academicJournals

Vol. 7(5), pp. 329-335, May 2013
DOI: 10.5897/AJEST2013.1483
ISSN 1996-0786 ©2013 Academic Journals
http://www.academicjournals.org/AJEST

African Journal of Environmental Science and Technology

Full Length Research Paper

Some crustacean zooplankton of Wular lake in Kashmir Himalaya

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Accepted 10 May, 2013

In a taxonomic survey of crustacean zooplankton collected from Wular lake of Kashmir, a pictorial key was developed. Thirty-six (36) pictures of 25 species of crustacean zooplankton, out of which 21 represented 16 Cladocera taxa belonging to Chydoridae (*Alona affinis, A. rectangula* and *A. monacantha, Chydorus sphaericus* and *C. ovalis*), Daphnidae (*Daphnia magna, D. catawba, D. magna*, *D. pulex*; *D. rosea, D. galeata, D. retrocurva* and *Moinodaphnia*), Polyphemidae (*Polyphemus pediculus*) and Sididae (*Sida crystallina*) and 15 pictures of Copepoda belonged to 9 species being represented by three families viz Cyclopidae (*Cyclops scutifer*, *C. bicuspidatus, C. vernalis, C. panamensis, Eucyclops agilis, Megacyclops viridis*), Canthocamptidae (*Bryocamptus hiemalis*) and Diaptomidae (*Diaptomus* sp.).

Key words: Crustacean, Cladocera, Copepoda, taxonomy, Wular lake.

INTRODUCTION

An identification key is a tool to assist a user to identify an organism. It guides the user along a path towards identification. An identification is performed by selecting from among the listed features those that match your specimen; essentially you describe the features of your specimen to the key. The tool then compares your described features against a database of the features of all the organisms in the key, and returns a list of those organisms that match your choices. As you choose answers to the questions asked by the key, the list of potential matches is progressively reduced. Crustaceans a globally-distributed faunal group found across all habitats from the equator to the poles and form important link as food items of higher trophic levels, besides being used as bioindicators in the aquatic systems (Pedrozo and Rocha, 2005; Burns and Galbraith, 2007; Rajashekhar et al., 2009; Joshi, 2011; Shah et al., 2013; Shah and Pandit, 2013). It is in view of their ecological importance in understanding the health of aquatic ecosystem, a taxonomic survey based on key features of crustacean zooplankton, was carried out in the largest freshwater body of Indian subcontinent, the Wular lake of Kashmir Himalaya. Till date there is no photographic key available for crustacean zooplankton from Kashmir Himalaya and therefore the study aimed to develop the same.

MATERIALS AND METHODS

Wular lake, an ox-bow type lake located in the north-west of Kashmir about 55 km from Srinagar city, is situated at an altitude of 1,580 m (a.m.s.l), and lies between 34°16´-34°20´N and 74°33´-74°44´E geographical co-ordinates. The lake is drained in the north-east by the only single outlet in the form of River Jhelum (Figure 1). The lake has been declared as the wetland of national importance (1986) under wetland programme of Ministry of Environment and Forests (MoEF), Government of India and is designated as Ramsar Site (a Wetland of International Importance under Ramsar Convention, 1990).

Samples for crustacean zooplankton were collected by filtering 100 litre sub-surface water from five study sites through 80 µm nylon Bolt mesh and fixed in 4% formalin to which 4-5 drops of

