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## Copepods (Cyclopoida) of the Punjab (Pakistan)

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**ABSTRACT:** The following species though already described and listed from other countries, are being recorded for the first time from the Punjab, Pakistan.

- Cyclopoida.
1. *Paracyclops affinis* (Sars) 1863.
  - 2s *Eucyclops prionophorus* Kiefer 1931.
  3. *Cyclops (Diacyclops) navus* Harrick 1882.
  4. *Cyclops (Diacyclops) haueri* Kiefer 1931.
- The following species after having been thoroughly examined are being described as new.

1. *Paracyclops fischeri* sp. nov.
  2. *Mesocyclops cokeri* sp. nov.
  3. *Mesocyclops forbesi* sp. nov.
- The following sub-species after having been throughly examined are being discribed as new.
1. *Cyclops bicuspidatus jurinei* ssp. nov.

## INTRODUCTION

Very little work has been done on Copepods of the Punjab, Arora (1931) reported for the first time two species of *Cyclops* i.e. *Cyclops leukarti* and *Cyclops viridus* from Lahore. Later Mahoon and Sultana (1977) while listing twelve new records of Entomostraca of Lahore have described only one species of Copepod i.e. *Eucyclops agilis* Koch. In addition Mahoon and Zia. (1985) described ten species of *Cyclops* all from various localities of Lahore. While out of total ten, eight species were recorded as new.

The present work was under taken in view of the importance of the Copepods in the food Chain of aquatic ecosystem. It is hoped that the present information will stimulate research of similar nature from the Punjab.

## MATERIAL AND METHOD

Material made available was already fixed and preserved in 3 to 5% formalin. It was washed in water for five minutes. Morphological details were examined by preparing temporary mounts lactic acid. Material for temporary mount was dehydrated and cleared in cedarwood oil. All illustrations were drawn using camera lucida.

## ORDER CYCLOPOIDA

### Diagnosis:

Anterior part of the body much broader than posterior; two egg sacs carried laterally; antennule may reach to the end of metasome, antennules podomeres from four (4) to seventeen (17) podomeres; leg 5 vestigial, of one-two-three podomeres; caudal setae unequal in length.

### KEY TO GENERA

- (1) Leg 5 of one segment . . . . . 2  
 Leg 5 of two segments . . . . . 3
- (2) 1st antenna of 11 podomeres . . . . . *Paracyclops* Claus  
 1st antenna of 12 podomeres; caudal ramus with spines . . . *Eucyclops* Claus.
- (3) Distal segment of leg 5 small and armed with 2 spines . . . . . *Cyclops* Muller.  
 Distal segment of leg 5 armed with an apical seta and a long terminal or sub-terminal inner spine; last 2 segments of first antenna usually with a hyaline membrane . . . . . *Mesocyclops* Sars.

Genus *Paracyclops* Claus

### Diagnosis:

First antenna of 11 podomeres; leg 5 of one distinct podomere armed with one spine and two setae.

### KEY TO SPECIES

First antenna of 11 podomeres; leg 5 armed with two terminal setae and



- one spine . . . . . *Paracyclops affinis*.  
 First antenna of 10 podomeres; leg 5 with two terminal setae . . . . .  
*Paracyclops fischeri* sp. nov.

***Paracyclops affinis* (Sars) 1836**

(Figs: 1-5)

**Diagnosis:**

Cephalothorax part of metasoma longer than thorax; antennules large of eleven podomeres; median eye broad elliptical in outline; fifth leg of single podomere; caudal-rami smaller than last abdominal segment.

Cephalothorax part of metasoma (Fig. 1) is larger than the urosoma part. It is broadly oval. Median eye is broad elliptical in outline.

