testudinella patina* (250x)

FIGURE 2. 8 *Dicranophorus australiensis* (450x)

FIGURE 2.8a *D. australiensis - Trophus*

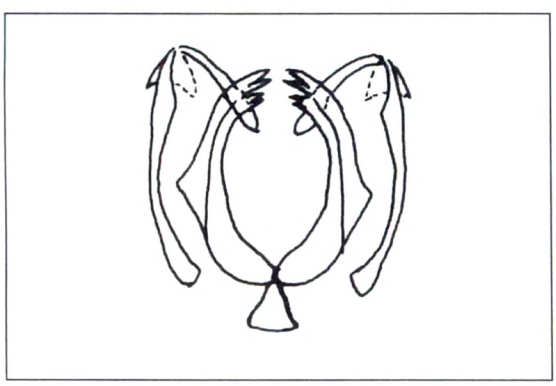


FIGURE 2.9 *Encentrum sp.*

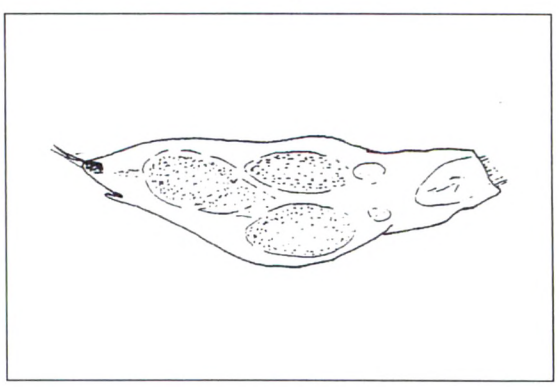


FIGURE 2.10 *Asplanchna brightwelli* (155x)

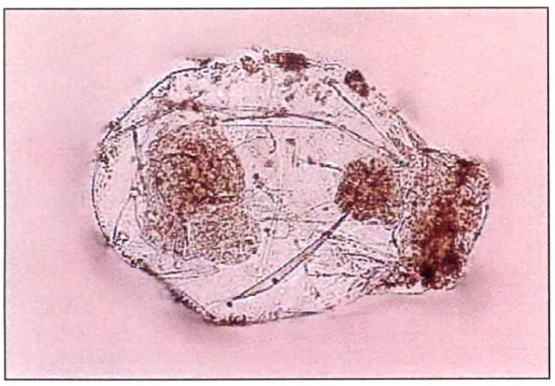


FIGURE 2.10a *A. brightwelli* - Trophus

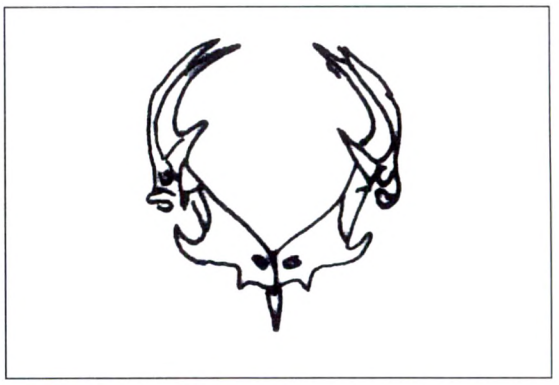


FIGURE 2.11 *Asplanchna sieboldi* (70x)

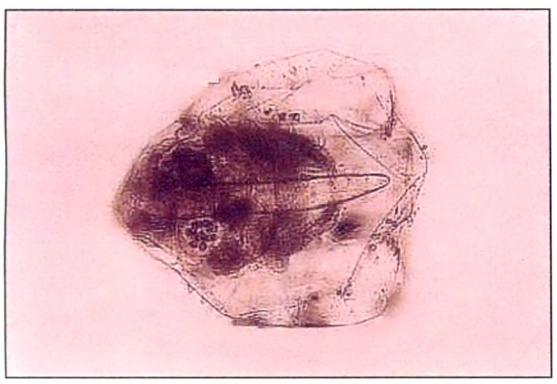


FIGURE 2. 11a *A. sieboldi* - Trophus

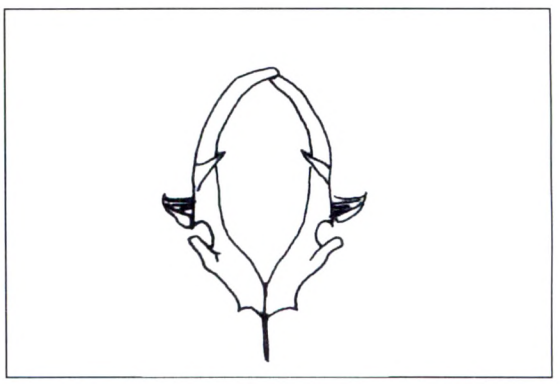


FIGURE 2.12 *Trichotria tetractis* (200x)

