A Study of Copepodid Stages of *Mesocyclops edax* Forbes, 1891(Copepoda: Cyclopoida)

Luay A. Ali[1] and Kazhal H. H. Rahim[2]

1. College of Education, Salahaddin University-Hawler Kurdistan region, Iraq
E-Mail: Luay_a_a@yahoo.com
2. Dept. Basic Science, College of Nursing, Hawler Medical University
kazhalhassan@Hotmail.com

Abstract. The present study was conducted to define the copepodid stages of ***Mesocyclops edax*** (Copepoda: Cyclopoida) in the laboratory. Eggs of adult females were isolated and incubated in sterile petridish at 25±1C°. During the follow up of the development of these eggs and after five days later of the last stage of nauplius the copepodid I, II, III, IV and V were observed. The study was included the descriptions of obtained copepodid stages.

Key word*:* Copepodid stages, *Mesocyclops edax,* Copepoda, Cyclopoida, Greater Zab River**.**

Introduction

Copepods are very small crustaceans, most ranging from less than one millimeter to several millimeters in length. Free-living freshwater copepods can be distinguished from other small aquatic invertebrates by a variety of morphological characteristics. Knowledge of copepodid morphology is in-dispensable for the investigation of stage-dependent biological and ecological phenomena and the elucidation of phylogenetic relationships. As part of present study of the life cycle of fresh-water Cyclopoida, is describe the copepodid stages of *Mesocyclops edax*.

Many previous studies have been carried out on the life cycles of copepoda in different parts of the world. A study of the development of larval stages of seven species of marine copepoda made by (1). These species included representatives of four different families in all these species and he found five copepodid stages. While, (2) showed the development of a representative from each of the three most common freshwater families and genera, he observed six copepodid stages, including the adults with *Diaptomus vulgaris*, but only five copepodid stages with *Cyclops strenuus* and *Canthocamptus staphylinus*. However, (3) described somites, appendage. Segments and ornamenent elements of six copepodid stages of *Dioithona oculata* including adults, they reported new information about morphological development of appendage segments and ornamenent elements. Regarding to antennules developments through the copepodid phase. (4) reported that after the nauplius was molted to copepodid I, new segments are formed only in the median and proximal regions of the

antennule. An increase in the number of segments due to the expression of new inter segmental articulations was commonly observed during the ontogeny of the antennules.

In Iraq generally and in Kurdistan particularly, most previous studies on copepod were mainly restricted to surveying different species in different aquatic environment, there are no study on life cycles of copepoda, this study become the first study of copepodid stage of free copepod in Iraq in general and in Kurdistan region in particular.

Material and methods

Greater Zab River is a large river (392 km) in Iraq. This river is one of the main tributary of the Tigris, it originates mainly from mountainous area of Iran and Turkey. It is situated between 36°-37° north latitudes and 43°-44° east longitude (5). During the period of June 2009, the samples were collected near Khabat sub district far about 40 km to the west of Erbil city (Fig. 1). Samples were collected by filtering, 50 liter of the river water by using planktonic net, with 55 µm pore size then the samples were concentrated to 10 ml of river water.

After returning to the laboratory the adult female of copepods is began to produce the eggs were placed in small petridish with little amount of distal water at 25±1 C° and drops of water at 25 C° were added every six hour by using small syringe reparation. Then they were placed in incubator at 25 ±1 C° (6 and 7). Every day plastic cups were checked under dissecting microscope and the copepodid stages observation was made daily. Photomicrographs were taken for each stage by using Olympus compound microscope and digital camera model (Sony, DSC-W55).

Results and Discussion

Mesocyclops edax was originally described from Lake Superior of North America (8). Generally, cyclopoida exhibit complex life cycles and relatively long generation times compared with other zooplankton. The life cycle consists of six nauplius stages, followed by five copepodid larval stages before final molt into adult. The eggs typically hatch as nauplius larvae which are not similar to their parents. They are much smaller, broader in proportion, have only a few pairs of limbs, and possess no tail end to their body, they may be colorless, the only conspicuous part of them being their eyes and the nauplius was molted to copepodid I (9 and 10). In this study, the copepodid stages of *Mesocyclops edax* have been descibed.

