

## An Association between *Hesione picta* (Polychaeta: Hesionidae) and *Ophionereis reticulata* (Ophiuroidea: Ophionereididae) from the Brazilian Coast

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**José Eriberto De Assis, Emerson de Azevedo Silva Bezerra, Rafael Justino de Brito, Anne Isabelley Gondim, and Martin Lindsey Christoffersen (2012)** An association between *Hesione picta* (Polychaeta: Hesionidae) and *Ophionereis reticulata* (Ophiuroidea: Ophionereididae) from the Brazilian coast. *Zoological Studies* 51(6): 762-767. This paper is the 1st report on the association between *Hesione picta* and *Ophionereis reticulata*, based on specimens found in the southwestern Atlantic, State of Paraíba, Brazil. The associated partners were found under rocks during low tide. We studied 30 specimens of *O. reticulata*, which harbored 30 hesionids. Observations of animals in aquaria showed that the polychaete responded to the presence of the ophiuroid, slowly crawling until it touched the latter. After recognizing its partner, the polychaete remained in its habitual position on the aboral surface of the ophiuroid, as also observed in the natural environment. On the other hand, when the hesionid was placed with other ophiuroid species which coexist at the same locality, the animals withdrew from each other. <http://zoolstud.sinica.edu.tw/Journals/51.6/762.pdf>

**Key words:** Hesionid, Ophionereidid, Intertidal fauna.

Both the ecology and ecological roles of polychaete associations have recently received increasing attention (Britayev 1989, Britayev et al. 2003, Britayev and Zamishliak 1996, Clark 1956, Glasby and Watson 2001, Hendler and Meyer 1982, López et al. 2001, Martin et al. 1991, Martin et al. 2009, Martin and Britayev 1998, Martin et al. 2008, Paris 1955, Petersen and Britayev 1997). The roles of echinoderms as hosts in associations were reviewed for the northeastern Atlantic by (Barel and Kramers 1977), who included a checklist of the associated polychaetes. This list was updated for brittle stars by (Alvà and Jangoux 1989), and more recently completed for polychaetes by (Martin and Britayev 1998).

Reported polychaetes associated with

ophiuroids and starfishes were found on the disc, arms, and even the oral cavity of the hosts (Hendler and Meyer 1982). The frequency with which polychaetes are found varies within species. *In situ* observations by (Britayev et al. 1989) indicated that the scale-worm *Arctonoe vittata* was more frequently found on the disc of the starfish *Asterias rathbunae*. On the other hand, the syllid *Branchiosyllis exilis* was more frequently found on the arms of its host, *Ophiocoma echinata* (Hendler and Meyer 1982).

In Brazil, the only association between polychaetes and brittle stars reported to date was the scale-worm *Malgremniella variegata* (Treadwell, 1917) with *Ophionereis (Ois.) reticulata* (Say, 1825) from the coast of the State of Bahia (Santa-Isabel

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et al. 1996). The present study reports for the 1st time an association between this brittle star and the hesionid *Hesion*e *picta* (Müller, 1858). We hypothesized that *H. picta* is a facultative associate of *Ois. reticulata*.

## MATERIALS AND METHODS

Polychaetes and ophiuroids were collected in the intertidal zone of Ponta do Cabo Branco, João Pessoa, Paraíba, Brazil (7°8'42"S, 34°48'14"W) (Fig. 1), during field trips (in 2005-2010) to catalog the invertebrate fauna of the South Atlantic. Sampling was done during low tide, using only our hands to search under rocks. Rocks were carefully overturned until the presence of an echinoderm was ascertained. We then searched for the polychaete, to see if it was found together with its partner. Each collected pair was transported to the lab in tagged plastic bags with seawater and algae, in an attempt to reduce stress among members of the pair as much as possible. In the lab, each pair was placed into a small aquarium (54 × 28 × 28 cm), aerated with an air pump and with natural seawater for further observations. Specimens were also observed and photographed under a Zeiss stereomicroscope (model no. 475200/9901, Oberkochen, Germany). Chaetae were observed and photographed with an Olympus BX41 compound microscope (Tokyo, Japan). The behavior of the target host was compared to that of other ophiuroid species found in the same locality: *Ophiothrix* (*Ophiothrix*) *angulata* (Say, 1825), *Ophioderma* (*Oma.*) *appressum* (Say, 1825), and *Oma. cinereum* Müller & Troschel,



Fig. 1. South of Cabo Branco beach during low tide.