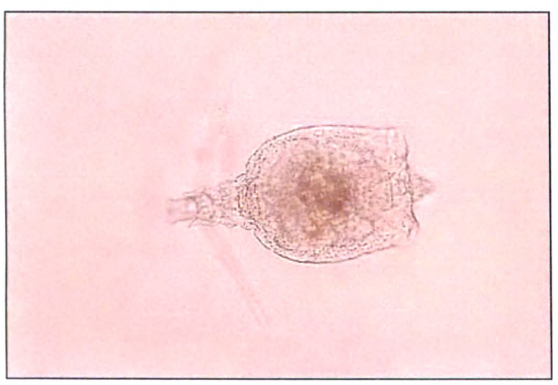


FIGURE 2. 13 *Platyias quadricornis* (150x)

FIGURE 2.14 *Plationus patulus* (300x)

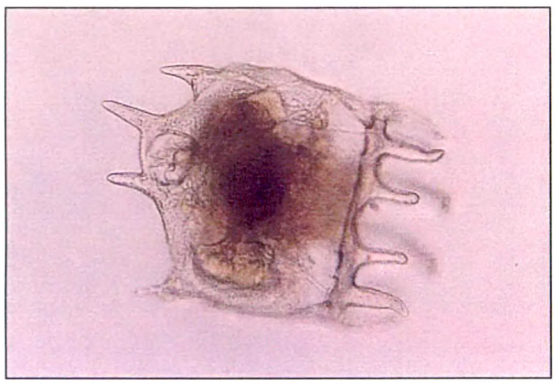


FIGURE 2.15 *Brachionus angularis* (440x)

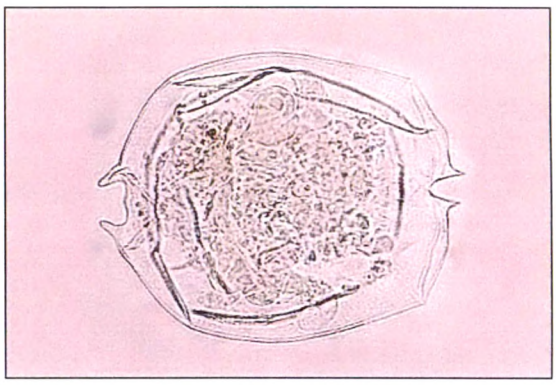


FIGURE 2.16 *Brachionus bidentatus* (250x)

FIGURE 2. 16a *Brachionus bidentatus* (235x)

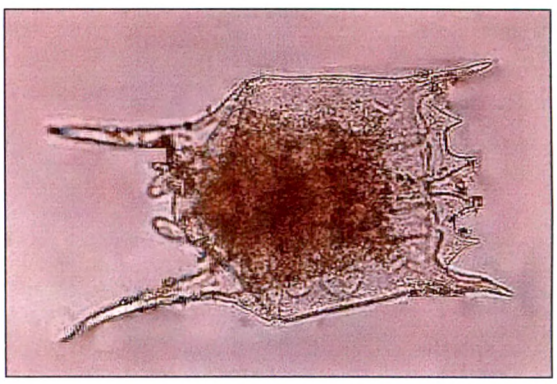


FIGURE 2.17a *Brachionus calyciflorus*(160x)

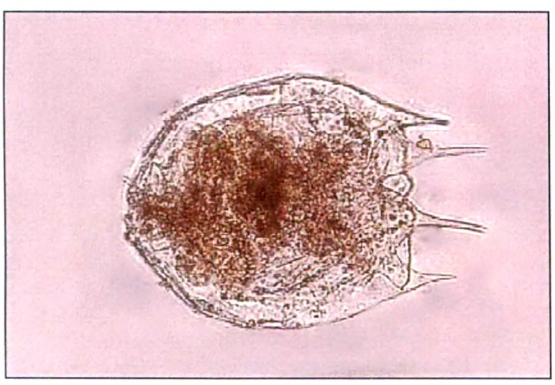


FIGURE 2.17b *Brachionus calyciflorus* (205x)

FIGURE 2.17c *Brachionus calyciflorus* (215x)

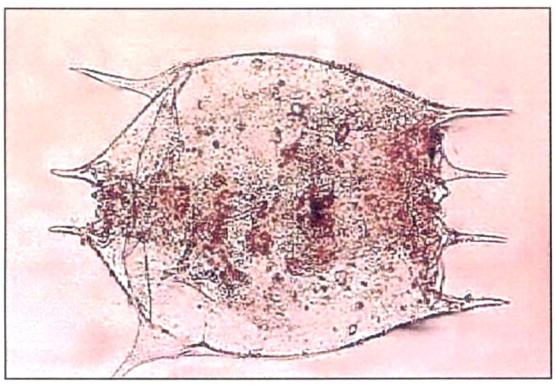


FIGURE 2.18 *Brachionus caudatus* (290x)

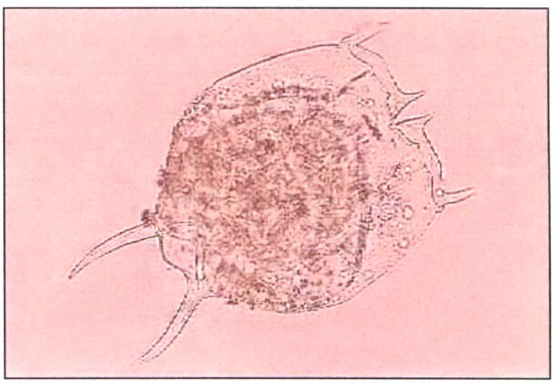


FIGURE 2.19 *Brachionus diversicornis* (210x)