Antennules (Fig. 2) are large. Each is composed of eleven podomeres. Podomere 7 is the largest. Podomeres 3 and 10 are almost equal in length. The same is the case with podomeres 6, 9 and 11. Podomere 5 is the smallest. Podomere 1 has four setae, one is very long and the other three are equal in length. Podomeres 2, 4 and 10 have two setae each. Podomere 3 has six setae, four are large and two are small. Podomeres 5, 6, 8, and 9 have one seta each. Podomere 7 has three setae. Podomere 11 has 5 terminal setae, four are equal while one is very small.

Paired antennae (Fig. 3) at the anterior end are prominent. Each is composed of 3 podomeres. Podomere 1 has three setae. Podomere 2 has three small setae in the middle of the outer margin and three large setae at the distal margin. Podomere 3 has six terminal setae. These become successively longer from median to the outer distal margin. All are recurved medianly.

Fifth leg (Fig. 4) is represented by a single podomere. It resembles a raised papilla. It has a long seta in the middle. On either sides there is small seta on one side, while a small spine towards other side.

Caudal rami (Fig. 5) are smaller than the last urosomal segment in length. Each ramus is three times the breadth in length. Each ramus has four terminal setae. Seta 2 is three times the 1 in length. First three setae (1-3) have setules while the seta 4 has no setules.

Locality: Lahore - Sheikhpura road 10 kms.

Date of collection. October, 1984.

NOTE: According to Yeatman (1959), *Paracyclops affinis* was first listed by

Sars (1863). The description given for the species by these authors is fully applicable on the present collection. The most notable features are.

1. Antennule is of eleven podomeres.
2. Leg 5 is like a raised papilla, having two setae one in the middle and other on one side while there is a small spine on the other side.

*Paracyclops fischeri* Sp. nov.

(Figs. 6-10)

**Diagnosis:** Cephalothorax part of body narrow in front; antennules of ten podomeres, distal podomere with five terminal setae; caudal rami smaller than last abdominal segment, caudal ramus with three setae, inner seta of caudal ramus more than two times of second; genital segment with characteristic lateral spines.

Cephalothorax of metasoma (Fig. 6) when viewed from above is oval but its anterior part narrow in front. The median eye located close to the anterior end on the dorsal side though is round but has a concave anterior margin.

The antennules (Fig. 7) are small. Each antennule has ten podomeres. Podomere 8 is the largest. Podomeres 3, 7 and 10 are equal in length. The same is the case with podomeres 2, 4 and the 5. Podomere 1 has eight setae. Podomeres 2, 3 and 7 have two setae each. Podomere 4 has five setae and podomere 5 is devoid of seta. Podomeres 6 and 9 have one seta each. Podomere 8 has four setae. Terminal or podomere 10 has five setae, one is very long and two about one-half, the remaining two one-third in length.

Paired antennae (Fig. 8) at the anterior end are small. Each is composed of three podomeres. Proximal podomere (1) has one seta extending as far as the tip of the terminal segment. Middle podomere (2) have small setae all along its inner boarder. The terminal segment (3) have seven setae. These become successively longer all along the inner boarder towards the tip. The long terminal seta is followed by a thick claw-like seta on the outer side.

The last urosomal segment also have setules all along its posterior and lateral margins. Fifth leg (Fig. 9) forms the part of metasome and is represented by small lobe. Its distal part has two setae one is longer than other. Both have setules on either margins.

Urosoma part of the body is larger than the free segmented part of the metasoma. Genital segment is large and broad. It has two characteristic lateral spines on each side at  $1/3$  distance from its margin.



Caudal rami (Fig. 10) are smaller than the last urosomal segment. Each ramus is slightly longer than its breadth. Seta 1 twice the 2 in length and seta 2 is three times the 3 in length. Lateral setae are represented by small spines located in the middle of the outer margin.

Locality: Lahore - Sheikhpura road 10 kms.

Date of Collection, October, 1984.