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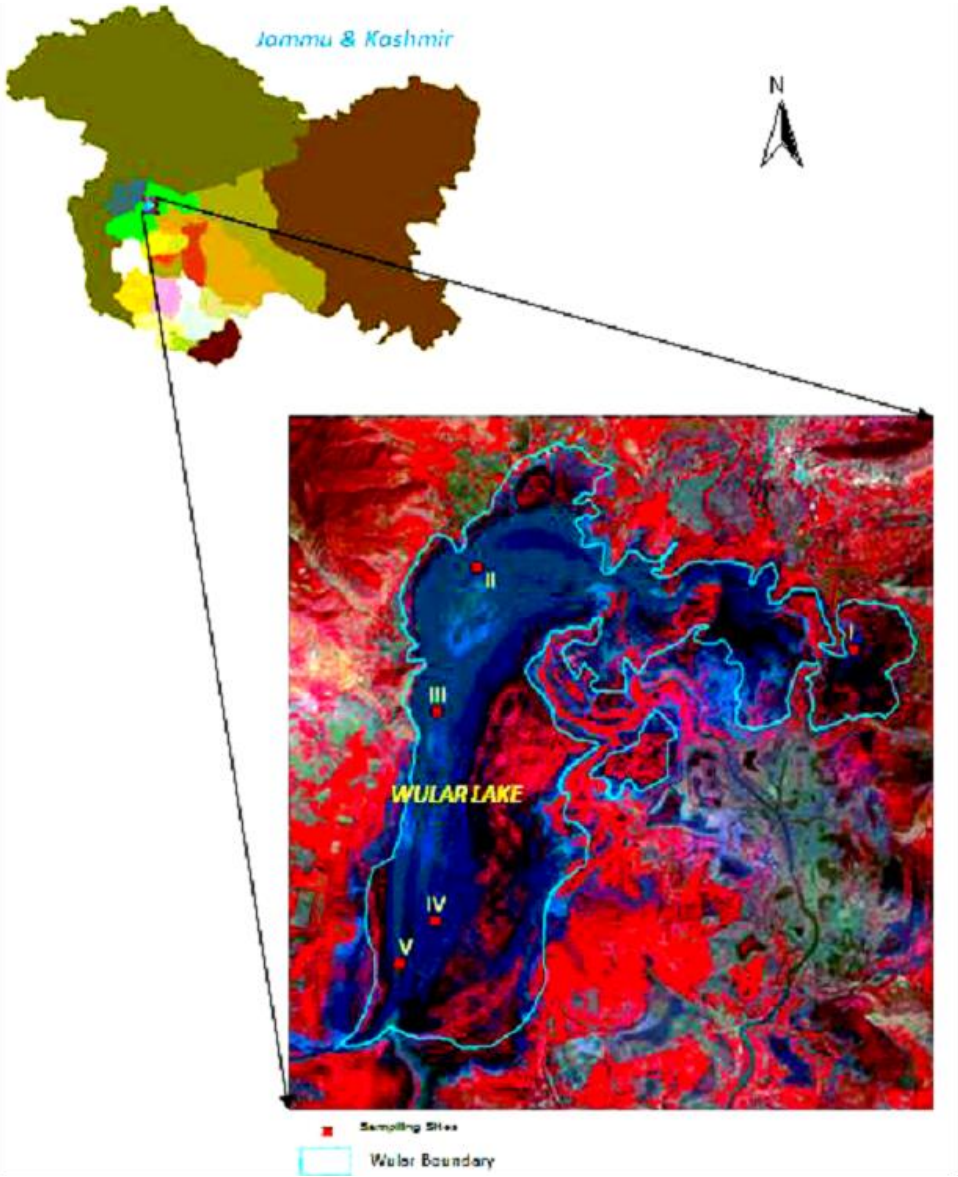

Figure 1. Location of study sites within Wular lake.

glycerine and 5% sucrose were added. Identification was made to the lowest possible taxon using standard taxonomic keys (Smith and Fernando, 1978; Bacler et al., 1984; Pennak, 1989; Edmondson, 1992). All pictures are original taken with digital camera (14.2MP) under Magnus binocular microscope (MLX-DX, no.4 B 523861).

RESULTS AND DISCUSSION

Identifying features of Cladocera (Figure 2)

Alona affinis (Leydig, 1860)*:* The rostrum is more or less pointed; antennule is rod like in appearance. Wider distribution and are considered lacustrine zooplankton (plate 1). Postabdomen of *Alona Affinis:* 10-14 marginal denticles basal spine long (2-3 spinules) (plate 2).

Alona rectangula (Sars, 1861): Littoral species, Postabdomen of *Alona rectangula* with 8-9 denticles (plate 3). Postabdomen with 8-9 denticles *Alona rectangula* (plate 3)

A. monacantha (Sars, 1901): Valves with distinct longitudinal striae. Inferoposteal angle with 1-3 small teeth, Postabdomen with 9-10 denticles (plate 4). Claws with very long basal spine *A. monacantha* (plate 5)

Bosmina longirostris (Müller, 1776): World-wide distribution. Postabdomen long, proximal teeth with 2-3 pectens (plate 6).