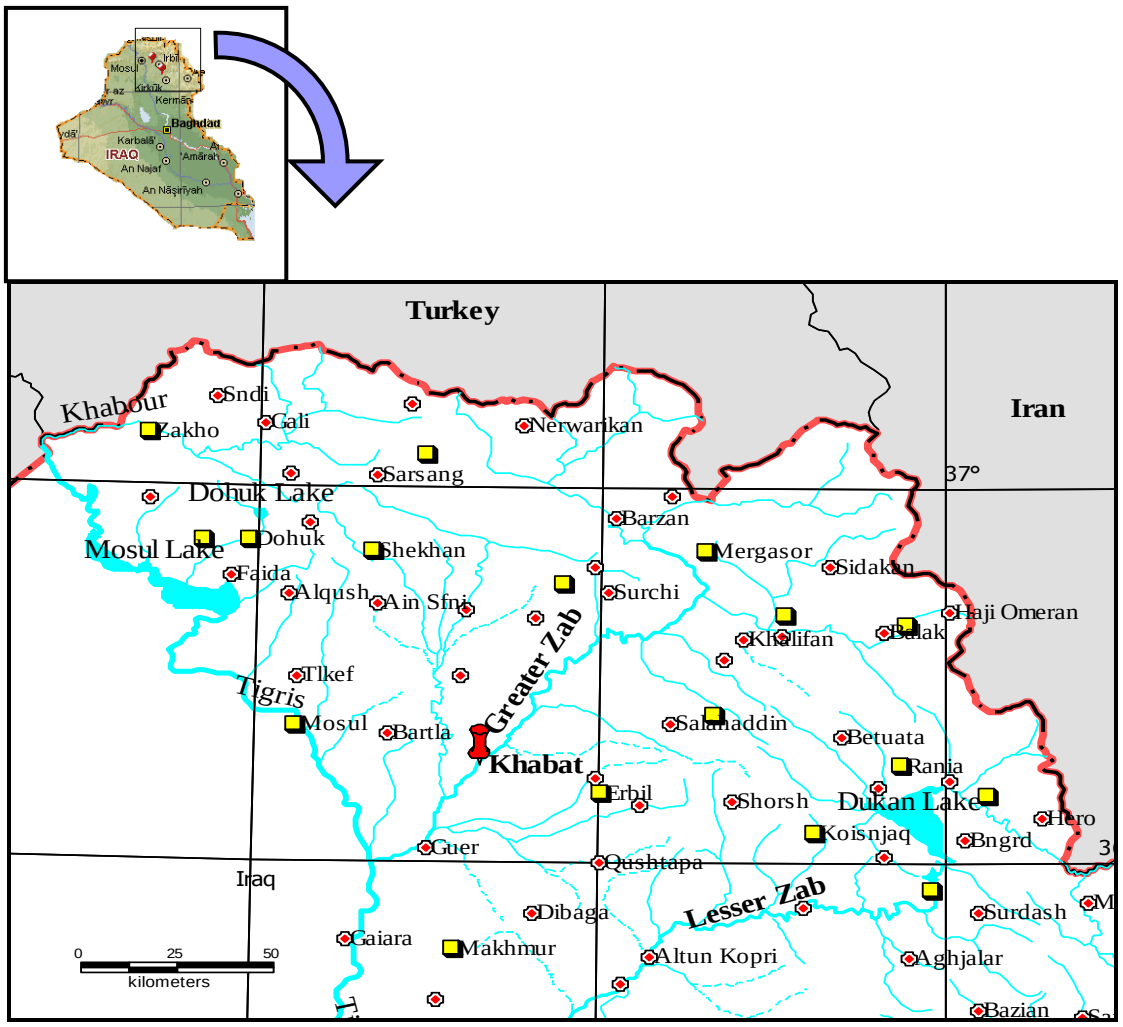

Fig. (1) Map of Iraq, showed location of sampling sites of Greater Zab, River (Map info. Vers. 9).