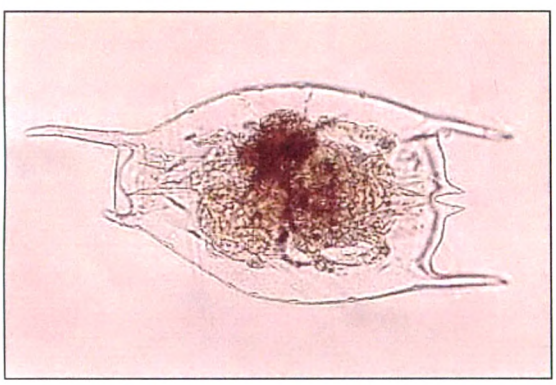


FIGURE 2.20 *Brachionus falcatus* (170x)

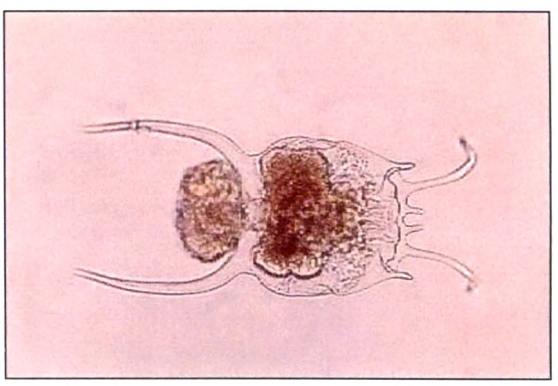


FIGURE 2.21a *Brachionus forficula* (370x)

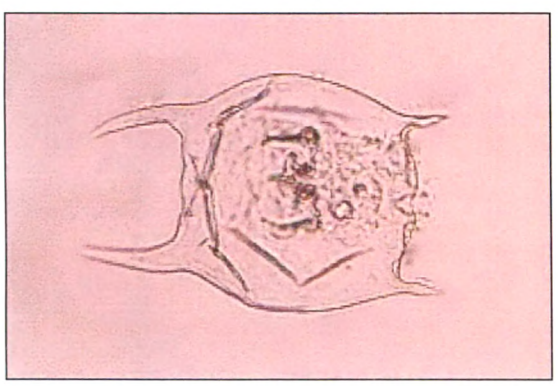


FIGURE 2.21b *Brachionus forficula* (370x)

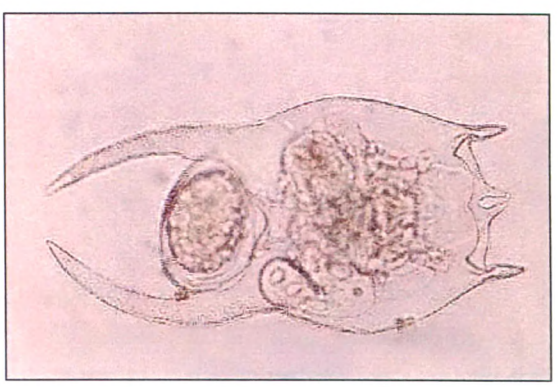


FIGURE 2.22a *Brachionus quadridentatus* (210x)

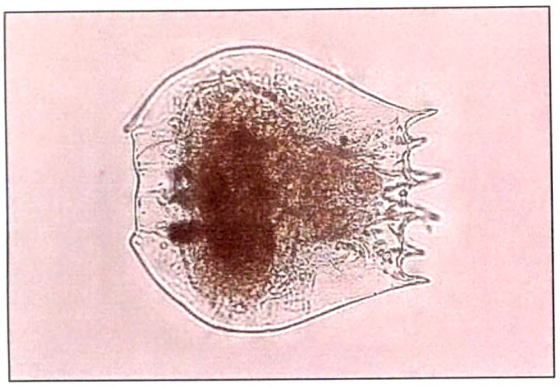


FIGURE 2.22b *B. quadridentatus* (250x)

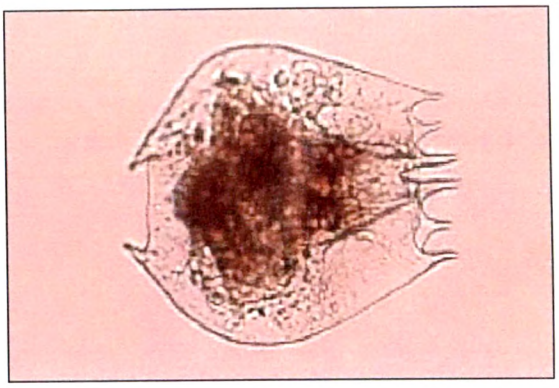


FIGURE 2.22c *B. quadridentatus* (170x)

