



Systematics and phylogeny of Cristacoxidae (Copepoda, Harpacticoida): a review

RONY HUYS^{1,3} & TERUE CRISTINA KIHARA²

¹Department of Zoology, Natural History Museum, Cromwell Road, SW7 5BD, London, UK. E-mail: rjh@nhm.ac.uk

²Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, Rua do Matão, trav. 14, n° 321, 05508-900 São Paulo, Brazil. E-mail: tkihara@ib.usp.br

³Corresponding author

Table of contents

Abstract	2
Introduction	2
Material and methods	3
Taxonomic account	4
Order Harpacticoida Sars, 1903	4
Family Cristacoxidae Huys, 1990	4
Genus <i>Noodtorthopsyllus</i> Lang, 1965	5
<i>Noodtorthopsyllus tageae</i> sp. nov.	5
Family Nannopodidae Brady, 1880	21
Genus <i>Acuticoxa</i> gen. nov.	21
<i>Acuticoxa ubatubaensis</i> sp. nov.	22
Discussion	27
Key to genera of Nannopodidae	36
Acknowledgements	37
References	37

Abstract

Both sexes of a new species of *Noodtorthopsyllus* Lang, 1965 (Harpacticoida, Cristacoxidae) from a sandy beach in São Paulo State (Brazil) are described using light and scanning electron microscopy. *Noodtorthopsyllus tageae* **sp. nov.** displays a mosaic of characters drawn from both *Noodtorthopsyllus* and *Cristacoxa* Huys, 1990, blurring the boundaries between both genera. Consequently, *Cristacoxa*, the type genus of the nominal family-group taxon Cristacoxidae Huys, 1990, is relegated to a junior subjective synonym of *Noodtorthopsyllus*, and its type species is transferred to the latter as *N. petkovskii* (Huys, 1990) **comb. nov.** A new genus *Acuticoxa* is proposed to accommodate *A. ubatubaensis* **sp. nov.** (type species), collected on the northern continental shelf of São Paulo State, and *A. biarticulata* **sp. nov.**, previously identified as *Laophontisochra* sp., from the Northern Magellan Straits. Amended diagnoses are provided for *Noodtorthopsyllus* and *Laophontisochra*.

Autapomorphies supporting the monophyly of the Cristacoxidae are re-evaluated, including new data on P3 endopod sexual dimorphism and caudal ramus development. It is concluded that a recently published hypothesis of a deeply rooted split of the family into two highly divergent lineages cannot be supported. Consequently, both *Laophontisochra* and *Acuticoxa* **gen. nov.** are removed from the Cristacoxidae and tentatively assigned to the Nannopodidae (*ex* Huntetanniidae), forming a clade with three other genera displaying coxal modifications on leg 1 (*Rosacletodes* Wells, 1985; *Huntemannia* Poppe, 1884; and an as yet undescribed genus from Brazil). Based on the sexual dimorphism of the P4 endopod, we propose to transfer *Metahuntemannia* Smirnov, 1946 and *Pottekia* Huys, 2009 from the Nannopodidae to the Canthocamptidae (subfamily Hemimesochrinae) where they are probably most closely related to *Psammocamptus* Mielke, 1975; *Bathycamptus* Huys & Thistle, 1989; *Perucamptus* Huys & Thistle, 1989; and *Isthmiocaris* George & Schminke, 2003. An identification key to the genera of the Nannopodidae is presented.

Key words: *Acuticoxa* **gen. nov.**, *Noodtorthopsyllus tageae* **sp. nov.**, *Cristacoxa*, *Cubanocleta*, *Noodtorthopsyllus*, *Laophontisochra*, Nannopodidae, caudal ramus development, phylogeny

Introduction

Huys (1990) established the harpacticoid family Cristacoxidae to accommodate three monotypic genera from primarily intertidal sandy habitats: *Noodtorthopsyllus* Lang, 1965, *Cubanocleta* Petkovski, 1977 and *Cristacoxa* Huys, 1990. The family was placed in the Laophontoidea T. Scott, 1905 on the basis of the presence of a posterior process on the second antennular segment, fusion of the antennary basis and proximal endopodal segment forming an allobasis, absence of an inner seta on P1 exp-2 and presence of only four elements on exp-3, 2-segmented P1 endopod with elongate enp-1 and only 2 elements on enp-2, at most 2-segmented condition of P2–P4 endopods, sexual dimorphism on P3 endopod (apophysis in male homologous to outer spine of female), and male sixth legs showing dimorphic asymmetry and bearing two elements each. According to Huys (1990) and Huys and Lee (1998/99) the Cristacoxidae shares a sistergroup relationship with the Laophontopsidae Huys & Willems, 1989 and the monophyly of the former is supported by an extensive suite of autapomorphies, including the extremely long and slender spermatophore with curled neck, presence of a posterior spinous process on the first antennular segment, absence of the antennary exopod and abexopodal seta, uniramous 2-segmented mandibular palp with asetose basis, presence of a modified basally fused spine on the proximal coxal endite of the maxilla, presence of outer cristae on the praecoxa and coxa of P1 and four geniculate setae on P1 exp-3, elongation of the apical exopodal spines of P2–P4, and pedomorphic origin of the fifth legs (*cf.* Huys 1990: 102–103), forming a common plate in both sexes.

The proposal of the genus *Laophontisochra* George, 2002 for the type species *L. maryamae* George, 2002 and a second unnamed species challenged the phylogenetic significance of the majority of Huys' (1990) cristacoxid autapomorphies, since this genus displayed distinctly more primitive character states (*e.g.* no spinous processes on antennule, antenna with vestigial exopod (and with abexopodal seta in *Laophontisochra* sp.), mandible with exopod and 2 setae on basis, biramous P5 in the type species) than any other cristacoxid (George 2002). In the absence of information on the male, George (2002) assigned *Laophontisochra* to the Cristacoxidae on the basis of limited supporting evidence, *i.e.* the presence of a crista on the coxa of P1, and a newly defined apomorphic state, the elongate maxillipeds. The former character state could, however, not be confirmed for *Laophontisochra* sp. and the evolutionary significance of morphometric characters at suprageneric level, such as maxillipedal size, has yet to be assessed in copepods. This is particularly the case