Copepodid I

The final naupliar stage metamorphoses and molt into the first copepodid stage after 25-30 hours. The body length with seta and furca is 400-410µm (fig. 2). The body consists of five segments. The cephalothorax bears antennule, antennae, mandibulae, maxillulae, maxillae, maxillipedes and one pair of swimming limbs. Distal segment terminates with furca. Furcal branches are twice as long as wide each with fourth setae, two small spines inserted respectively bristles at the lateral and terminal external silk bare back. Antennule with six segments, body is transparent with dark intestine, the naupliar eye is visible throughout the copepodite stages and is positioned in central line at the anterior body edge. Mandible gnathobase much developed over a row of teeth acute, first limb and second limb biramas composed two segments exopod and endopod.

Copepodid II

The development of copepodid I to copepodid II required 18-24hours. Body Length 485-493µm (fig. 3). The body consist of six somite including the cephalothorax (which is more rounded than that of previous stage) and five segments of urosome, at this stage one new free segment and one new pair of swimming limbs appear, last segment (anal somite) with a ventral row spines along posterior end at the base of furcal branch, antennules with seven segments.

Copepodid III

The development of copepodid II to copepodid III required 21-25hours. The cephalothorax appendages are similar to those of the previous stage. In this stage one new free segment and one new pair of swimming limbs are added to the body. The body length 605-619 µm (fig. 4) with seven segments, on the thoracic four biramous swimming limbs are present. Antennules consist of nine segments.

Copepodid IV

Copepodid III metamorphose to copepodid IV after one molt during 20-24 hours. Body measures about 730-750µm in length (fig. 5). The body consists of cephalothorax, eight free segments, and furca, antennules divided into ten segment the metasome has four segments each one has a pair of swimming legs, each furcal ramus has five plumose setae, the inner is shortest. The presentation of the bud of limb five occurs, at this stage female can differentiated from male (male have nine somites).

Copepodid V

Copepodid IV metamorphose to copepodid V after one molt during 22-24 hours. The body length is about 768-780 µm (fig. 6), with nine, segments, urosome five segments. Anal somite with a row of spines on the edge posterior presence after the anal operculum. Furcal branches are three times as long as wide. Urosomite genital well rounded. Draft of seminal receptacle on the second urosomite. This stage is distinguished by the relatively long last urosomite (anal somite), which is longer than the next somite. This somite divides in the last molt, forming two somites that are similar in length in the adult. The metasome has four segmentsone has a pair of swimming legs, uorsome with five segments, leg five is fully formed in this stage distal segment of leg five armed with two long spine and a median seta, inner spine of second segment of leg five longer than terminal seta, inner margin of caudal ramus with hairs, antenule eleven segment and divide to produce seventeen segments in the adult stage. In general, the increase in length was much more pronounced at the molt between nauplius V1 and copepodid1. Female exhibit faster growth than males at the copepodid IV, V and adults, the number of segments of antennae increases with development of copepodid (11).

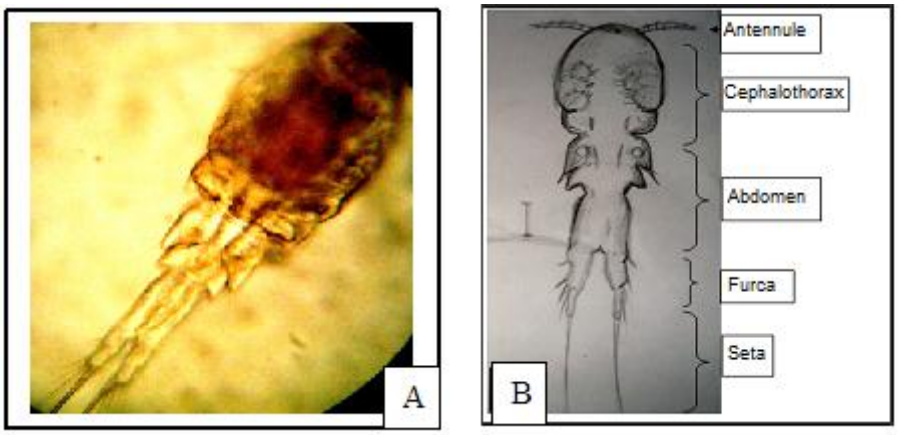

Fig. (2): Copepodid I.