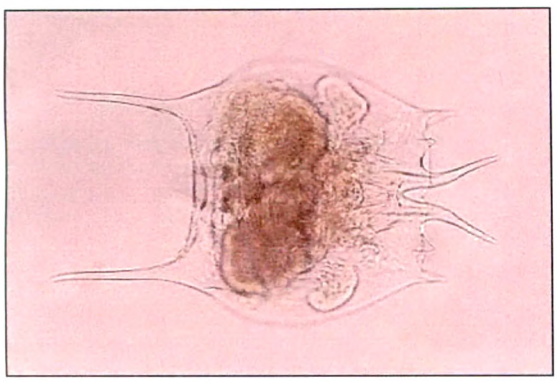


FIGURE 2.23 *Brachionus rubens* (295x)

FIGURE 2.24 *Keratella procurva* (315x)

FIGURE 2.25 *Keratella tropica* (260x)

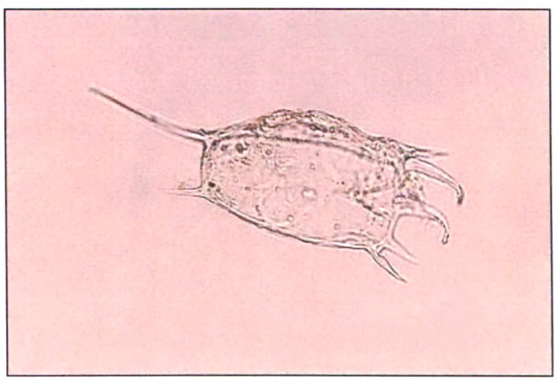


FIGURE 2.26 *Anuraeopsis coelata* (540x)

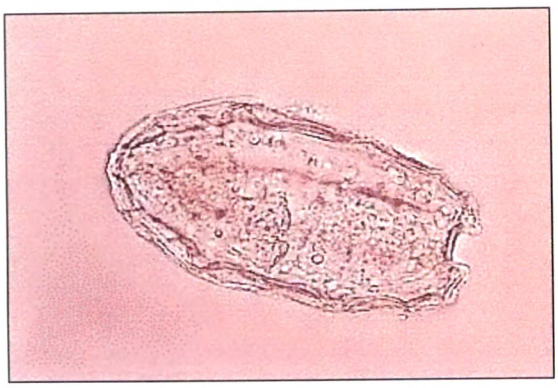


FIGURE 2.27 *Anuraeopsis fissa* (640x)

FIGURE 2.28 *Colurella obtusa* (670x)

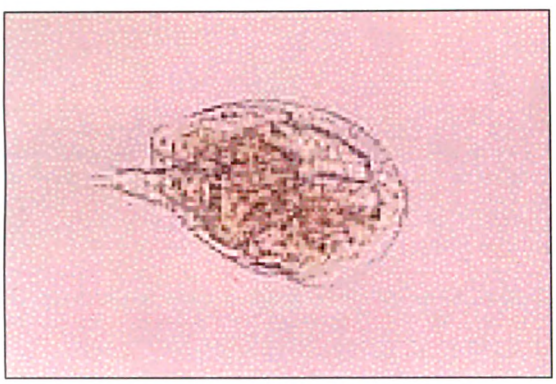


FIGURE 2.29 *Colurella uncinata* (595x)

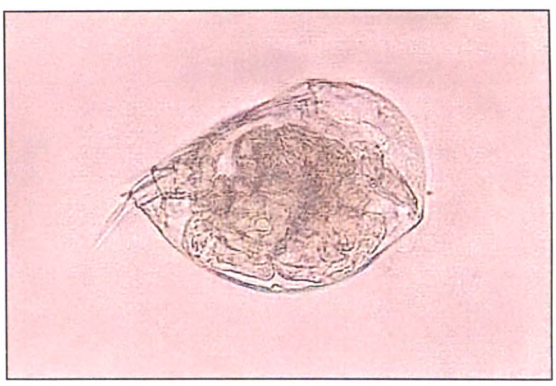


FIGURE 2.30 *Lepadella acuminata* (630x)

FIGURE 2.31 *Lepadella ovalis*

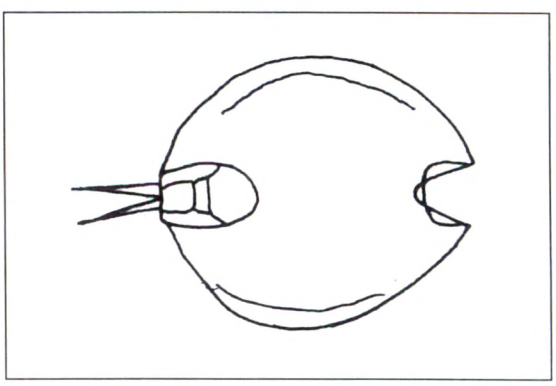


FIGURE 2.32 *Lepadella patella* (505x)

