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Absence of consistent genetic differentiation among several morphs of *Actinia* (Actiniaria: Actiniidae) occurring in the Portuguese coast

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Abstract

Actinia equina, the beadlet sea anemone, is a very labile species, displaying variable colour patterns, broad habitat choice and diverse modes of reproduction. Historically, studies using genetic markers such as allozymes and differences in habitat choice lead several authors to propose that different colour morphs could represent different species. One of the species defined was *A. fragacea*. In this paper, the relationships between brown, red and green colour morphs of *A. equina* and *A. fragacea* were studied, using two DNA fragments (one mitochondrial and one nuclear). Individuals were sampled from three different areas in Portugal separated by a maximum distance of 500 km. This is the first study applying direct sequencing of selected gene fragments to approach the validity of *Actinia* morphs as different genetic entities. The results show that, at least in the Portuguese coast, these colour morphs do not correspond to the two valid species recognized in the literature. The existence of cryptic species is discussed.

Key words: *Actinia equina*, *Actinia fragacea*, Portugal, Cnidaria, morphotypes

Introduction

The beadlet sea anemone *Actinia equina* L. is a widespread species that lives in the rocky intertidal and subtidally to depths of up to 20m. This anemone is predominantly a scavenger, feeding unselectively on macrofaunal carrion (Davenport *et al.* 2011).

Historically, this species was considered to be distributed from North Russia and the Baltic Sea to tropical West African waters, including the archipelagos of Madeira, Azores and Canaries, South Africa, Mediterranean and Black sea, the Red Sea and Far East (Stephenson 1935; Manuel 1981; Cha *et al.* 2004). In its range, this species is considered very labile, showing variable colour patterns (individuals may display red, brown, orange, green and mottled column and tentacles), broad habitat choice, and diverse modes of reproduction (asexual and/or sexual). Their high level of morphological diversity, allied with its extensive distribution, lead different authors to propose that different morphs could represent different species (e.g., Carter & Thorpe 1981; Haylor *et al*. 1984; Monteiro *et al.* 1997; Schama *et al.* 2005).

The first morph of *A. equina* recognized as a species was *A. fragacea* Tugwell, which presents a red or dark red column and tentacles with green, yellow or blue spots in the column. According with previous authors (e.g. Haylor *et al.* 1984 and references therein), this species shows a different distribution and ecology from *A. equina*, lacking vivaparity and presenting only sexual reproduction. The identity of this species was corroborated by the use of allozymes, which showed that this morphotype was consistently different from *A. equina* in areas where they occurred in simpatry in the English Channel, suggesting reproductive isolation between them (Carter & Thorpe 1981).

Later, in a study investigating the ecological and genetic relationships between the red, brown and green morphs of *A. equina* in Britain (Isle of Man), the distinct character of the green morph was evaluated (Haylor *et al.* 1984). In this study, the green morph occupied different tidal levels and microhabitats when compared to brown and red morphs (which were indistinct one from each other). Again, allozymes showed that this morphotype was

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