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THE COPEPODID STAGES OF THE COPEPODS ACARTIA TONSA, A. CLAUSII AND EURYTEMORA HERDMANI FROM THE ANNAPOLIS RIVER, NOVA SCOTIA

C.J. CORKETT

Biology Department
Acadia University
Wolfville, N.S. B0P 1X0

The number of urosome segments, metasome segments, and metasome appendages for *Eurytemora herdmani, Acartia clausii,* and *A. tonsa* is given in tables and figures. These characters may be used to distinguish copepodids during routine examination of plankton samples, but the urosome-cephalothorax ratio is the only way of distinguishing between copepodids of *A. tonsa* and *A. clausii.*

On présente dans des tableaux et des figures le nombre de segments de l'urosome et du métasome ainsi que le nombre d'appendices du métasome d'*Eurytemora herdmani,* d'*Acartia clausii* et d'*A. tonsa.* Ces caractéristiques peuvent servir à distinguer entre eux les copépodites des diverses espèces lors d'examens de routine d'échantillons planctoniques, mais seul le rapport urosome-céphalothorax permet la distinction entre les copépodites d'*A. tonsa* et ceux d'*A. claussi.*

Introduction

There are relatively few publications on the 5 copepodid stages of copepods as most work on larval stages has concentrated on the naupliar stages. Even with published descriptions, it is often difficult to distinguish copepodid stages of species within the same genus. This often necessitates an initial investigation and description for each locality.

Kraefft (1910) gives diagrams of the urosome of *Acartia clausii* copepodids and Grandori (1912) gives diagrams of copepodid stages of *A. clausii* viewed from the dorsal side. Grice (1971) describes the copepodid stages of *Eurytemora herdmani.* The most relevant reference is Conover (1956) who describes the first 3 copepodid stages of *A. clausii* and *A. tonsa.*

Acartia clausii Giesbrecht 1889 sensu stricto is not found in North American waters where the correct species is *A. hudsonica* Pinhey, 1926 (Bradford 1976). Because of extensive use of *A. clausii* for the North American species, the name is retained in this work.

Acartia clausii, A. tonsa, and *Eurytemora herdmani* are the dominant copepods in the headpond of Annapolis River and a detailed redescription of them is given in this paper. Particular emphasis is given to those characters that can be seen during routine examination of plankton samples.

Methods

The copepodids were obtained on 24 July 1980 from the headpond of Annapolis River, in a vertical plankton haul from 6 m. The net had a mesh size of 80 μm Microdissection of the fifth pair of thoracic appendages was completed in a number of adult specimens to assure species identification. Dissected appendages were mounted in polyvinyl lactophenol in which lignin pink had been dissolved.

The diagrams were drawn freehand from specimens examined microscopically while on their side on a drained slide.

Table I. Copepodid stages of *Acartia clausii* and *A. tonsa*.

Copepodid stage:	I	II	III	IV♀	IV♂	V♀	V♂	Ad♀	Ad♂
No. urosome segments	2	2	2	2	3	3	4	3	5
No. metasome segments	3	4	4 or 5	4 or 5	4 or 5	4 or 5	4 or 5	4 or 5	4 or 5
No. metasome appendages	2	3	4	5	5	5	5	5	5
No. swimming feet	2	3	4	4	4	4	4	4	4
cephalothorax length (mm)	0.31-0.37	0.36-0.51	0.43-0.49	0.48-0.59	0.50-0.56	0.54-0.71	0.49-0.61	0.58-0.79	0.61-0.65

Table II. Copepodid stages of *Eurytemora herdmani*.

