

# **First record of the Harlequin crab *Lissocarcinus orbicularis*, an obligate symbiont of sea cucumbers, from the Red Sea.**

Robert Murray Lasley Jr<sup>1,2</sup>, Nathaniel Evans<sup>2,3</sup>, Gustav Paulay<sup>2</sup>, Daisuke Uyeno<sup>4</sup>, Susana Carvalho<sup>5</sup>

<sup>1</sup>University of Guam, Mangilao, Guam, USA. E-mail: rlasleyjr@gmail.com

<sup>2</sup>Division of Invertebrates, Florida Museum of Natural History, 1659 Museum Rd, Gainesville, FL 32611, USA.

<sup>3</sup>Tropical Biosphere Research Center, University of the Ryukyus, 1 Senbaru, Nishihara, Okinawa 903-0213, Japan

<sup>4</sup>Graduate School of Science and Engineering, Kagoshima University, 1-21-35 Korimoto, Kagoshima, 890-0065, Japan

<sup>5</sup>Red Sea Research Center, Division of Biological and Environmental Science and Engineering, King Abdullah University of Science and Technology (KAUST), Thuwal, Makkah, Kingdom of Saudi Arabia

## **Introduction**

The Harlequin crab, *Lissocarcinus orbicularis* Dana, 1852, is one of the most common echinoderm symbionts in the Indo West-Pacific (IWP). It is typically found as a single individual or heterosexual pair on sea cucumbers of the genera *Stichopus*, *Thelenota*, *Actinopyga*, *Bohadschia*, and *Holothuria*, where it feeds on host integument and detritus (Ng & Jeng 1999; Caulier *et al.* 2012, 2014). These crabs have a striking color pattern of white spots on a dark red-brown background, or dark spots on white, that often complements their hosts (Caulier *et al.* 2012).

*Lissocarcinus orbicularis* has been reported across the IWP from Africa to Hawaii and French Polynesia (Vannini & Innocenti 2000). It has been listed from the Red Sea but without reference to specific specimens or localities (Laurie, 1915; Shankarankutty & Thomas, 1963). The first record, and likely the second, can be attributed to Nobili (1906), which documented a specimen collected at the Banc de La Clocheterie reef, Obock, Djibouti (outside of the Red Sea). All other authors have excluded the Red Sea from the distribution of *L. orbicularis* (e.g., Guinot 1967, Vannini & Innocenti 2000, DiBattista *et al.* 2016). Here we provide the first record of *L. orbicularis* from the Red Sea.

## **Results and Discussion**

*Lissocarcinus* currently includes nine species, all putatively symbiotic, primarily on echinoderms, cerianthids, sea anemones, and possibly salps and some corals (Caulier *et al.* 2012; Evans 2016, 2018, Stephenson, 1972). *Lissocarcinus orbicularis*, *Lissocarcinus holothuricola* (Streets, 1876), and *Lissocarcinus ornatus* Chopra, 1931 are all symbionts of sea cucumbers and exhibit similar colorations (Fig. 1), but they are easily distinguished by differences in their frontal margin, epibranchial ridge, and fifth pereopod (Stephenson, 1972).

During an expedition to Saudi Arabia, an ovigerous female (BNOM-1763) was collected from Majjde Reef, Red Sea, near the mouth of the Gulf of Aqaba. Together with three specimens at the Florida Museum (UF) from the Gulf of Aqaba (UF 47297) and Wasaliyat Islands (UF 48601, UF 48625), we report this species across much of the extent of the Red Sea. Recent expeditions to Oman and Djibouti resulted in additional specimens from the region (see <http://specifyportal.flmnh.ufl.edu/iz/>).

## **Acknowledgments**

This research was supported by NEOM (grant 5209 - Biodiversity Baseline Assessment and Monitoring), the National Science Foundation (GECCO 1457769, DEB 1856245), and a Japan Society for the Promotion of Science (JSPS) post-doctoral fellowship (P22078).

## References

- Caulier, G., Parmentier, E., Lepoint, G., Van Nederveelde, F., & Eeckhaut, I. (2012). Characterization of a population of the Harlequin crab, *Lissocarcinus orbicularis* Dana, 1852, an obligate symbiont of holothuroids, in Toliara bay (Madagascar). *Zoosymposia*, 7, 177-184.
- Caulier, G., Lepoint, G., Van Nederveelde, F., & Eeckhaut, I. (2014). The diet of the Harlequin crab *Lissocarcinus orbicularis*, an obligate symbiont of sea cucumbers (holothuroids) belonging to the genera Thelenota, Bohadschia and Holothuria. *Symbiosis*, 62, 91-99.
- Dana, J. D. (1852). Conspectus crustaceorum, &c. Conspectus of the Crustacea of the Exploring Expedition under Capt. Wilkes, U.S.N., including the Crustacea Cancroidea Corystoidea. *Proceedings of the Academy of Natural Science of Philadelphia*. 6: 73-86.
- Evans, N.M. (2016). The systematics of Portunoidea Rafinesque, 1815, and the evolution of symbiotic swimming crabs. Ph.D. Thesis, University of Florida, 195p.
- Evans, N. (2018). Molecular phylogenetics of swimming crabs (Portunoidea Rafinesque, 1815) supports a revised family-level classification and suggests a single derived origin of symbiotic taxa. *PeerJ*, 6, e4260.
- DiBattista, J. D., Roberts, M. B., Bouwmeester, J., Bowen, B. W., Coker, D. J., Lozano-Cortés, D. F., ... & Berumen, M. L. (2016). A review of contemporary patterns of endemism for shallow water reef fauna in the Red Sea. *Journal of Biogeography*, 43(3), 423-439.
- Guinot, D. (1967). La faune carcinologique (Crustacea Brachyura) de l'Océan Indien occidental et de la Mer Rouge. Catalogue, remarques biogéographiques et bibliographie. In *CSA Specialist Meeting on Crustaceans*. Zanzibar, 19-26 IV 1964.
- Laurie, R.D. (1915). Reports on the marine biology of the Sudanese Red Sea.-XXI. On the Brachyura. *Journal of the Linnean Society of London. Zoology* 31(209): 407-475.
- Ng, P. K., & Jeng, M. S. (1999). The brachyuran crabs (Crustacea: Decapoda: Eumedonidae and Portunidae) symbiotic with echinoderms in Taiwan. *ZOOLOGICAL STUDIES-TAIPEI*-, 38(3), 268-274.
- Nobili, G. (1906). Faune carcinologique de la Mer Rouge. Décapodes et Stomatopodes. *Ann. Sci. Nat. (Zool.)*, Sér., 9, 4 (1906), pp. 1-347, pls. 1-11.
- Sankarankutty, C., & Thomas, P. T. (1963). Some abnormalities in *Lissocarcinus orbicularis* Dana (Crustacea-Portunidae) from Minicoy. *Journal of the Marine Biological Association of India*, 5(1), 144-145.
- Stephenson, W. (1972) An annotated check list and key to the Indo-West-Pacific swimming crabs (Crustacea: Decapoda: Portunidae). *Bulletin of the Royal Society of New Zealand*, 10: 1-64.
- Vannini, M., & Innocenti, G. (2000). Research on the coast of Somalia. Portunidae (crustacea brachyura). *Tropical Zoology*, 13(2), 251-298.