**NOTE:** It is different from the other listed species of the genus *Paracyclops* in the dimension of caudal rami. In *Paracyclops fimbriatus* fischer caudal rami are four to six times as long as wide. In *Paracyclops poppi* Rehberg these are three to four times as long as wide. In the present species the caudal rami are little longer than breadth. The antennule of this species is also composed of 10 podomeres which is a feature distinct for this species alone. In the other described species it is of 11 podomeres.

#### Genus *Eucyclops* Claus.

**Diagnosis:** Caudal ramus of female with spinules on outer margin; caudal ramus at least 4 times as broad in male and females; first antenna not reaching to margin of first body segment; caudal ramus 4 times as long as broad, with prominent saw on outer margin.

#### *Eucyclops prionophorus* Kiefer (1931) (Figs: 11-14)

**Diagnosis:** Metasoma distinct from urosoma, cephalothorax part of metasoma distinctly larger than thorax; antennules large of twelve podomeres; fifth leg not distinct from metasomal segment, with three setae; caudal rami larger than last abdominal segment.

Metasoma is distinctly larger than urosoma (Fig. 11) Metasoma is broad at the margin. The breadth slightly increase the length. Its outer margin is cone-like. Median eye is round placed close to the anterior margin. The last two free segments of the metasoma abruptly become narrow. The last free metasomal segment is 2/3 of the first free metasomal segment.

Antennules (Fig. 12) are large. Each is composed of twelve podomeres. Podomeres 11 and 12 are equal and long. Podomeres 4 and 9 are also equal in length. Podomere 6 is the smallest. Podomeres 1, 3 and 4 have three setae each. Podomeres 2, 5 and 11 have one seta each. Podomeres 7 to 10 have two setae each. Podomere 6 has no seta.

Fifth leg (Fig. 13) is not distinct from the 5th metasomal segment. It is only represented by a small lobe with only three setae. The terminal seta is straight and have setules. On one side of this seta there is one small spine. On other side is a long curved sub-terminal seta present in the middle on the median outer side.

Urosoma is little less than  $2/3$  of metasoma. Genital segment is 3 times longer than the urosoma segment 2. Urosome segment 2 is  $2/3$  of urosome segment 3. Urosome segment 4 is longer than the urosome segment 3.

Caudal rami (Fig. 14) are longer than the urosomal segment 4. The length of each ramus is 4 times the breadth. Each ramus has four terminal setae. Seta 2 is the longest. Setae 1 and 4 are equal in length. Lateral seta is located just at the base of seta 4 and it is in the form of a small spine. All along outer margin are fine setae. Each caudal ramus has one dorsal short and one dorsal long seta. The last urosomal segment has distal lateral spine on either sides.

Locality: Lahore - Sheikhpura road 10 kms.

Date of collection. October 1984.

NOTE: According to Yeatman (1959), *Eucyclops prionophorus* was first listed by Kiefer (1931). The description given for this species by these authors is fully applicable on the present collection. The most notable features are.

1. Cephalothorax part longer than the thorax.
2. Antennules are large and each is of 12 podomeres.
3. Caudal rami are 4 times as long as broad with prominent hair-like setae on their outer margins.

#### Genus *Cyclops* Muller.

**Diagnosis:** First antenna of ten podomeres; fifth leg reduced and of two podomeres, distal podomere small and armed with two setae, one apical and the other sub-apical.

#### KEY TO SPECIES.

- 1 Terminal podomere of leg 4 with one apical and one sub-apical spine . . . . .  
     . . . . . *Cyclops navius*
- 2 Of the two apical spines, inner 2 times the outer in length. . . . .  
     . . . . . *Cyclops haueri*
- 3 Of the two apical spines, outer terminal spine is about  $1\frac{1}{2}$  times as long as  
     inner terminal spine . . . . . *Cyclops bicuspidatus jurinei* sp. nov.



*Cyclops (Diacyclops) navus* Herrick (1882)  
(Figs: 15-20)

**Diagnosis:** Metasoma part of body oval in front; antennule of seventeen podomeres, distal podomere with four terminal setae; caudal rami equal to last abdominal segment; caudal ramus three times breadth in length; inner seta of caudal ramus half of second.