A. Photomicrograph (400X) B. Camera lucida drawing (scal bar= 0.045 mm).

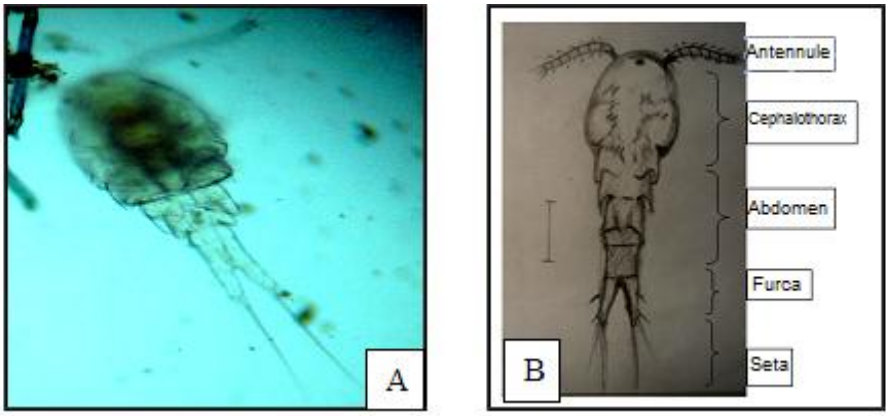

Fig. (3): Copepodid II.

A. Photomicrograph (400X) B. Camera lucida drawing (scal bar= 0.108 mm).

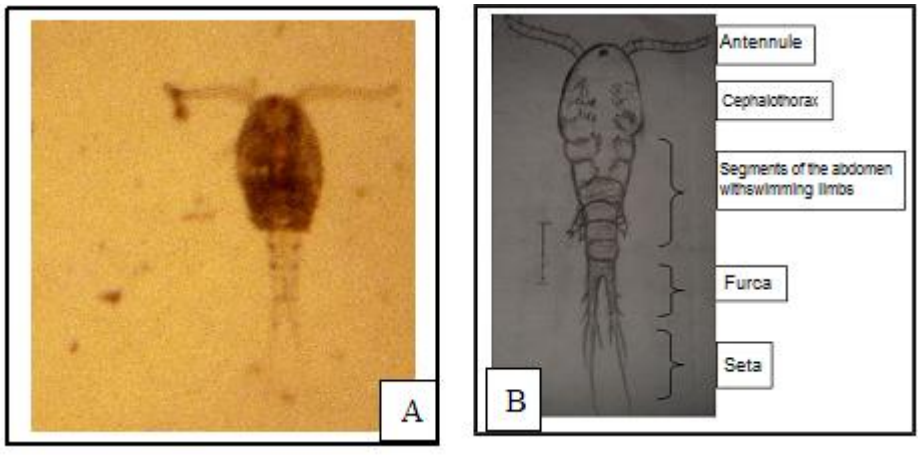

Fig. (4): Copepodid III.

A. Photomicrograph (400X) B. Camera lucida drawing (scal bar= 0.25 mm).

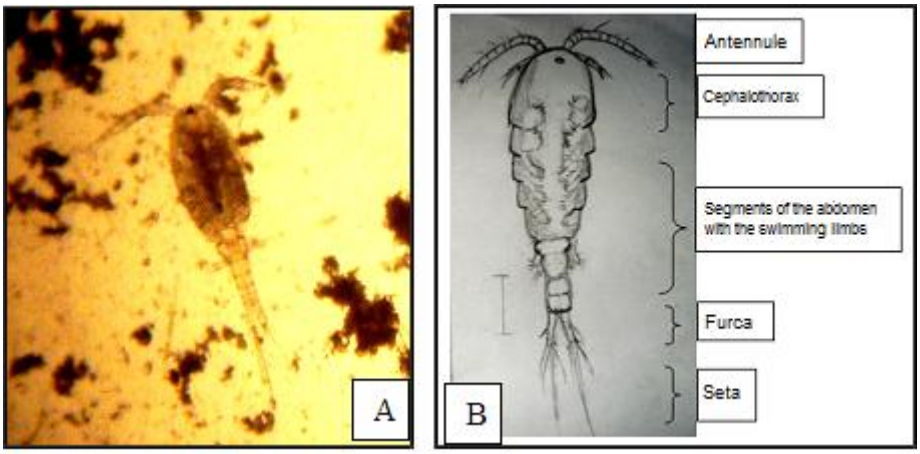

Fig. (5): Copepodid IV.