1842. The 2 partners were photographed in order to describe their color *in vivo*. They were then anesthetized with 7.5% magnesium chloride, fixed in 10% formalin, and preserved in 70% alcohol. The material was deposited in the Coleção de Invertebrados Paulo Young, Departamento de Sistemática e Ecologia, Centro de Ciências Exatas e da Natureza, Univ. Federal da Paraíba under the following catalogue numbers: UFPB/ECH-POLY 313, 314, 515, 882, 1257, 1348, 1367-1371, 1433, 1466, 1469, 1470, 1483-1487, and 1507-1516.

## RESULTS

### Description of the association

The associated partners were found under rocks (Fig. 1). We collected 30 specimens of *Hesion*e *picta* which were hosted by 30 specimens of *Ois. reticulata*. All *H. picta* found were in an association, but not all *Ois. reticulata* harbored hesionids. The present association had a prevalence of 100% due to the fact that we were only trying to find *H. picta*, which were consequently only found in an association, as stated before. The intensity, in all cases, was 1: 1. Although the studied area contains many other polychaete species, grouped in several families of sedentary or errant polychaetes, none of them was found to be associated to *Ois. reticulata*, except *H. picta*.

In the field, *H. picta* was most often found on the aboral surface of the ophiuroid disc, where it would remain more or less static during long periods (Fig. 2A, B). The polychaete was sometimes found between 2 arms of its host and also twisted around one of the arms.

*Hesion*e *picta* did not react positively to the presence of the ophiuroid *Ophiothrix* (*Ophiothrix*) *angulata*, which coexists in the same locality, when individuals of both species were placed together in experimental aquaria. On the contrary, the polychaete went in the opposite direction of the ophiuroid. In the case of 2 others brittle star species (also present in the study area), *Oma. appressum* and *Oma. cinereum*, the reaction of *H. picta* was not as repulsive, but nevertheless it slowly withdrew in each case, in a few seconds, maximizing its distance from both species of ophiuroids.

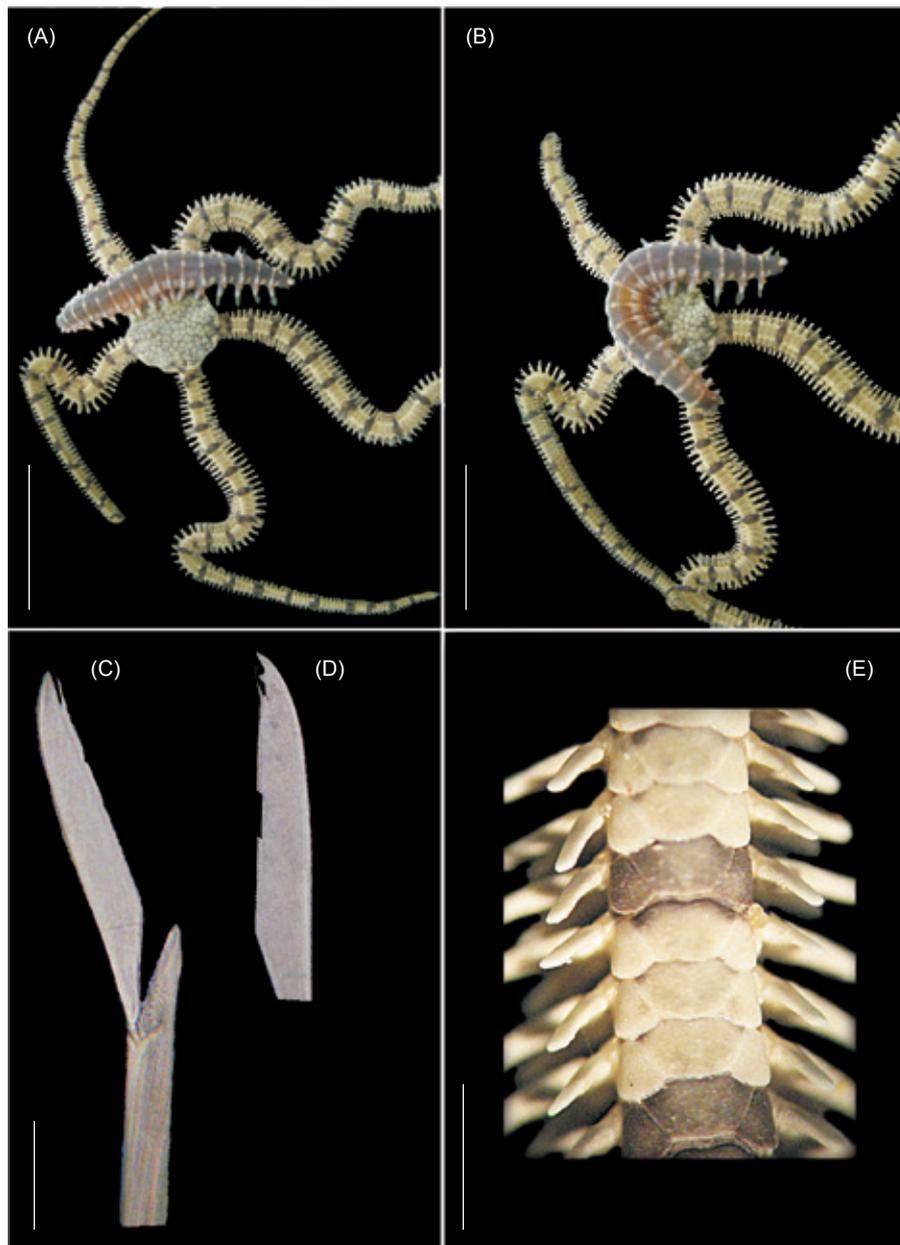
When placed at opposite sides of experimental aquaria, *H. picta* tried to find *Ois. reticulata*, by exploring the entire aquarium. When each

