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## Transisthmian differentiation in the tree-climbing mangrove crab *Aratus* H. Milne Edwards, 1853 (Crustacea, Brachyura, Sesarmidae), with description of a new species from the tropical eastern Pacific

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### Abstract

The tree-climbing mangrove crab *Aratus pisonii* (H. Milne Edwards, 1837) (Brachyura, Sesarmidae) is considered to have a transisthmian distribution, due to its presence in mangroves of the Western Atlantic as well as the Eastern Pacific. We here present evidence, based on the morphologies of male gonopods and on genetic data, that populations from these two coastlines are morphologically and genetically distinct and require the description of a new species, *Aratus pacificus* n. sp., as the sister-species of *Aratus pisonii*. The corresponding speciation event can be regarded as the outcome of differentiation following the closure of the Isthmus of Panama. As these coastal brackish species were probably among the last ones to become separated, the speciation can thus be dated to a time frame of no more than 3.1 million years.

**Key words:** new species, gonopods, eastern Pacific region, Isthmus of Panama

### Introduction

Several publications over the last two decades have discussed the biological consequences of the tectonic closure of the Isthmus of Panama and stimulated further research on the relationships between populations or sister species affected by this important geological event (reviewed by Lessios 2008). From this work has emerged a better understanding of the possible speciation steps this phenomenon induced in marine species. Perhaps contrary to expectation, Knowlton & Weigt (1998) and Williams & Knowlton (2001) showed that probably most of the transisthmian sister species in the snapping shrimp genus *Alpheus* began to genetically diverge not at the final closure of the Isthmus around 2.8–3.1 Mya (see Coates & Obando 1996), but much earlier (up to 18 Mya), depending on the ecology of the corresponding species. Indeed, Lessios (2008) stated that approximately two thirds of the transisthmian sister species that have been studied separated previous to the final stages of the closure. He also remarked that several species were still considered to have a transisthmian distribution, i.e. being recognized as the same species on both sides of the Isthmus, despite the long separation time, and suggested that they might include cryptic species.

Among the species considered to have a transisthmian distribution is the tree-climbing mangrove crab *Aratus pisonii* (H. Milne Edwards, 1837) (Decapoda, Brachyura: Sesarmidae). This species is mostly restricted to mangroves, as it lives in close association with aerial roots and leaves of the red mangrove *Rhizophora mangle* and *R. racemosa* (see Woodroffe & Grindrod 1991, Duke & Allen 2006). Compared with other brachyuran crabs from the neotropics (Melo 1996), *A. pisonii* has a surprisingly wide distribution. It is reported to range in the tropical Western Atlantic from the southern tip of Florida, the southwestern Gulf of Mexico and the Caribbean to southern Brazil (São Paulo state), and in the tropical Eastern Pacific from central Baja California to northern Peru (Beever *et al.* 1979, Melo 1996).

*Aratus pisonii* has been considered to have a transisthmian distribution for almost two centuries, even if sister species of several fishes, molluscs, echinoderms, and many crustaceans on each sides of the Isthmus have been identified as distinct species since the end of the nineteenth century (see Lessios 2008: tables 1–4). However

support during the observations in scanning electron microscopy and Dirk Brandis for his thoughtful advices concerning gonopod observations. We acknowledge Peter Castro, Peter Davie (University of Queensland) and two anonymous reviewers for suggestions and improvements in the first version of the manuscript. Robert Lasley, Seabird McKeon, Adriana Rebolledo-Navarro, Ingo Wehrtmann, Danièle Guinot, Paula Rodríguez Moreno Martin-Lefèvre (MNHN, Direction des Collections - Crustacés) had independently suspected or recognized the likely novelty of the Pacific populations of *Aratus*, but kindly refrained from describing it and allowed instead fruitful discussions on the topic.

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