Ceriodaphnia sp. Wider distribution. Head rounded with no rostrum, have a little, inflexible antennules. Upper rim of value is arched but lower rim of values delicately thorned branch, single compound eye present. Rostrum

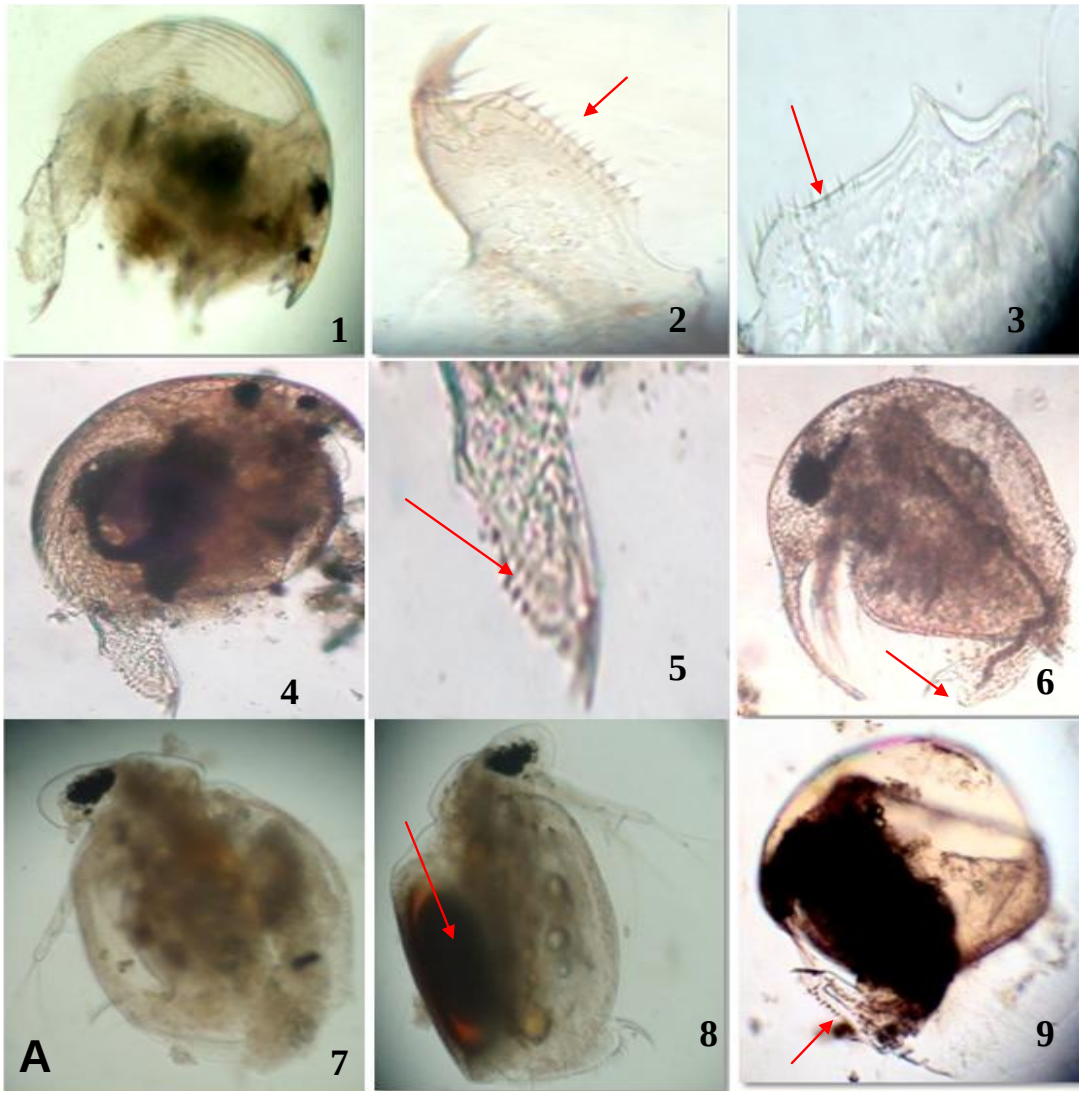

Figure 2a. Plates 1 - 9 are photographic pictures of Cladocera. Plate 1 = *Alona affinis;* plate 2=Postabdomen of *Alona affinis*; plate 3= Postabdomen of *Alona rectangula* with 8-9 denticles; plate 4 = *A. monacantha*; plate 5= Postabdomen of *A. monacantha*; plate 6= *Bosmina longirostris*; plate 7 = *Ceriodaphnia* sp.; plate 8= *Ceriodaphnia* sp. with ephippium; plate 9 = *Chydorus ovalis*.

(beak) absent, head is small and compacted, ventral side is rounded antennae fixed and branched; 3 segments on each Setae at the base of the second segment of the dorsal ramus of the antennae is longer than the ventral ramus (plate 7)

Ceriodaphnia sp. with ephippium containing the winter eggs (plate 8)

Chydorus ovalis (Kurz, 1874): Rounded to oval Post-abdomen with rounded apex 12-14 marginal denticles. Claws with 2 basal spines, the proximal one minute (plate 9)

Chydorus sphaericus (Mueller, 1785): Species of cosmopolitan distribution and a wide range tolerance to a multiplicity of environmental factors Nearshore and litto-ral, usually found clinging to filamentous algae. Usually more abundant in eutrophic waters. Spherical or broadly elliptical, shell usually reticulate, sometimes smooth. Postabdomen with 8-9 marginal denticles. Claw small proximal basal spine very minute (plate 10).

Daphnia magna (Straus, 1820): Is found in marginal habitats such as small ponds with abundant organic matter and saline ponds. Occasionally found along the margins of lakes (plate 11)

Daphnia catawba (Coker, 1926): Postabdominal process well developed with upper one well developed than the middle one (plate 12).

Posterior margin of post-abdomen deeply sinuate in lateral view; carapace spine usually short with alternate spines on both the sides of carapace spine. *Daphnia magna* (plate 13).