Metasoma (Fig. 15) when viewed from above is broadly oval. The length is greater than the breadth. Median eye which is located close to the anterior end on the dorsal side is oval in outline. Its narrow margin is in front.

The antennules (Fig. 16) are large. There are in total seventeen podomeres. Podomere 4 and 17 are of the same length. Podomere 16 is the longest. The same is the case with podomeres 7 and 12. Podomere 1 has five setae. Distal seta is large and the others are small. Podomeres 4 and 16 have three setae each, while podomeres 12 and 15 have two setae each. Podomere 7, 10 and 13 have no seta. Podomeres 3 and 6 are small. Podomere 1 is the massive podomere. The terminal podomeres has five setae, all are of the same size excepting inner which is longer than the others.

Paired antennae (Fig. 17) at the anterior end are prominent. Each is composed of 4 podomeres. Podomere 1 has a long seta on the inner margin and a short seta at the outer side. Podomere 2 has a short seta in the middle of the outer margin. Podomere 3 is larger than the second and has two long curved setae on the other side and a long seta in the middle. Podomere 4 is as long as the second and have seven setae at the terminal end.

Fifth leg (Fig. 18) is composed of two podomeres. Proximal podomere is more broad than long. It has a long seta on the inner distal margin. It extends about the base of an apical seta. The distal podomere has two setae, sub-apical seta is longer than the apical seta. Both apical and sub apical setae are smooth. Sub-apical seta is slightly curved towards the inner side.

Terminal podomere of endopodite of leg four (Fig. 19) is 3 times as long as wide. The terminal podomere of leg four has two spines. Inner spine is longer than the outer.

Caudal rami (Fig. 20) are slightly larger than the last urosomal segment. Each ramus is two and half times the breadth in length. Lateral seta on each ramus is located at two third distance from the end. There are four terminal setae. Seta 1 is longer than seta 4 and the seta 2 more than twice the length of the seta 1.



Locality: Lahore - Sheikhpura road 10 kms.

Dated of collection: October, 1984.

**NOTE:** *Cyclops navus* Herrick agrees in all the essential features given by Yeatman (1959). The most distinguishing features are:

1. Cephalothorax part of the body is longer than the thorax.
2. Antennules are of seventeen podomeres.
3. Terminal podomere of endopod of leg 4 with inner seta about twice the outer in length.
4. Leg 5 is of two podomeres. Distal podomere is with terminal and sub-terminal setae.

***Cyclops (Diacyclops) haueri* Kiefer (1931)**  
(Figs. 21-26)

**Diagnosis:** Cephalothorax of metasoma longer than thorax, urosoma as long as thorax, cephalothorax broad at 2/3 distance from anterior end, last thoracic segment narrow; antennules of seventeen podomeres; caudal rami longer than last urosomal segment, caudal ramus three times breadth in length, first (inner) seta of caudal ramus half of second, caudal lateral seta at 2/3 distance from the proximal end.

Metasoma (Fig. 21) is more long than broad. Anteriorly it is narrow, it is more broad in the middle. It is longer than the urosoma. Median eye is located close to the anterior end on the dorsal side. It is round in outline.

The antennules (Fig. 22) are long. Each has seventeen podomeres. Podomeres 4 and 7 are nearly equal in length. The same is the case with podomeres 16, 17. Podomere 1 has five setae, four are small and are of the same size but one is very long. Podomeres 2, 5, 12 and 15 have two setae each. Podomere 3 has four setae. Podomeres 4 and 16 have three setae each. Podomeres 6, 8, 9, 11, 14 and 17 have one seta each. Whereas podomeres 7, 10 and 13 have no seta. Podomere 6 is the smallest. All other podomeres are nearly equal in length excepting for number 1, 16 and 17. Podomere 1 is the longest and podomeres 16 and 17 though smaller than podomere 1 are equal in length. There are five terminal setae, median seta is long and the other four become successively smaller in size.

