



## Adaptative morphology for living in shallow water environments in spatangoid echinoids\*

MASAYA SAITOH<sup>1</sup> & KEN'ICHI KANAZAWA<sup>1,2</sup>

<sup>1</sup> Kanagawa University, Hiratsuka, Japan

<sup>2</sup> Corresponding author, E-mail: kanazawa@kanagawa-u.ac.jp

\*In: Kroh, A. & Reich, M. (Eds.) Echinoderm Research 2010: Proceedings of the Seventh European Conference on Echinoderms, Göttingen, Germany, 2–9 October 2010. *Zoosymposia*, 7, xii+316 pp.

### Abstract

Six spatangoid species living in an area about 1 km<sup>2</sup> at depths of 5–18 m were investigated in the Oki-Islands in the Japan Sea. The spatangoids capable of burrowing deeply principally adapt to unstable environment where the sediment surface is disturbed by storms. They are confined to the respective habitats depending on their functional morphology; apical tuft spines and fascioles for respiration, inflated plastron and stern-like postero-ventral shape for deep-burrowing. An exceptional spatangoid, *Lovenia elongata*, has specific morphologies for quick burrowing and rapid righting against disturbance of superficial sediment, which make it possible for it to live in fine- to coarse-grained sand at various water depths in spite of its burrowing just below the sediment surface.

**Key words:** Echinoidea, Spatangoida, morphology, distribution, burrowing depth

### Introduction

Spatangoid echinoids live in littoral to bathyal zones, burrowing to various depths in different types of sediments. They have a wide variety of test shapes with a complex arrangement of functionally and morphologically distinct spines, and their morphologies with respect to function, ontogeny, phylogeny, etc. have been studied in detail (e.g., Nichols 1959; Smith 1980; McNamara 1987; Kanazawa 1992; Nérauderau *et al.* 1998; Eble 2000; Villier *et al.* 2004; Smith & Stockley 2005; Saucède *et al.* 2006; Kroh & Smith 2010). In contrast to extensive morphological knowledge, little is known about ecological aspects of spatangoids, and only some species have been intensively studied: Moore (1936), Nichols (1959), Buchanan (1966), Beukema (1985), De Ridder & Jangoux (1987, 1993), Nakamura (2001), Nunes & Jangoux (2004, 2007) for *Echinocardium cordatum* (Pennant); Brattström (1946), Hollertz & Duchene (2001) for *Brissopsis lyrifera* (Forbes); Chesher (1963), Moore & López (1966) for *Moiria atropos* (Lamarck); Kier & Grant (1965), Chesher (1968) for *Meoma ventricosa* (Lamarck), Ferber & Lawrence (1976) for *Lovenia elongata* (Gray); Schinner (1993) for *Schizaster canaliferus* (Lamarck); Thompson & Riddle (2005) for *Abatus ingens* (Koehler). These studies have shown that each spatangoid species has a specific ecology in relation to the environment it is adapted to, such as substratum and water depth. However, a comprehensive ecological study on several spatangoids that live in a region where they are confined to their respective habitats has not been made so far. For such