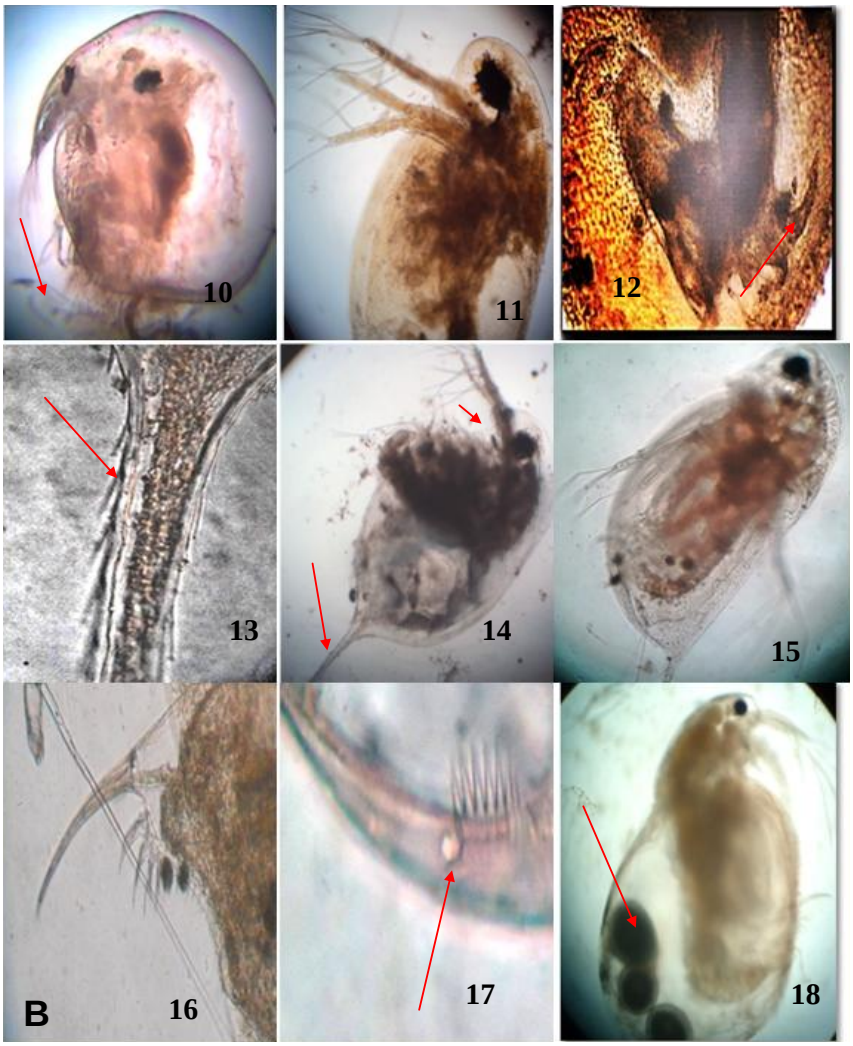

Figure 2b. Plates 10 -18 are photographic pictures of Cladocera. Plate 10=C. *sphaericus;* plate 11= *Daphnia magna;* plate 12=Postabdomen of *D. catawba*; plate 13= Basal spine with setae of *D. magna*; plate 14= *D. pulex*; plate 15= *D. rosea;* plate 16=*D. galeata,* plate 17= *D. retrocurva=;* plate 18= *Moinodaphnia* sp. with eggs.

Figure 2c. Plates 19 - 21 are photographic pictures of Cladocera. Plate 19 = *Polyphemus pediculus;* plate 20= *Sida crystallina;* plate 21= basal spine of *S. crystallina.*

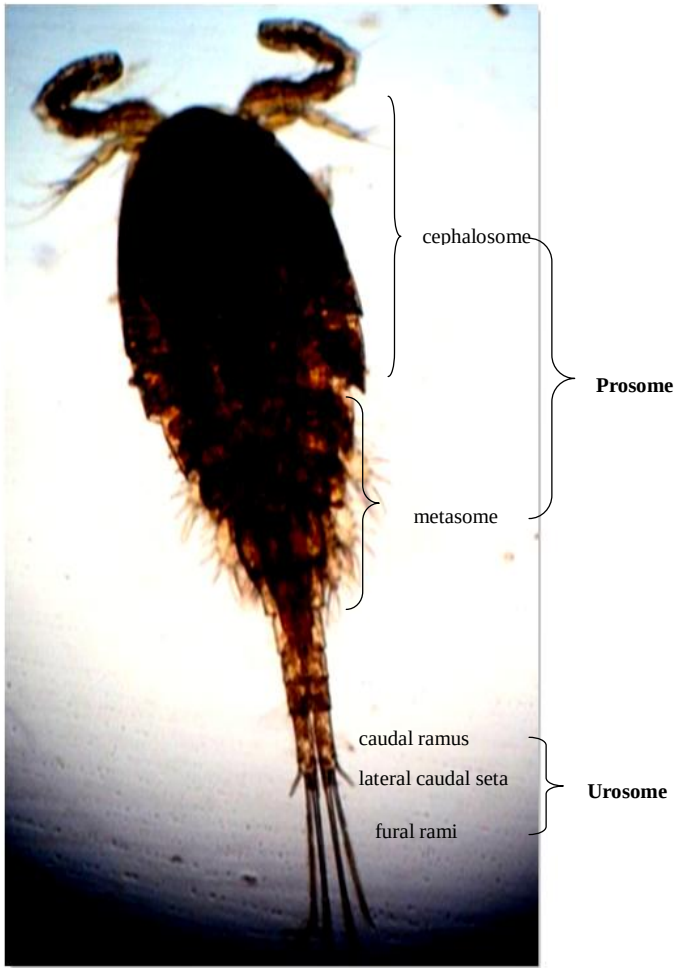

Figure 3. Structure of a typical copepod.