Paired antennae (Fig. 23) at the anterior end are prominent. Each is composed of four podomeres. Podomere 1 has a long seta on the inner margin having small serrations on either sides, one seta is in the middle and other at the outer side. Podomere 2 has a short seta on the outer side. Podomere 3 is longer than the

podomere 2 and has two small and two large setae on the outer side. Two large setae are also present at the middle of its distal margin. Podomere 4 has five terminal setae. All are unequal. All along the inner margin of podomere 4 small setae are present. The presence of long serrated seta on the podomere 1 and small setae all along - the inner margin of the podomere 4 forms a distinctive feature for the species.

Fifth leg (Fig. 24) is composed of 2 podomeres. It has a seta of moderate length of the distal margin of the proximal podomere. The distal podomere has two setae, one is very long and the other is small. Large seta is slightly curved inward. Both the setae are smooth.

Third endopodite of leg 4 (Fig. 24) has two terminal spines. Inner terminal spine longer than the outer.

Caudal rami (Fig. 26) are twice the length of the last urosomal segment. Each ramus is nearly three times the breadth in length. Lateral seta on each ramus is located at 2/3 distance from the end. There are four terminal setae. Seta 1 is one half of the seta 2, while the seta 3 is little smaller than the seta 2.

Locality: Lahore - Sheikhupura road 10 kms.

Date of collection: October, 1984.

NOTE: *Cyclops haueri* Kiefer agrees in all the essential features given by Yeatman (1959). The most distinguishing features are:

1. Cephalothorax part longer than thorax.
2. Antennules are of seventeen podomeres.
3. Terminal podomere of endopod of leg 4 with inner seta twice the outer in length.
4. Leg 5 is of two podomeres. Distal podomere with terminal and sub-terminal setae.

*Cyclops bicuspидatus jurinei* sp. nov.  
(Figs. 27-32)

**Diagnosis:** Cephalothorax part of metasoma oval in front; antennules of seventeen podomeres, distal podomere with five terminal setae; fifth leg of two distinct podomeres, proximal podomere small with a long seta on outside, distal podomere long with an apical and sub-apical seta, both equal in length, outer margin of sub-apical seta serrated; caudal rami equal to last abdominal segment, ramus lateral seta 2/3 distance from the base; leg 4 endopod, outer terminal seta 1½ times than the inner seta.



Metasoma part of body when viewed from above (Fig. 17) is broadly oval in front. Median eye which is located close to the anterior end on the dorsal side is circular in outline.

The antennules (Fig. 28) are large. Each antennule is composed of seventeen podomeres. Podomeres 5 and 6 are equal in length. Same is the case with podomeres 16 and 17. Podomere 1 has five setae, one seta is very long. Podomere 4 also have five setae out of them one is very long. Podomere 16 has three setae, one is large extending nearly to the terminal seta of podomere 17. The other podomeres have one seta each. Podomeres 2, 3, 5, 6 and 10 are small. Podomere 1 is massive. Terminal podomere have five setae, one is small, two are equal and the remaining two are larger than the others.

Paired antennae (Fig. 29) at the anterior end are prominent. Each is composed of 4 podomeres. Podomere 1 has a long seta on the inner margin and a short seta at the outer margin and one in the middle. Podomere 2 has no seta. Podomere 3 is approximately of the size of podomere 2 and has five setae on the outer side. Podomere 4 is as long as podomere 3 and have five terminal setae. Two are exceptionally long and other three are short. Three very small setae are on the inner margin and one is on the outer side.

Leg 5 (Fig. 30) is composed of 2 podomeres. Proximal podomere is small. It has a long seta on the distal end. It hardly extends the distal podomere. The distal podomere has two setae apical and sub-apical, both are equal in length. Sub-apical seta is serrated on the outer side.