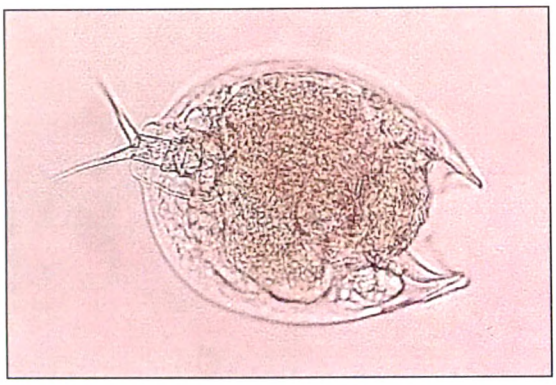


FIGURE 2.33 *Lepadella rhomboides* (500x)

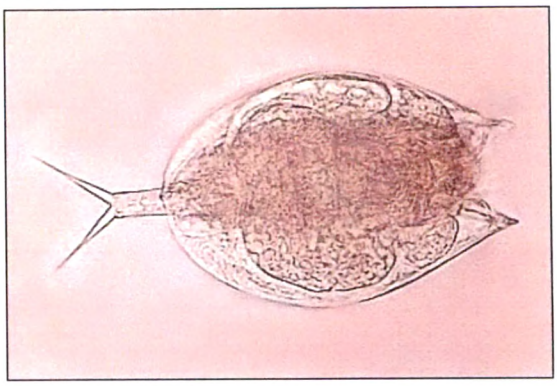


FIGURE 2.34 *Mytilina ventralis* (270x)

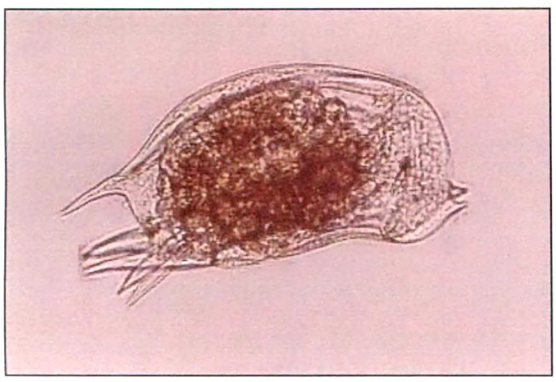


FIGURE 2.35 *Euchlanis dilatata* (260x)

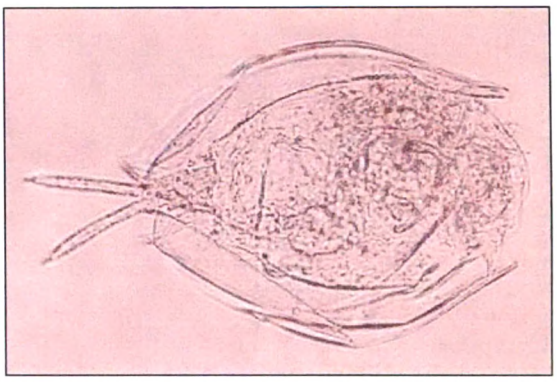


FIGURE 2.35a *E. dilatata* - Trophus

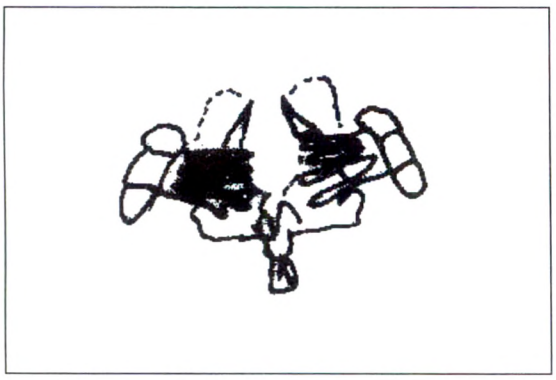


FIGURE 2.36 *Euchlanis oropha*

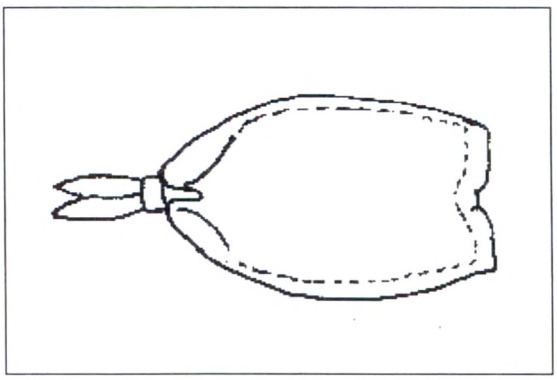


FIGURE 2.37 *Euchlanis meneta* (300x)

FIGURE 2.37a *E. meneta* - Trophus

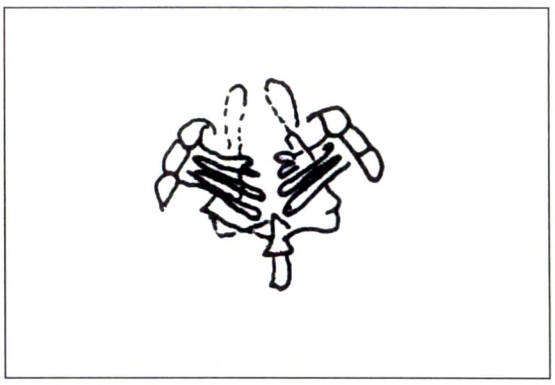


FIGURE 2.38 *Lecane inopinata* (595x)