polychaete specimen found its associate, they subsequently remained close to each other (Figs. 2A, B). The 2 partners could be separated without major difficulties, but they quickly reacted by becoming associated again.

Pairs of *H. picta* and *Ois. reticulata* were non-specific at the individual level. Individuals separated from their original associate were able to form a new pair when placed in contact with a different partner.

## DISCUSSION

Many polychaete species, including polynoids, syllids, and hesionids (Martin and Britayev 1998), live in association with echinoderms (e.g., starfishes, sea urchins, and brittle stars) (Martin and Britayev 1998). They prefer the more protected oral surface of the hosts, a location where access to the food is easier, sometimes inhabiting the arms of the host as parasites and



**Fig. 2.** (A, B) *Hesionone picta* in different positions on the dorsal surface of *Ophionereis reticulata*; (C) falgicer chaetae of chaetiger 2 of *H. picta*; (D) same structure enlarged, showing serrations along the lamina; (E) fragment of arm of *O. reticulata*, showing spines which support the polychaete. Scale bars: A, B = 25 mm; C, D = 0.5 mm; E = 2.0 mm.

inside the ambulacral grooves (Martin and Alvà 1988, Martin and Britayev 1998), and were even be found in the gut (Schiaparelli et al. 2011).

The association reported herein is similar to other previously described relationships involving polychaetes and ophiuroids, except *Malmgreniella variegata*, which was found at the oral surface of the disc (Santa-Isabel et al. 1996). In other associations, such as between the syllid *Branchiosyllis exilis* and *Ophiocoma echinata*, the polychaete was found on the ventral surface of the ophiuroid (Hendler and Meyer 1982).

Many papers recorded the 2 species in other regions of the world, in particular in the Gulf of Mexico and Caribbean Sea (Hartman 1951, Clark 1953, Millott 1953, Thomas 1973, Fauchald 1977, Hendler and Meyer 1982). However, we believe that this association possibly only occurred in our populations.

### Types of relationships

Relationships may be monoxenous associations (where organisms are associated with 1, 2, or even 3 closely related hosts), and polyxenous (i.e., involving hosts from very different taxonomic groups) (Martin and Britayev 1998). The latter seems to be less common among polychaetes.

However, it can occur in polynoids and hesionids (e.g., *Ophyodromus flexuosus*) (Martin and Britayev 1998). For the association reported here, *H. picta* was exclusively found in association with *Ois. reticulata*, so that the association was defined as being monoxenous, according to Martin and Britayev (1998). In turn, *Ois. reticulata* was also reported as a host of another polychaete, the scale-worm *Mal. variegata* (Millott 1953, Pettibone 1993).

### Adaptations for association

Polychaetes may show different types of adaptations for an associated mode of life: life cycle, reproductive, behavioral, cryptic coloring, food supply, and specialized chaetae. This latter case was reported as being more common in parasitic polychaetes (López et al. 2001, Martin and Britayev 1998). Among the various adaptations listed above, we report in this paper behavioral host recognition and cryptic coloring.

*Ophionereis reticulata* possesses arms with transverse dark bands which can provide *H. picta* with some degree of camouflage. This camouflage is more evident especially when they are in their natural habitat under rocks (Fig. 3).

