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Phylogenetic relationships among the genera of the Penaeidae (Crustacea: Decapoda) revealed by mitochondrial 16S rRNA gene sequences

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Abstract

The phylogenetic relationships within the family Penaeidae are examined based on mitochondrial 16S rRNA gene sequence analysis of 30 species from 20 genera. The analysis generally supports the three-tribe scheme proposed by Burkenroad (1983) but it is not consistent with the five-group classification of Kubo (1949). Three clades are resolved: (*Penaeus* sensu stricto + *Fenneropenaeus* + *Litopenaeus* + *Farfantepenaeus* + *Marsupenaeus* + *Melicertus* + *Funchalia* + *Heteropenaeus*), (*Metapenaeus* + *Parapenaeopsis* + *Xiphopenaeus* + *Rimapenaeus* + *Megokris* + *Trachysalambria*) and (*Metapenaeopsis* + *Penaeopsis* + *Parapenaeus*), corresponding to the Penaeini, Trachypenaeini and Parapenaeini respectively, while the affinities of *Atypopenaeus* and *Trachypenaeopsis* are obscure. The molecular data support that *Miyadiella* represents the juvenile stage of *Atypopenaeus*. Within the Trachypenaeini, *Trachypenaeus* sensu lato is clearly paraphyletic, while the monophyly of *Penaeus* sensu lato in the Penaeini is questionable.

Key words: mitochondrial DNA, phylogeny, Penaeidae, *Penaeus*, *Trachypenaeus*

Introduction

Penaeid shrimps (Crustacea, Decapoda, Penaeidae) are among the most economically important of all crustaceans (Holthuis 1980; Dall *et al.* 1990; Pérez Farfante & Kensley 1997; Chan 1998). They are also generally considered to be a primitive group of decapod crustaceans (Schram 1977; 1982; Dall *et al.* 1990; Abele 1991). While the family has a world-wide distribution, its highest diversity occurs in the Indo-West Pacific region. About 200 species are known to date and these have usually been grouped into 17 genera (see Dall *et al.* 1990). Nevertheless, in the most recent revision of the penaeid genera, Pérez Farfante & Kensley (1997) recognized 26 genera in the family Penaeidae Rafinesque-Schmaltz, 1815, mainly by splitting *Penaeus* Fabricius, 1798, and *Trachypenaeus* Alcock, 1901, into six and four genera respectively.

Although the taxonomy of penaeids has been widely studied, detailed discussions of the overall phylogenetic relationships between the genera are limited and only two comprehensive schemes have ever been proposed. Kubo (1949) separated the family (then as subfamily Penaeinae) into five groups without assigning formal names to these groups. No assessment of the relative relationships among groups was presented, except the suggestion that the monotypic group comprising *Miyadiella* Kubo, 1949, is basal (Fig. 1a). Dall *et al.* (1990) stated that Kubo (1949) treated the *Parapenaeus* Smith, 1885, group to have diverged a little before the others, but Kubo (1949: 179) stated explicitly that he considered the *Miyadiella* group to be the oldest. *Miyadiella* was established by Kubo (1949) and its taxonomic status has been controversial, with some

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