Copepodid stage:	I	II	III	IV♀	IV♂	V♀	V♂	Ad♀	Ad♂
No. urosome segments	2	2	2	3	3	3	4	3	5
No. metasome segments	3	4	5	4 or 5	4 or 5	5	5	5	5
No. metasome appendages	2	3	4	5	5	5	5	5	5
No. swimming feet	2	3	4	4	4	4	4	4	4
cephalothorax length (mm)	0.30-0.31	0.37-0.38	0.47-0.48	0.49-0.55	0.47-0.51	0.55-0.59	0.51-0.59	0.58-0.60	0.53-0.61

Results and Discussion

The features by which copepodid stages are most easily distinguished are the number of urosome segments, metasome segments, and metasome appendages. These features, as they relate to *Acartia clausii, A. tonsa,* and *Eurytemora herdmani,* are summarized in Tables I and II. The copepod body is divisible into 3 regions: cephalosome, metasome, and urosome (Fig 1c). The metasome is equivalent to the region of "free thoracic segments" (Corkett 1967) and contains the swimming feet and the fifth thoracic appendages. The total number of metasome appendages and swimming feet is entered separately in Tables I and II. As the fifth thoracic appendages do not appear until copepodid IV, the first 3 copepodid stages have only swimming feet on their metasome. The number of pairs of swimming feet in the tables refers only to the fully developed pairs and not to the single rudimentary pair which may be seen as a bud in copepodids I, II, and III.

1. *Acartia clausii* Giesbrecht, 1889 and *Acartia tonsa* Dana, 1849. (Table I).

Conover (1956), in his study of these same 2 *Acartia* species from Long Island Sound, found that the copepodids may be distinguished by the form of the urosome. The relatively shorter urosome in *A. tonsa* gives a lower urosome-cephalothorax ratio than found in *A. clausii.* This ratio, determined for 43 individuals from all copepodid stages, was 1 to 4-4.5 in *A. tonsa* and 1 to 3-3.5 in *A. clausii.* The urosome-cephalothorax ratio is the only practical way of distinguishing *A. tonsa* copepodids from *A. clausii* copepodids. Conover (1956) also states that the caudal rami in *A. tonsa* are quadrate (i.e. are as wide as they are long), whereas in *A. clausii* the rami are longer than wide. These observations were made from a dorsal or ventral viewpoint and are therefore not discernible from the side as illustrated in Figure 1.

Copepodid I (Fig 1a). Two complete swimming legs, the third appearing as a bud. Three metasome segments and 2 urosome segments.

Copepodid II (Fig 1b). Three complete swimming legs, the fourth appearing as a bud. Four metasome and 2 urosome segments.

Copepodid III (Fig 1c). Four complete swimming legs, the fifth appearing as a bud. The fourth and fifth metasome segments have an incomplete division which is seen only ventrally (Fig 1c). This is indicated as 4 or 5 metasome segments in Table I. Two urosome segments.

Copepodid IV (Fig 1d & 1e). Sexes are separable, with the male having 3 urosome segments and the female 2. Metasome with 4 or 5 segments as in copepodid III. There are 4 swimming legs with the fifth appendages being present as a small 2-segmented limb.

Copepodid V (Fig 1f & 1g). Sexes are separable, with the male having 4 urosome segments and the female 3 with a swollen genital segment. Metasome with 4 or 5 segments. Four swimming legs, with the fifth appendages present as a 2-segmented limb similar to that in copepodid IV.

Adults (Table I). The male has a 5-segmented urosome while the female has 3 urosome segments. Metasome with 4 or 5 segments.

2. *Eurytemora herdmani* Thompson & Scott, 1897 (Table I).

The dominant species of *Eurytemora* in the sample is *E. herdmani.* Individuals of a second species were identified as *E. hirundoides* using Wilson (1932) but are recorded here as *E. affinis* because probably all records of *E. hirundoides* from North America are *E. affinis* (Katona 1972).