The partner recognition behavior we found



Fig. 3. A *Hesion picta* and *Ophionereis reticulata* pair photographed *in situ*.

resembles the association described by (Millott 1953) and (Santa-Isabel et al. 1996). Active searching by the polychaete was also shown in studies by (Hickok and Davenport 1957). They experimentally demonstrated that there are some physiological stimuli for the polychaete *Podarke pugettensis* Johnson, 1901, also a hesionid, to search for its associate, *Luidia foliolata* (Grube, 1866). Although behavioral similarities to other previously studied polychaetes were observed, we conducted no analytical examination of the association presently reported. It is clear; however, that in our study, the polychaete always tried to remain close to its partner.

### Dependence of the commensal on its host

Within hesionids, only 3 species are known to become obligatorily associated with their host, *Gyptis ophiocomae* Storch & Niggemann, 1967, *Ophiodromus angustifrons* (Grube, 1878), and *Parasyllidea humesi* Pettibone, 1961, while others present a form of facultative association (Martin and Britayev 1998). All *H. picta* collected manually in the studied area were found associated with *O. reticulata*. However, in other previous work, this species of polychaete was reported not to be associated with any other taxa (Martin and Britayev 1998).

*Ophionereis reticulata* was characterized as an omnivorous species, consuming sediments, green and red algae, and polychaetes (Yokoyama and Amaral 2008). The polychaete *H. picta* was also characterized as an omnivorous species (Fauchald and Jumars 1979), feeding on small invertebrates, detritus, and bacteria (Westheide 1967, Pearson 1971, Rasmussen 1973, Wolff 1973). This represents indirect evidence suggesting that *H. picta* might feed on the material eaten by *Ois. reticulata*, or on the waste material released by the ophiuroid.

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### REFERENCES

- Alvå V, M Jangoux. 1989. Sur les symbioses entre polychètes et ophiures avec la description d'un nouveau cas de commensalisme. Actes du VIe Séminaire International sur les Echinodermes, Paris.
- Barel CDN, PGN Kramers. 1977. A survey of the echinoderm associates of the North-East Atlantic area. Zoologische verhandelingen **156**: 1-159.
- Britayev TA. 1989. The symbiotic polychaetes: morphology, ecology and distribution. In: V. A. Sveshnikov (ed.) Symbiosis among marine animals, pp. 60-74.
- Britayev TA, EM Krylova, D Martin, R Von Cosel, TS Aksiuk. 2003. Symbiont - host interaction in the association of the scaleworm *Branchiopolynoe* aff. *seepensis* (Polychaeta: Polynoidae) with the hydrothermal mussel, *Bathymodiolus* spp. (Bivalvia: Mytilidae). InterRidge News **12**: 13-16.
- Britayev TA, AV Smurov, AV Adrianov, AG Bazhin, AV Rhzavsky. 1989. Ecology of symbiotic polychaete *Arctonoe vittata* according to the peculiarity of starfish *Asterias ratbunae* ecology. In: V. A. Sveshnikov (ed.) Symbiosis among marine animals, pp. 102-127, Moscow.
- Britayev TA, EA Zamishliak. 1996. Association of the commensal scale-worm *Gastrolepidia clavigera* (Polychaeta: Polynoidae) with holothurians near the coast of South Vietnam. Ophelia **45**: 175-190.
- Clark RB. 1956. *Capitella capitata* as a commensal, with a bibliography of parasitism and commensalism in the polychaetes. Ann. Mag. Nat. Hist. **9**: 433-448.
- Fauchald K. 1977. Polychaetes from Intertidal Areas in Panama, with a Review of Previous Shallow-Water Records. Smith. Contr. Zool. Wash. **221**: 1-81pp.
- Fauchald K, PA Jumars. 1979. The diet of Worms: a study of polychaete feeding guilds. Oceanogr. Mar. Biol. Ann. Rev. **17**: 193-284.
- Glasby CJ, C Watson. 2001. A new genus and species of Syllidae (Annelida: Polychaeta) commensal with octocorals. The Beagle **17**: 43-51.
- Hartman O. 1951. The Littoral Marine Annelids of the Gulf of Mexico. All. Hanc. Found. Calif. **75**: 7-124.
- Hendler G, DL Meyer. 1982. An association of a polychaete, *Branchiosyllis exilis* with an ophiuroid, *Ophiocoma echinata*, in Panama. Bull. Mar. Sci. **32**: 736-744.
- Hickok JF, D Davenport. 1957. Further studies in the behavior of commensal polychaetes. Biol. Bull. **113**: 397-406.
- López E, TA Britayev, D Martin, G San Martín. 2001. New symbiotic associations involving Syllidae (Annelida: Polychaeta), with taxonomic and biological remarks on *Pionosyllis magnifica* and *Syllis* cf. *armillaris*. J. Mar. Biol. Association of the UK **81**: 399-409.
- Martin D, P Abelló, J Cartes. 1991. A new species of *Ophryotrocha* (Polychaeta: Dorvilleidae) commensal in *Geryon longipes* (Crustacea: Brachyura) from the Western Mediterranean Sea. J. Nat. Hist. **25**: 279-292.
- Martin D, MT Aguado, TA Britayev. 2009. Review of the symbiotic genus *Haplosyllides* (Polychaeta: Syllidae), with a description of a new species. Zool. Sci. **26**: 646-655.
- Martin D, V Alvå. 1988. *Sphaerodorum ophiurophoretos* n. sp., une nouvelle espèce de Sphaerodoridae (Annelida, Polychaeta) commensal sur *Amphipholis squamata* (Echinodermata, Ophiuridae). Bull. Inst. Roy. Sc. N. de Belg. **58**: 45-49.
- Martin D, T Britayev. 1998. Symbiotic polychaetes: review of known species. Oceanogr. Mar. Biol. **36**: 217-340.

