

## REMARKS ON Z. KABATA CLASSIFICATION OF COPEPODA

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### ABSTRACT

The paper presents the concept of Kabata's classification of Copepoda.

**KEY WORDS:** Copepoda parasitica, phylogenetic tree, Z. Kabata

The aim of this note is to commemorate the work of prominent crustaceologist, prof. Zbigniew Kabata in the development of Copepoda systematics. At the round table conference on Crustacea held in Gdynia on 4th June 1998 at occasion of prof. Zbigniew Kabata's visit, his concept of Copepoda classification was presented as follows.

The main question in classification of copepods which was realized by Kabata in 1979 and before that by Thorell 1859, Sars 1903, Wilson 1910 and others, was a trouble in connection of free living copepods with parasitic ones. The former had been changed significantly in adaptation to parasitic way of life over evolution lasting millions of years. Kabata (1979 and 1981), since Lang's (1948) theory, gives the correct choice of appropriate criteria for suitable morphological characteristics. He selects the clues for any new particular problem. Very important in this approach was the analysis of adaptations to the parasitic way of life in some copepods.

Kabata (1979) attempted to review the classification of Copepoda with the aid of „primary” or „primitive” characteristics. The „primary” characteristics constitute the basic clues to the phylogeny of copepods, parasitic copepods in

particular. In essence, these characteristics were preferred because they were deemed less susceptible to the influence of parallelism and convergence, often imposed by parasitism on copepod morphology; the latter should constitute the basis for classification. The use of the „testimony of degeneration” has resulted in the establishment of such patently artificial taxa as Lernaepodoida, and in forcing together siphonostomatous, poecilostomatous and gnathostomatous species in the same suborder, Cyclopoida. There remains the question of how to determine whether a given characteristic is primary or secondary. The primary characteristics originate from the morphological matrix inherited from the ancestral species and recognizably retained by the copepod. For example, he considers the gnathostome type of mouth-parts to be primitive, because it is widespread throughout Copepoda (see g, Fig. 1) and because its occurrence is not determined by the mode of life. Pelagic Calanoida, demersal Harpacticoida, predatory and saprophytic species, all may be equipped with mouth-parts of similar type, suggesting ancestral affinity. On the other hand, species with similar modes of life and high morphological resemblance may have mouth parts of different types. This would suggest convergent evolution of two distinct stocks, rather than phylogenetic affinity.

A diagram of Kabata classification is shown in Fig. 1. It involved acceptance of the fact that one cannot discuss the phylogeny of parasitic copepods in isolation from that of their free-living relatives. Parasitism has evolved on several occasions in this abundantly successful order of Crustacea. The scheme was based on two facts (referred to as „major events”), basic to the entire evolution of Copepoda. The first fact was the development of tagmosis in previously metamericly undifferentiated ancestors. The position of the border between the anterior and posterior tagma gave rise to two evolutionary stems: Gymnoplea and Podoplea. First recognized by Giesbrecht (1892), subsequently largely disregarded by the students of parasitic Copepoda, these two stems have an important place in the evolutionary scheme of Copepoda. Gymnoplea comprise those species that have the fifth leg-bearing segment incorporated in the anterior tagma, whereas those with the fifth leg in the posterior tagma are grouped in Podoplea. (The evolution of tagmosis is indicated by S, in Fig. 1). Aberrant Monstrilloida, which have no mouth as adults, must be left out of these considerations. Two suborders departed from the ancestral type; the newly established Poecilostomatoida and Siphonostomatoida evolved a radically new buccal apparatus. Siphonostomatoida have tabular mouths and styled-like dentiferous mandibles; Poecilostomatoida have gaping mouths and falcate, pliable mandibles. The evolution of

the new buccal apparatus is indicated by M in Fig. 1. The evolution of the siphonostome mouth either accompanied or preceded the beginning of parasitism on fishes. It seems to have been a pre-adaptation to this way of life.

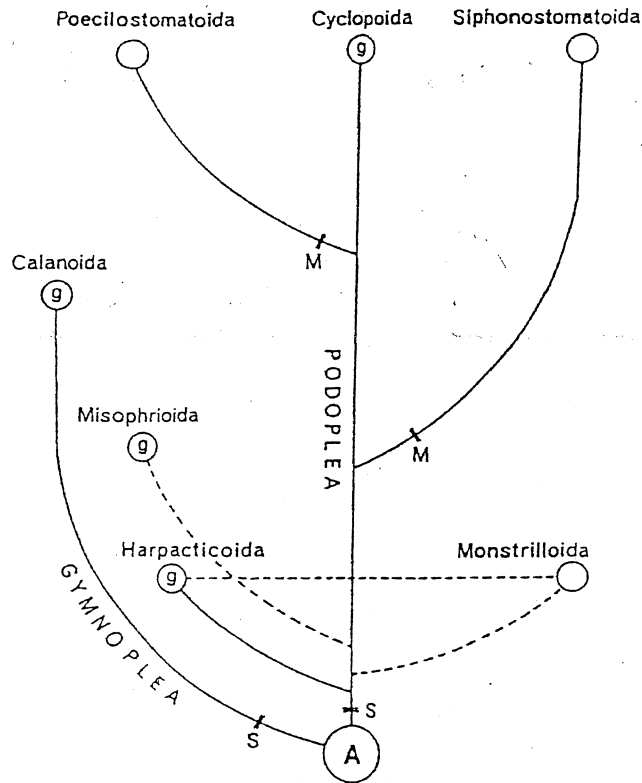


Fig. 1. Hypothetical phylogenetic tree of Copepoda (From Kabata 1981)

In addition to establishing the two new suborders mentioned above, the proposed classification dismantles Cyclopoida by removing from the old taxon all species with siphonostome and poecilostome mouths. Caligoida have been incorporated into Siphonostomatoida, and Notodelphyoida into Cyclopoida.

In the opinion of Kabata (1979) the crux of the matter is the correct choice of appropriate criteria, of suitable morphological characteristics. The new clues must be applied in each particular problem. A good example of a need for evaluation of morphological criteria is the fourth leg of the caligid of the copepods. This leg is in the process of undergoing reduction as the result of a barrier formation by the expanded third interpodal bar, a barrier that functionally separates the fourth leg from those anterior to it. The fourth leg has become uniramous in *Caligus* Müller 1785, and related genera. Its

reduction to a vestige consisting of a single segment marks off the genera *Pseudocaligus* Scott 1901, and *Pseudolepeoptheirus* Markevich 1940, otherwise indistinguishable from *Caligus* and *Lepeoptheirus* Nordmann 1832, respectively. In *Caligopsis* Markevich 1940, the fourth leg had disappeared. The presence or absence of this leg, its structure and size, are used as discriminants at the generic level. *Pseudanuretes* Yamaguti 1936, is another well defined genus, distinguished by the possession of a unique and prominent flagellum of unknown nature at the base of the second maxilla. This feature sets it off from other caligid genera. *Pseudanuretes*, however, contains species that have vestigial fourth legs, as well at least one (*Pseudanuretes fortipedis* Kabata 1965) with full-sized uniramous ones. To be consistent, one would have to split *Pseudanuretes* into two genera. To do so, would be to detract from the diagnostic value of the unique flagellum. By not doing so, one puts in doubt the validity of the fourth leg in this capacity, i.e. the validity of *Pseudocaligus*, *Pseudolepeoptheirus*, and *Caligopsis*. The final choice and decision are still awaiting the voice of authority.

Concluding: Kabata's system is a deeply consideral concept supported by a very good knowledge of Copepoda. This knowledge is footing on convincing argumentation and the discussion of other authors.

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