FIGURE 2.39 *Lecane bulla* (415x)

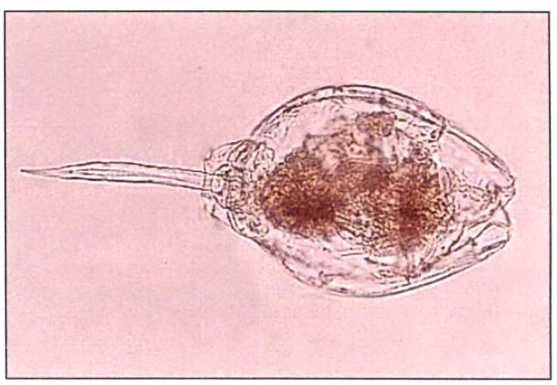


FIGURE 2.40 *Lecane closterocerca* (555x)

FIGURE 2.41 *Lecane crenata* (345x)

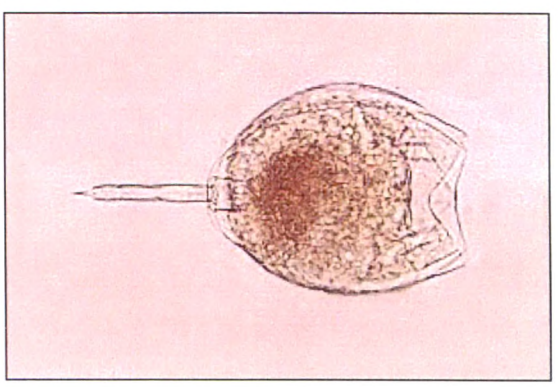


FIGURE 2. 42 *Lecane elachis* (665x)

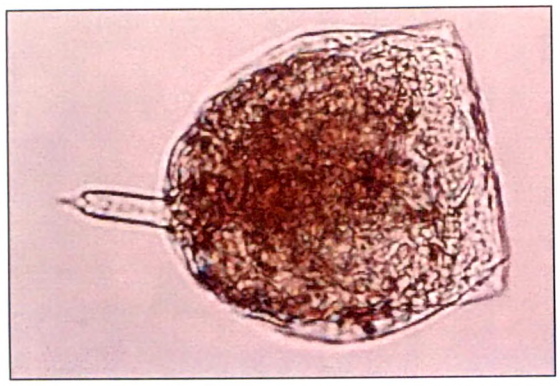


FIGURE 2.43 *Lecane hamata* (640x)

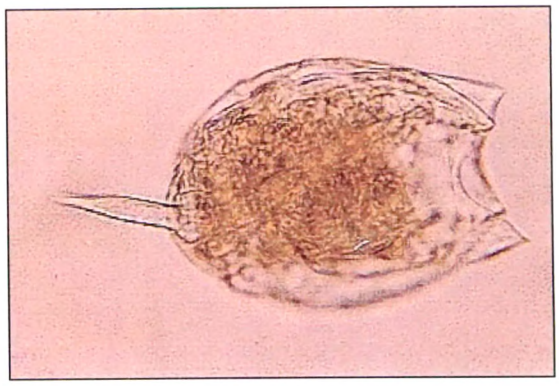


FIGURE 2.44 *Lecane pyriformis* (720x)

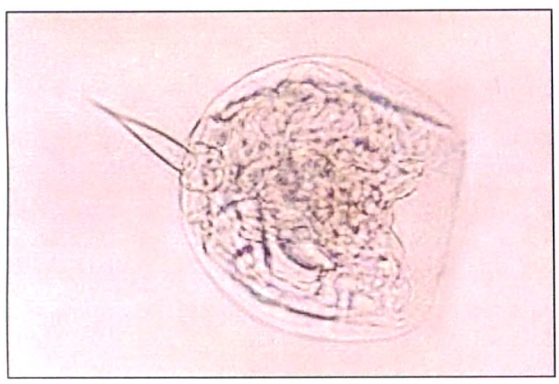


FIGURE 2.45 *Lecane quadridentata* (330x)

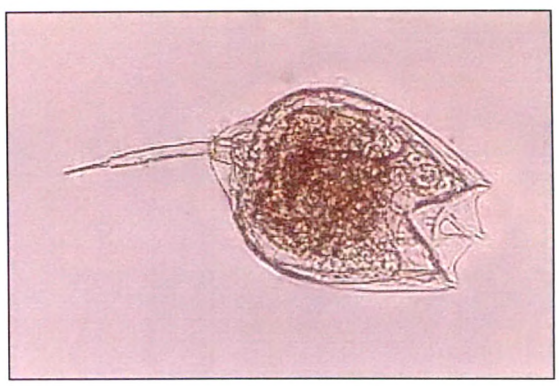


FIGURE 2.46 *Lecane stenroosi* (445x)

