



## Systematics and biogeography of Tropical Eastern Pacific *Chthamalus* with descriptions of two new species (Cirripedia, Thoracica)

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### Abstract

Distribution patterns of *Chthamalus* along the Tropical Eastern Pacific region have not yet been described, mostly due to unknown species ranges and the presence of cryptic species that has biased previous attempts to describe them. Prior to this paper, four formal and two informal species of *Chthamalus* have been recognized as occurring along the Pacific Americas coast: *C. dalli* Pilsbry; *C. fissus* Darwin; *C. anisopoma* Pilsbry; *C. panamensis* Pilsbry, *Chthamalus* sp. “cortezianus” and *Chthamalus* sp. “mexicanus”. The two informal species were already known to exist, based on previous studies using allozymes and gene sequencing, but their morphological characterizations were not determined, thus preventing their recognition and the ascertainment of their status under the International code of Zoological Nomenclature. The main goal of the present study was to discover the morphological differences that distinguish these two species, to determine their latitudinal range, to establish some relationship among the other species of *Chthamalus*, and to correlate these with the informal names previously used. Two new species of *Chthamalus* are described: *C. hedgecocki* **sp. nov.** occurring along the Mexican coast (Mexican province) and *Chthamalus southwardorum* **sp. nov.** occurring from the Gulf of California (Mexico) to the north of Peru, being a typical member of Panamanian *s. l.* Province. Both species belong to the *Chthamalus fissus* group of species as they have bidenticulate setae with basal guards on cirrus II and an absence of conical spines on the outer face of the exopod of cirrus I. The names *Chthamalus* sp. “cortezianus” is herein associated with *C. hedgecocki* and *Chthamalus* sp. “mexicanus” with *C. southwardorum*. An extensive sympatric distribution of *Chthamalus* species was noticed along the Eastern Pacific, and *Chthamalus panamensis*, previously known to be limited to the Panamanian coast, was found up to the Mexican coast in sympatry with *C. hedgecocki*. The COI genetic divergence between *C. panamensis* and *C. hedgecocki* varied between 2.8–4.3 using (GTR+G). We suggest that these species form a sibling pair based on to their morphological, ecological and genetic similarities and their evolution took place along the Eastern Pacific coast after the closure of the Isthmus of Panama. *Chthamalus southwardorum* is the best choice for a sibling pair with *C. proteus*, as they share morphological and ecological features; nevertheless they present a very high genetic divergence (24.3 to 25.1 GTR+G). Further studies are needed to clarify the evolutionary processes that led to the evolution of the *Chthamalus fissus* group of species along the Tropical Eastern Pacific coast and in the Caribbean.

**key words:** Systematics, biogeography, *Chthamalus*

### Introduction

The Tropical Eastern Pacific region (TEP) presents some challenging problems concerning historical events that influenced the development of the extant marine biota. The isolation from the Indo-Pacific region (Dar-