A. Photomicrograph (200X) B. Camera lucida drawing (scal bar= 0.142 mm)

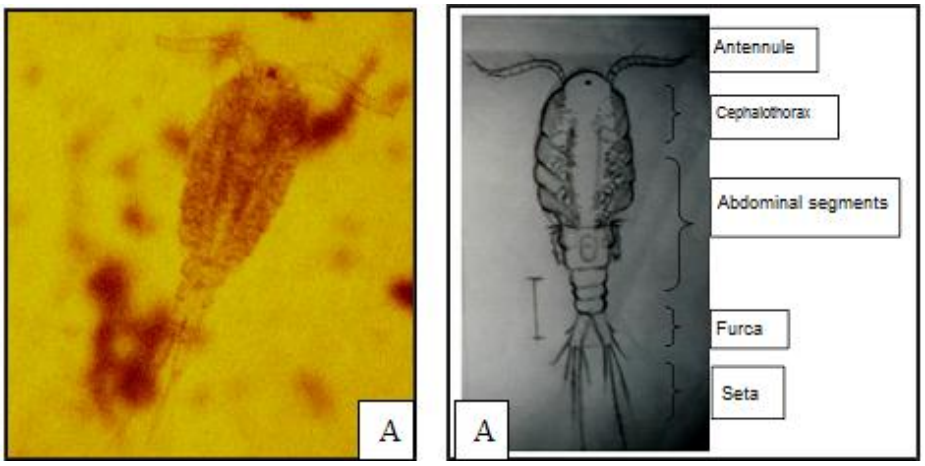

Fig. (6): Copepodid V.

A. Photomicrograph (400X) B. Camera lucida drawing (scal bar= 0.196 mm)

References:

1.Oberg, M. (1906). Die metamorphose der plankton copepoden der Kiefer buch. wiss. Meere suntersuchun herausgeg, V. D. Komm, Z. wiss. Unter such, D.deutsh-Meere in Kiel,U.D, Biol,Anstallt, Helgoland.Neue. (Cited by The larval development of fresh water copepod.The Oho state Ewers, L. A. (1930).

2. Dietrich, W. (1915). Metamorphoseder freilebenden susswass copepoden fur wissenschaft. Zoologie, Bd.113. (cited by Ewers, 1930).

3. Ferrari, D. F. and Ambler, W. J. (1992). Nauplii and Copepodid of the cyclopoid copeopid *Diathona oculata* (Farran 1913)(oithonide) from Aman groove Cay in Belize, Proc. Biol. Soc. Wash, 105(2) : 275-298.

4. Schutze, M. L. M.; Rocha, C. E. F. and Boxshall, G. A. (2000). Antennulary development during the copepodid phase in the family Cyclopidae(Copepoda, Cyclopoida). Zoosystema, 22 (4): 749-806.

5. Susa, A. (1960). Index of Iraq geography. Dar Al-Tamadon Publ., Baghdad: 61pp. (In Arabic)

6. Grabda, J. (1963). Life cycle and morphogenesis of *Lernaea cyprinacea* L. Acta Parasitol. Polonica, 11: 169- 198.

7. Tsotetsin, A. M. (2005). Aspect of the ecology, life cycle and patho- logy of *Lamproglena clarae* (Copepoda: Lernaidae), collectedfrom the gills of *Clarias gariepinus* from the Vaal river system, South Afrika. Coll. Faculty Sci., Univ. Rand Afrikaans. 101pp.

8. Forbes, S. A. (1891). On some Lake Superior Ento- mostraca.-Report of the United States Commission of Fish and Fisheries for 1887: 701-718.

9. Sommer, U. (1989). Plankton ecology, succession in plankton communities. Springer-verlage, Newyork, USA.

10. Marshall, A.J. and Williams, W. D. (2002). Textbook of zoology invertebrates. 7th ed., CBS publishers and distributors, NewDelhi. India.

11. Dudley, P. (1966). Development and systematic of some Pacific marine ascidians. University of Washington Publications in Biology, 21: 1-282.