Endopodite of leg 4 (Fig. 31) has two terminal setae. Outer terminal seta is  $\frac{2}{3}$  longer than the inner seta.

Caudal rami (Fig. 32) are equal to the last abdominal segment. Each ramus is three times the breadth in length. Lateral seta on each ramus is located at  $\frac{2}{3}$  distance from the end. There are four terminal setae. Seta 1 is longer than seta 4, while the seta 2 is the longest.

Locality: Lahore - Sheikhpura road 10 kms.

Date of collection: October, 1984.

NOTE: Wilson (1959) has listed, in addition to *Cyclops bicuspidatus* two more of its sub-species viz *C. bicuspidatus thomasi* S.A. Forbes 1882, a widely distributed species in North America and *C. bicuspidatus lubbocki* Brady 1868, a questionable record from New York. The distinction is based on the number of podomeres in the antennules. *C. bicuspidatus thomasi* has 17 and *C. bicuspidatus lubbocki* has

fourteen. The antennule in present species has 17 podomeres and as such it resembles the *Cyclops bicuspidatus* and its sub-species *Cyclops bicuspidatus thomasi*. It however differ from the two in the nature of 5th leg. The sub-terminal seta in the present collection of this species is claw-like and serrated on one side. In *C. bicuspidatus* and *C. bicuspidatus thomasi* the terminal and sub-terminal setae are both flexible and smooth.

On the basis of above differences it is being listed as a new sub-species of *Cyclops bicuspidatus* viz *C. bicuspidatus jurinei*.

### Genus *Mesocyclops* Sars.

**Diagnosis:** Paired antennules large, of seventeen podomeres; fifth leg of distinct podomeres, proximal large and broad with one seta; distal podomere with one terminal and one sub-terminal seta.

### KEY TO SPECIES

Leg 5 distal podomere with sub-apical seta smooth . . . . .  
*Mesocyclops cokeri* sp. nov.

Leg 5 distal podomere has sub-apical seta with proximal part serrated . . . . .  
. . . . . *Mesocyclops forbesi* sp. nov.

### *Mesocyclops cokeri* sp. nov. (Figs: 33-38)

**Diagnosis:** Cephalothorax part of metasoma longer than thorax; antennules large of seventeen podomeres, last two podomeres with hyaline plates; median eye circular in outline; genital segment long; fifth leg of two podomeres, distal podomere with apical and sub-apical setae; inner terminal spine of endopod of leg four not twice as long as the outer terminal spine.

Metasoma (Fig. 33) part of the body is larger than the urosomal segments. Median eye at the anterior dorsal end of the body is circular in outline.

Paired antennules (Fig. 34) are large. Each antennule is composed of seventeen podomeres. Podomere 16 is the longest. Podomere 7, 17 and podomeres 4 and 15 are of equal length. Podomere 3 is the shortest. Podomere 1 has seven setae, three are very long, two are intermediate and two are very short. Likewise podomeres 2, 5 and 16 have two setae each. Podomeres 3, 8, 9, 11, 14 and 15 have one seta each. Podomere 4 have five setae while podomeres 6, 7, 10, 12, and 13 have no seta. Podomere 17 have five terminal setae, two are equally long while the remain-



ing three are equally short. Last two podomeres of the antennule have narrow hyaline plates running along the entire length of the podomeres.

Paired antennae (Fig. 35) at the anterior end are prominent. Each is composed of four podomeres. Podomere 1 has a small seta at the distal outer margin. Podomere 2 has no seta. Podomere 3 has two setae at the distal margin, one is long and the other is short. Podomere 4 has four setae, all are different in length.

Fifth leg (Fig. 36) is represented by two podomeres. The proximal podomere has a long seta on one side having setules on both the margins. The distal podomere has two setae, one is apical and other is sub-apical. Apical seta has setules on both margins from mid region to its apex. The sub-apical seta also has setules on both the margins starting at 2/3 distance from the base.

The terminal segment of leg four (Fig. 37) has two terminal spines. Inner spine is not twice as long as the outer terminal spine.