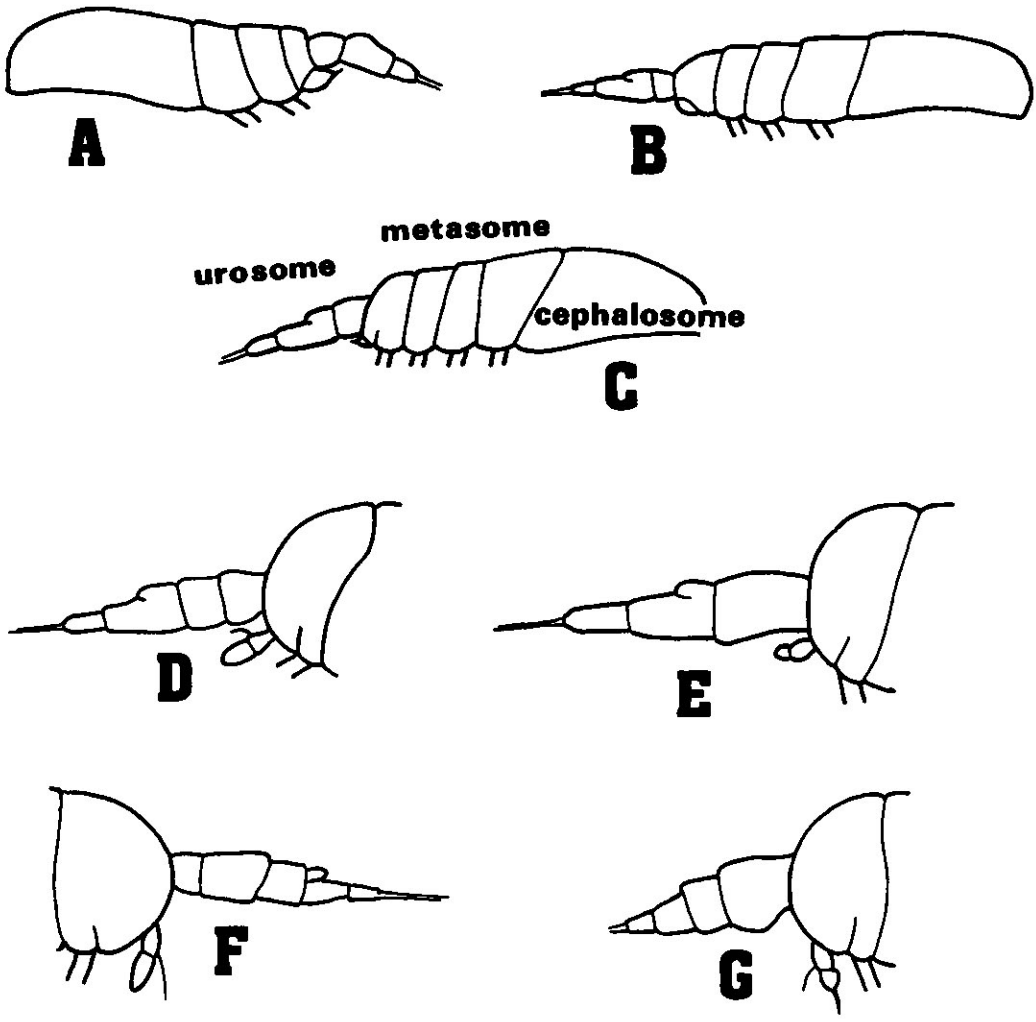

Fig 1. Copepodid stages of *Acartia*. A: *A. clausii* copepodid I; B: *A. tonsa* copepodid II; C: *A. clausii* copepodid III; D: *A. clausii* copepodid IV male; E: *A. clausii* copepodid IV female; F: *A. clausii* copepodid V male; G: *A. tonsa* copepodid V female.

Copepodid I (Fig 2a). Two complete swimming legs, the third appearing as a bud. Three metasome segments and 2 urosome segments.

Copepodid II (Fig 2b). Three complete swimming legs, the fourth appearing as a bud. Four metasome and 2 urosome segments.

Copepodid III (Fig 2c). Four complete swimming legs, the fifth appendage appearing as a bud. Five metasome segments and 2 urosome segments.

Copepodid IV (Fig 2d & 2e). Sexes are separable. The division between the fourth and fifth metasome segment is often incomplete and the metasome thus appears to have 4 (Fig 2e) or 5 (Fig 2d) segments. The urosome has 3 segments in both sexes. There are 4 complete swimming legs and the fifth pair of appendages is sexually dimorphic, being larger and wider in the male (Fig 2d) than in the female (Fig 2e). The sexual dimorphism in the fifth pair of thoracic appendages is the only character that can be used to distinguish the sexes in this copepodid stage.