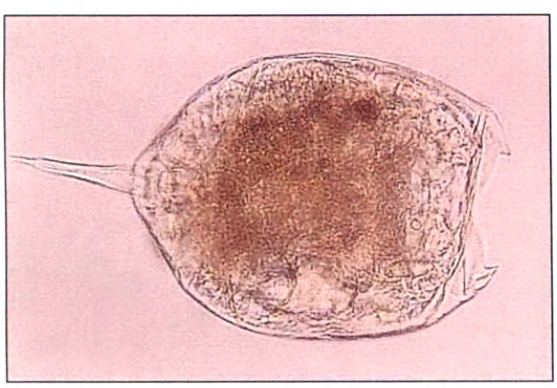


FIGURE 2.47 *Lecane arcula* (600x)

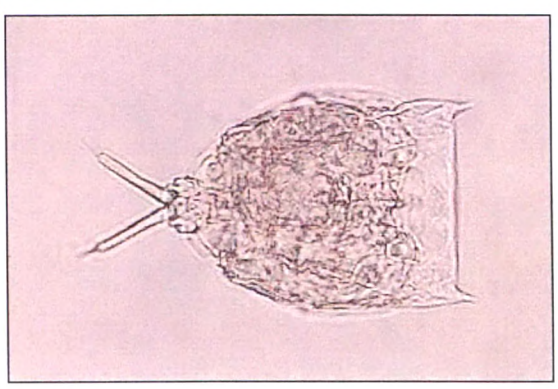


FIGURE 2.48 *Lecane crepida*

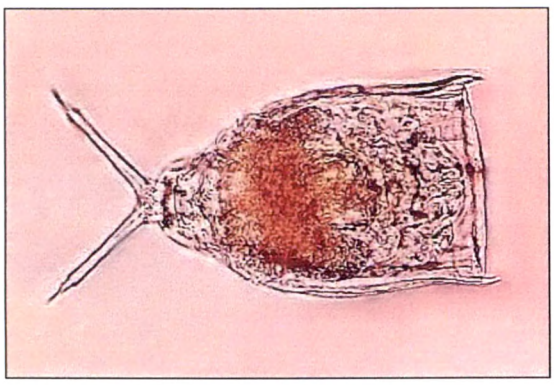


FIGURE 2.49 *Lecane curvicornis*

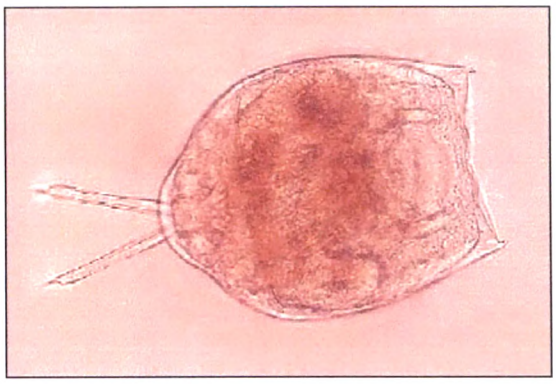


FIGURE 2.50 *Lecane inermis*

FIGURE 2. 51 *Lecane leontina*

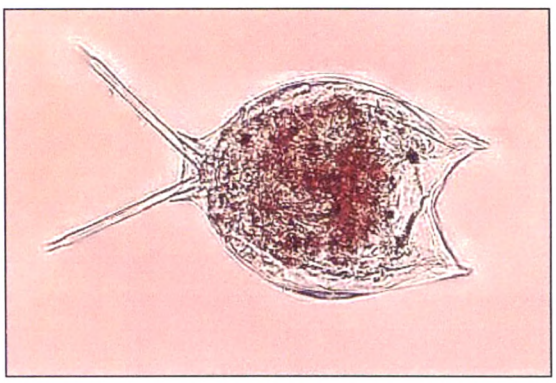


FIGURE 2.52 *Lecane luna*

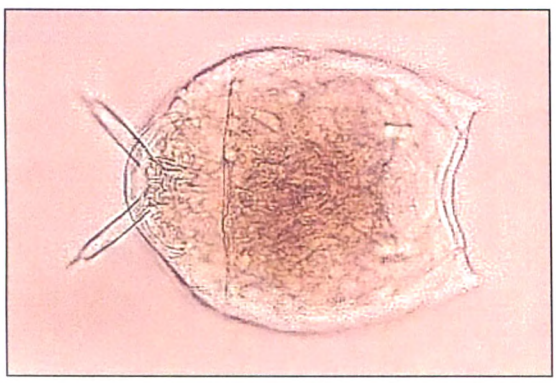


FIGURE 2.53 *Lecane nana*

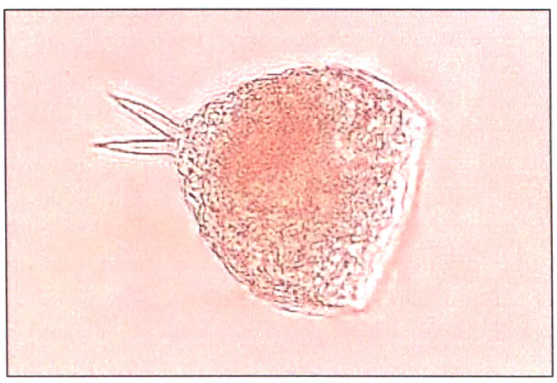


FIGURE 2.54 *Lecane papuana* (370x)