Caudal rami (Fig. 38) are larger than the last urosomal segment. Each ramus is nearly three times the breadth in length. Each ramus has four terminal setae. Seta 2 is more than twice in length of the seta 1. Seta 4 is the smallest of all. Lateral seta is present at 2/3 distance from the proximal end and has setules. All the ramal setae have setules.

Locality: Lahore - Sheikhpura road 10 kms.

Date of collection. October, 1984.

**NOTE:** It is different from the other listed species in the character of terminal podomere of first antenna. In *Mesocyclops edax* (S.A Forbes) the hyaline plate has a number of sharp notches and in the hyaline plate of *Mesocyclops leuckarti* (Claus) there is one deep notch. In the present species the last two podomeres of the antenna are with hyaline plates. These are narrow and run along the entire length of the podomeres. In addition the inner terminal spine of endopod of leg 4 is not twice as long as the outer terminal spine.

*Mesocyclops forbesi* sp. nov.  
(Figs: 39-43)

**Diagnosis:** Cephalothorax part of metasoma oval in front; antennule of seventeen podomeres, distal podomere with a hyaline plate with only 3 notches and six terminal setae; caudal rami larger than last urosomal segment, caudal ramus three times breadth in length.

When viewed from above the metasoma (Fig. 39) part of the body is broadly oval, the length is greater than breadth. Median eye which is located close to the anterior end on the dorsal side is circular in outline.

The antennules (Fig. 40) are large. In total there are seventeen podomeres. Podomere 7 and 15 are equal in length. The same is the case with podomere 16 and 17. Podomere 1 has eight setae, one towards the outer margin is very large. Podomere 2 has three setae one is very large, while the other two are small. Podomeres 3, 5, 15 and 16 have two setae each. Podomere 4 has five setae, three are long and two are short. Podomeres 10, 13 and 14 are without seta, the other podomeres have one seta each. There are six setae at the terminal podomere, one is long and five are small though slightly of different lengths.

Paired antennae (Fig. 41) at the anterior end are prominent. Each is composed of four podomeres. Podomere 1 has a long seta on the inner margin extending beyond the terminal podomere. Two short setae at the outer distal margin. Podomere 2 has a short seta at the outer margin. Podomere 3 is smaller than the terminal (4) but little larger than the podomere 2. It has three setae at the middle of its outer margin and also five setae at its distal end. Podomere 4 or terminal has five setae. These are of different lengths. The second seta from the inner margin is bow-shaped.

Fifth leg (Fig. 42) is composed of two podomeres. The proximal podomere has a long seta on the inner distal margin. More than half of this seta is covered with setules. It extends about half of the apical seta. The distal podomere has two setae, one is apical and the other is sub-apical. Apical seta is longer than the sub-

apical seta. On the outer margin of the distal half of the sub-apical seta is serrated. The apical seta, however, is smooth.

Caudal rami (Fig. 43) are longer than the last urosomal segment. Each ramus is three times the breadth in length. Lateral seta on each ramus is located at  $2/3$  distance from the proximal end. There are four terminal setae. Seta 1 is longer than seta 4, while seta 2 is the longest. In addition there is a dorsal median seta near the dorsal distal margin of the ramus. Inner margin of the ramus has setules.

Locality: Lahore - Sheikhpura road 10 kms.

Date of Collection: October, 1984.

NOTE: The present species because of seventeen podomeres in the antennule



and last two podomeres of first antenna bearing with hyaline plate is included in the genus *Mesocyclops*. It differs from all listed species in the nature of hyaline plate. *Mesocyclops edax* (S.A. Forbes) the hyaline plate of last podomere of first antenna with a number of sharp notches. Whereas *Mesocyclops leuckarti* (Claus) the hyaline plate is *with* one deep notch but in the present species the hyaline plate of penultimate podomere is entire but that of terminal podomere has 3 notches.

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