Daphnia pulex (Leydig, 1860): Occasionally in shallow water along the edge of lakes, carapace spine 1/5 to 1/3 of carapace length in mature specimens, ventral margin of head concave, tip of rostrum directed postero-ventral (plate 14)

Daphnia rosea (Sars, 1862): Species bears toothed crust on antero-dorsal margin of the head, although usually crested, is never produced into a helmet. The optic vesicle is very close to antero-ventral margin of the head (plate 15)

D. galeata (Sars, 1864)*:* Postabdomen with well developed setae with plain postabdominal claw (plate 16).

Daphnia retrocurva (Forbes, 1882): Middle pecten of the Postabdominal claw well differentiating from the rest (plate 17).

Moinodaphnia sp.: First antennae attached posterior to compound eye; post-abdomen with a row of lateral feathered setae, and a distal bident tooth on post-abdominal margin near base of post-abdominal claw (plate 18).

Polyphemus pediculus (Linnaeus, 1761): Carapace much reduced, not covering the entire body, forming the brood chamber, body very rounded, short with elongate "tail" huge compound eye - specimens very uniform in shape, immediately recognizable (plate 19).

Sida crystallina (Müller, 1776): Head with dorsal gland, pointed rostrum, dorsal ramus of antennae with two segments (plate 20).

Postabdominal claw long cylindrical tapering toward the end with 3-4 setae.

Identifying features of copepods

Copepods: The major articulation divides the body of Copepoda into an anterior prosome and a posterior urosome. Anteriorly is the cephalosome bearing the five head appendages and the maxillipeds and posterior to this are three free prosomites bearing the second to fourth swimming legs. The urosome comprises an anterior somite bearing the fifth pair of legs and five other somites (referred to as abdomen) with caudal rami elongated into fural rami with or without setae the distinguishing feature which help in identification of majority of the copepod species (Figures 3 and 4)

Cyclops scutifer (Sars, 1863): Inner margin of caudal rami with fine hairs (using high magnification), caudal rami 4 times as long as broad, Fourth and fifth metasomal segments expand into pointed wings, and the positions of the lateral setae (65 to 73% from base) distinguish it from (plates 22 and 23).

Eucyclops agilis (Koch, 1838): Caudal ramus usually not more than 5 times as long as broad, lateral spinules conspicuous on outer margins of caudal ramus and lateral hairs (plates 24 and 25).

Cyclops bicuspidatus thomasi (Forbes, 1882): Species associated with eutrophy (plate 26). The interior of the caudal rami is covered with hairs. *Cyclops bicuspidatus thomasi* (plate 27).

Megacyclops viridis (Jurine, 1820): Body is somewhat robust and leg 5^{th} is very characteristic. Length inner seta of the fural rami is more than twice as long as outer seta (plates 28 and 29).

Cyclops vernalis (Fischer, 1853): *Fural rami* bear prominent hairs on both the sides, inner margin of caudal ramus without hairs (plates 30 and 31).

C. panamensis (Marsh, 1913): Caudal rami with hairs (lateral seta without hairs) (plate 32).

Diaptomus minutus (Lilljeborg1889): Leg 5^{th} with exopod flattened, sharply pointed inner process (plates 33 and 34). *Diaptomus* sp. First antenna as long as body, caudal ramus of equal length, the forth leg not differentiating (plate 35).

Bryocamptus hiemalis (Pearse, 1905) : With egg sac on genital segment (plate 36).

ACKNOWLEDGEMENT

Thanks are due to the Director, Centre of Research for Development and Head, Environmental Science, University of Kashmir for providing necessary laboratory facilities.

Figure 4. Plate 22-30 are pictures of copepods. Plate 22 = *Cyclops scutifer*; plate 23 = *C. scutifer* caudal ramus; plate 24 = *Eucyclops agilis*; plate 25 = Caudal ramus with minute setae on outer margin of *Eucyclops agilis;* plate 26 = *Cyclops bicuspidatus;* plate 27 = Urosome and caudal ramus of *C. bicuspidatus;* plate 28 = *Megacyclops viridis;* plate 29 = Fural rami of *Megacyclops viridis;* plate 30 = *Cyclops vernalis.*