Copepodid V (Fig 2f & 2g). Sexes are separable. There are 5 metasome segments in both sexes and there is a projection on the postero-lateral corner of the fifth metasome segment in the female. The female urosome has 3 segments, the genital segment being swollen. The male urosome is 4-segmented. There are 4 complete swimming legs and the fifth appendages are sexually dimorphic, the male having a 4-segmented larger and wider pair than the 3-segmented female pair.

Adults (Table II). There are 5 metasome segments in both sexes. The urosome is 3-segmented in the female and 5-segmented in the male.

Acknowledgements

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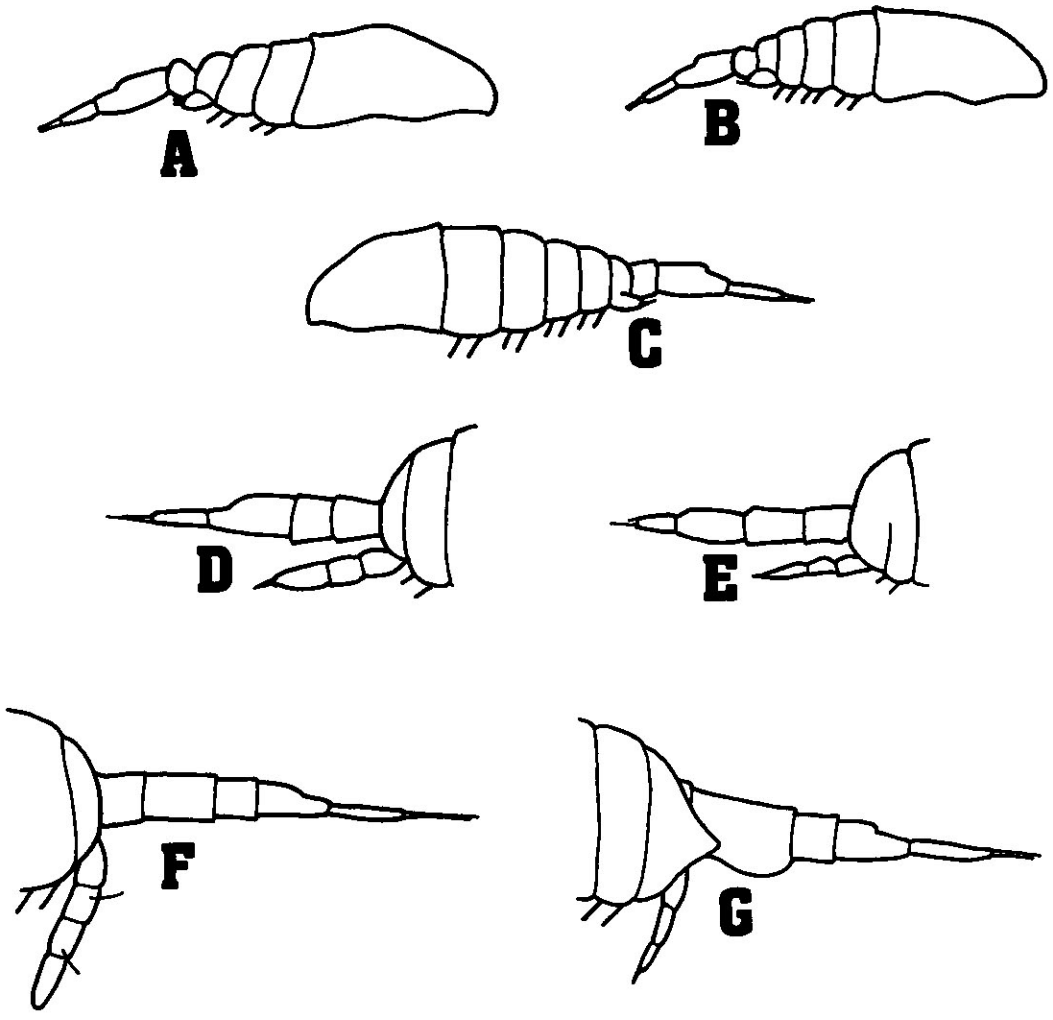

Fig 2. Copepodid stages of *Eurytemora herdmani*. A: copepodid I; B: copepodid II; C: copepodid III; D: copepodid IV male; E: copepodid IV female; F: copepodid V male; G: copepodid V female.