- Martin D, I Marin, TA Britayev. 2008. Features of the first known association between Syllidae (Annelida, Polychaeta) and crustaceans. *Org. Divers. Evol.* **8**: 279-281.
- Millott N. 1953. A remarkable association between *Ophionereis reticulata* (Say) and *Harmothoe lunulata* (Delle Chiaje). *Bull. Mar. Sci.* **3**: 96-99.
- Paris J. 1955. Commensalisme et parasitisme chez les Annelids Polychaètes. *Vie et Milieu* **6**: 525-536.
- Pearson TH. 1971. Studies on the ecology of the macrobenthic fauna of Lochs Linnhe and Eil, west coast of Scotland 11. Analysis of the macrobenthic fauna by comparison of feeding group. *Vie et Milieu, Supplement 22*: 53-91.
- Petersen ME, TA Britayev. 1997. A new genus and species of polynoid scaleworm commensal with *Chaetopterus appendiculatus* Grube from the Banda Sea (Annelida: Polychaeta), with a review of commensals of Chaetopteridae. *Bull. Mar. Sci.* **60**: 261-276.
- Pettibone MH. 1993. Scaled polychaetes (Polynoidae) associated with ophiuroids and other invertebrates and review of species referred to *Malmgrenia* McIntosh and replaced by *Malmgreniella* Hartman, with descriptions of new taxa. *Smiths. Contrib. Zool.* **538**: 1-92.
- Rasmussen E. 1973. Systematics and ecology of the Isefjord marine fauna (Denmark). *Ophelia* **11**: 1-507.
- Santa-Isabel LM, WRP Cerqueira, OFS Alves. 1996. Associação entre *Ophionereis reticulata* (Say, 1825) (Ophiuroidea, Ophiunereididae) e *Malmgreniella variegata* (Treadwell) (Polychaeta, Polynoidae) das praias de Salvador, Bahia, Brasil. *Rev. Bras. de Zool.* **13**: 137-142.
- Schiaparelli S, MC Alvaro, R Barnich. 2011. Polynoid polychaetes living in the gut of irregular sea urchins: a first case of inquilinism in the Southern Ocean. *Antarct. Sci.* **23**: 144-151.
- Thomas LP. 1973. Western Atlantic brittlestars of the genus *Ophionereis*. *Bull. Mar. Sci.* **23**: 585-599.
- Westheide W. 1967. Monographie der Gattungen Hesionides Friedrich und Microphthalmus Meznikow (Polychaeta, Hesionidae). *Z. Morph. Okol. Tiere.* **61**: 1-159.
- Wolff WJ. 1973. The estuary as a habitat. An analysis of data on the soft-bottom macrofauna of the estuarine area of the Rivers Rhine, Meuse and Scheldt. *Zoologischer verh.* **726**: 1-242.
- Yokoyama LQ, ACZ Amaral. 2008. The diet of *Ophionereis reticulata* (Echinodermata: Ophiuroidea) in southern Brazil. *Rev. Bras. Zool.* **25**: 576-578.