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Acrothoracican barnacles (Lithoglyptida) in Taiwan, including the taxonomic status of *Balanodytes taiwanus* Utinomi, 1950 and cryptic diversity of *Auritoglyptes bicornis* (Aurivillius, 1892)

BENNY K.K. CHAN^{1,3}, CHI CHIU CHEANG¹, I-HAN CHEN¹ & GREGORY A. KOLBASOV²

¹Biodiversity Research Center, Academia Sinica, Taipei 115, Taiwan

²Moscow State University, Biological Faculty, Department of Invertebrate Zoology, White Sea Biological Station, Moscow, Russia

³Corresponding author. E-mail: chankk@gate.sinica.edu.tw

Abstract

We list five acrothoracican barnacles of the order Lithoglyptida currently found in Taiwanese waters, including two new records, *Trypetesa habeii* Utinomi, 1962 and *Berndtia purpurea* Utinomi, 1950 and a new undescribed species of the genus *Lithoglyptes*. We also investigate the morphology and molecular genetics of *Balanodytes taiwanus* Utinomi, from its type locality, Taiwan. The original description of *B. taiwanus* in Utinomi (1950a) reported the absence of caudal appendages. Re-examination of the somatic body of one of the syntype specimens (the other syntype only having an opercular bar remaining) of *B. taiwanus* deposited in the Seto Marine Laboratory in Japan, revealed the presence of caudal appendages. The morphology of our specimens collected in various locations in Taiwan fits the description in Utinomi (1950a) and all have caudal appendages. The diagnosis of *Balanodytes* Utinomi, 1950 is revised herein. The genus *Armatoglyptes* Kolbasov & Newman, 2005 is a *nomen nudum* and a junior synonym of *Balanodytes*. Our results also show that the widespread species *Lithoglyptes habeii* Tomlinson, 1963 is a junior synonym of *B. taiwanensis*. The molecular sequence divergence of the 16S rDNA and COI genes were studied for samples of another monotypic genus *Auritoglyptes* (*A. bicornis*) from different regions of Taiwan. It was shown that there are at least three phylogenetic clades in Taiwan, suggesting that *Auritoglyptes* represents a cryptic species complex.

Key words: 16S rDNA, *Armatoglyptes*, *Auritoglyptes*, *Balanodytes*, *Cytochrome oxidase* subunit I, cryptic species, Taiwan

Introduction

The barnacles of the superorder Acrothoracica have no external mineral shells and bore into calcareous substrates, such as molluscan and thoracican shells, corals, bryozoans and calcareous rocks in the marine environment (Tomlinson 1969, 1987). During the voyage of H.M.S. *Beagle*, Darwin discovered his first barnacle, an acrothoracican later described as *Cryptophialus minutus* Darwin, 1854, within a gastropod shell from Chile (Tomlinson 1987). The morphology of this barnacle stimulated Darwin's interest to examine the diversity of the whole group of the Cirripedia, leading to almost a decade of study into cirripede taxonomy and evolution.

The taxonomy of the Acrothoracica has been thoroughly studied (Tomlinson 1969; Kolbasov & Newman 2005; Kolbasov 2009). Traditionally, the Acrothoracica were divided into two main orders, the Pygophora and the Apygophora (Tomlinson 1969). The Apygophora included a single family, the Trypetesidae Krüger, 1940. Apygophoran barnacles have uniramal terminal cirri and lack an anus. The pygophorans have biramal terminal cirri and an anus (Tomlinson 1969). The Pygophora was further divided into two families, Lithoglyptidae Aurivillius, 1892 and Cryptophialidae Gerstaecker, 1866-1879. In Kolbasov (2009), Kolbasov, Newman & Høeg revised the superorder Acrothoracica, rearranging the acrothoracican species into two new orders, the Lithoglyptida and the Cryptophialida. The Lithoglyptida comprise Lithoglyptidae and Trypetesidae, in which the females are characterized by having a wide aperture, a large saddle-like labrum and well-developed mouth cirri. Kolbasov & Newman (2005) reviewed the family Lithoglyptidae. The Lithoglyptidae consists of three subfamilies, the