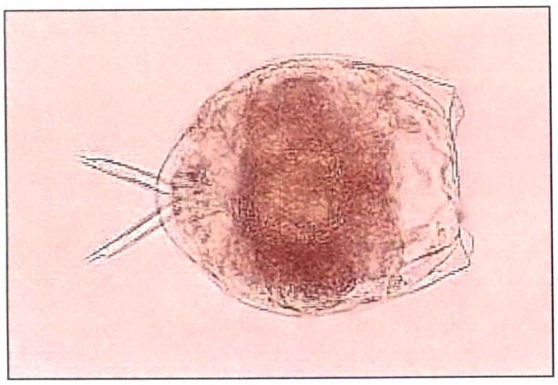


FIGURE 2.55 *Lecane ungulata* (205x)

FIGURE 2.56 *Trichocerca braziliensis*

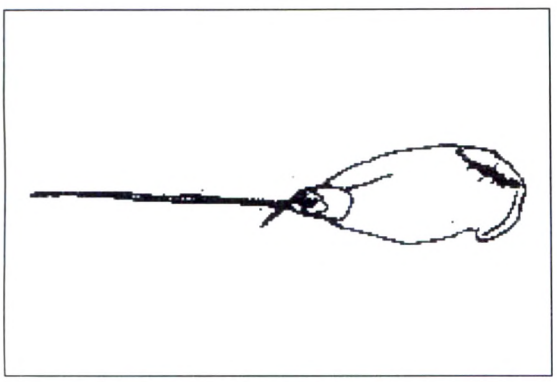


FIGURE 2. 56a *T. braziliensis* - Trophus

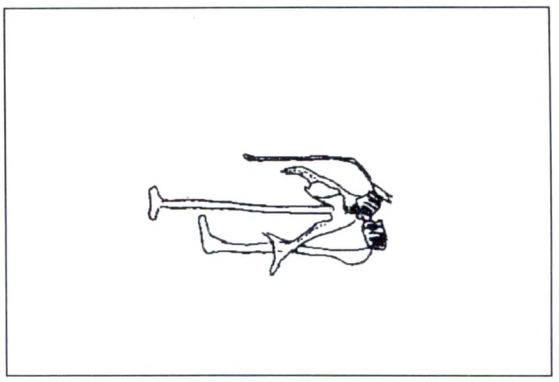


FIGURE 2.57 *Cephallodella misgurunus* (370x)

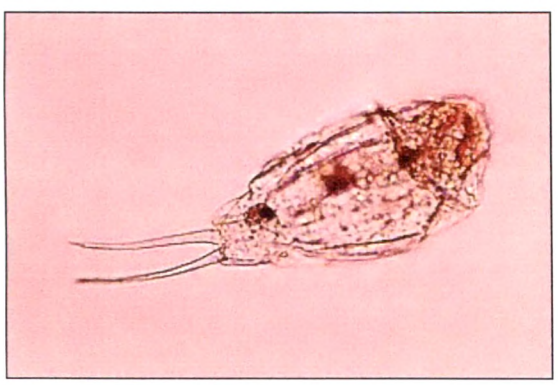


FIGURE 2.57a *C. misgurunus - Trophus*

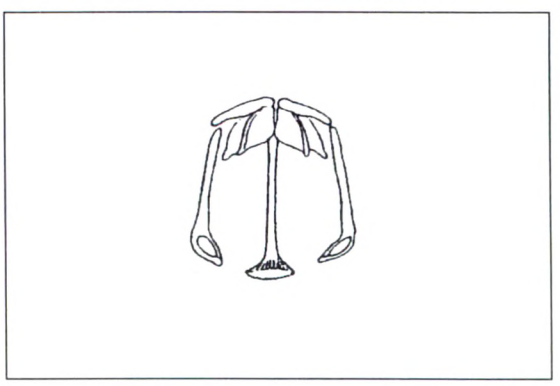


FIGURE 2.58 *Scaridium longicaudum* (210x)

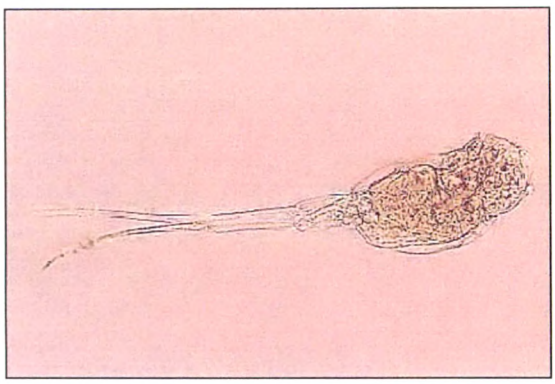


FIGURE 2.59 *Polyarthra* sp. (470x)