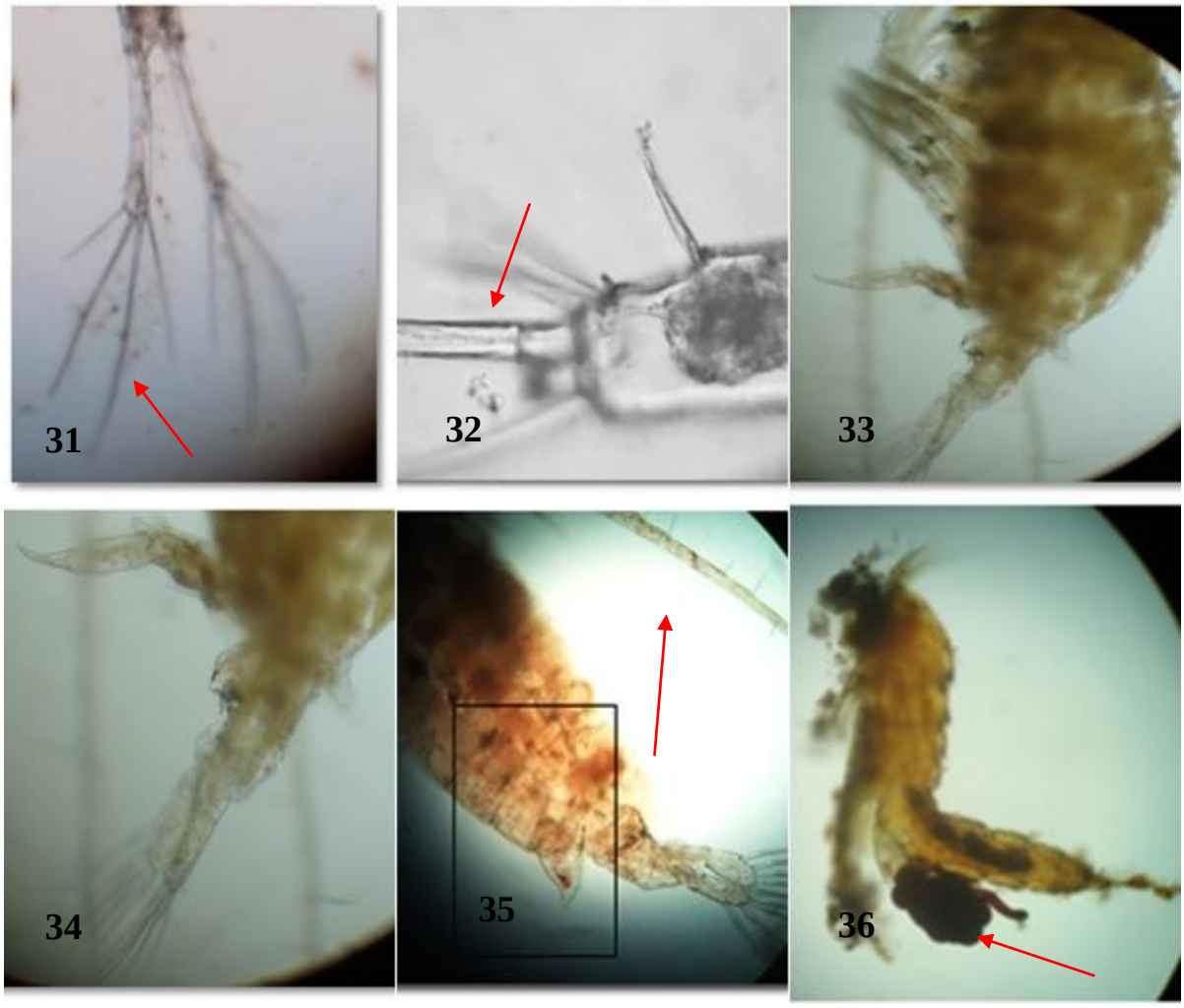

Figure 4. Plate 31-36 are pictures of copepods. Plate 31 = Fural ramus of *C. vernalis;* plate 32 = Caudal rami with hairs (lateral seta without hairs) of *C. panamensis;* plate 33 = *Diaptomus minutus ;* plate 34 = *Diaptomus minutus* with 5th leg*;* plate 35 = *Diaptomus* sp.*;* plate 36 = *Bryocamptus hiemalis* with egg sac.

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