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First record of *Pseudomyicola spinosus* in *Argopecten ventricosus* in Baja California, Mexico

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Abstract

This is the first record of the copepod *Pseudomyicola spinosus* in the scallop *Argopecten ventricosus* in northwestern Mexico, and describes: (1) the known annual prevalence and intensity of this copepod on scallops from culture sites (Gulf of California) and natural populations (Pacific coast), (2) the histopathological effects caused on the soft tissues of scallops, and (3) the relationship between prevalence and intensity records and environmental parameters. The copepod was present throughout the period of investigation, showing similar prevalence and ratio of copepod to scallop patterns in both cultured scallops and wild specimens from natural habitats. Highest prevalence and ratio values were detected in summer–autumn at both sites, probably because scallops showed a weak condition from the combined effects of spawning, reabsorption of residual gametes, and high temperature. The condition index of *A. ventricosus* showed a significant correlation with the presence of the copepod in Magdalena Bay (−0.67). *P. spinosus* was observed in the gills of scallops, producing alterations or rupture of filaments, and in the stomach, causing detachment and loss of the epithelium. No relationship between copepod infestation with temperature, salinity, chlorophyll, and seston were found during the investigation. Although *P. spinosus* was present year-round at both sites, no association between infestation and scallop mortalities was detected.

Keywords: *Pseudomyicola spinosus*; *Argopecten ventricosus*; Parasitic copepod; Infestation; Histopathology; Scallop

1. Introduction

Pseudomyicola spinosus (Raffaele and Monticelli, 1885) is a parasitic copepod that is distributed in the Atlantic, Pacific, and western Indian Oceans. It is found in the mantle cavities of more than 50 species of bivalves around the world. In Mexico, it has been reported in coastal Baja California affecting mussel populations (Cáceres-Martínez et al., 1996). Cáceres-Martínez and Váquez-Yeomans (1997) described histopathological effects of *P. spinosus* in the mantle and gills of *Mytilus galloprovincialis* and *Mytilus californianus*. Recently, this copepod has been observed in the catarina scallop *Argopecten ventricosus* (Sowerby, 1842) in Baja California Sur, Mexico, but there are no reports available on this subject.

The scallop is distributed from upper California in the north to Peru in the south, and is of great economic importance in northwestern Mexico (Chávez-Villalba and Cáceres-Martínez, 1992). However, some aspects of the natural history of this species, including its parasites, are poorly documented. Available information on this subject concerns studies of taxonomy of nematodes that form cysts in the scallop muscle (Gómez del Prado, 1984); description of members of the family Phyllobothriidae (order Trypanorhyncha) found in the digestive gland and gonad (Gómez del Prado et al., 1992); description of the commensal *Tumidotheres*

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margarita (Félix-Pico, 1992); and reports of abundance of fouling species on the shell (Félix-Pico and García-Domínguez, 1993). Studies of other metazoan parasites have not been done even though several copepods were reported to cause tissue disorders and unusual mortalities in scallops and other bivalve mollusks (Munford et al., 1981).

We document the first record of *P. spinosus* in the scallop *A. ventricosus* from culture sites and natural populations in northwestern Mexico, taking into consideration: (1) documenting the seasonal prevalence and intensity of this copepod on scallops from two localities along the Baja California Peninsula, natural beds on the Pacific coast and culture ponds on the Gulf of California coast, (2) description of histopathological effects caused by this parasite on soft tissues of scallops, and (3) studying relationships between prevalence and intensity records with environmental parameters.

2. Materials and methods

This study was conducted in two localities; in Bahía de La Paz using adult cultured scallops (height range; 50.3–62.7 mm) and in Bahía Magdalena using adult scallops (height 56.7–72.0 mm) from natural beds (Fig. 1). Samples were taken every six weeks for one year. On every occasion, 60 adult scallops were collected from each site; 50 to estimate a condition index and for macroscopic analyses, and the other 10 for histopathological evaluation.

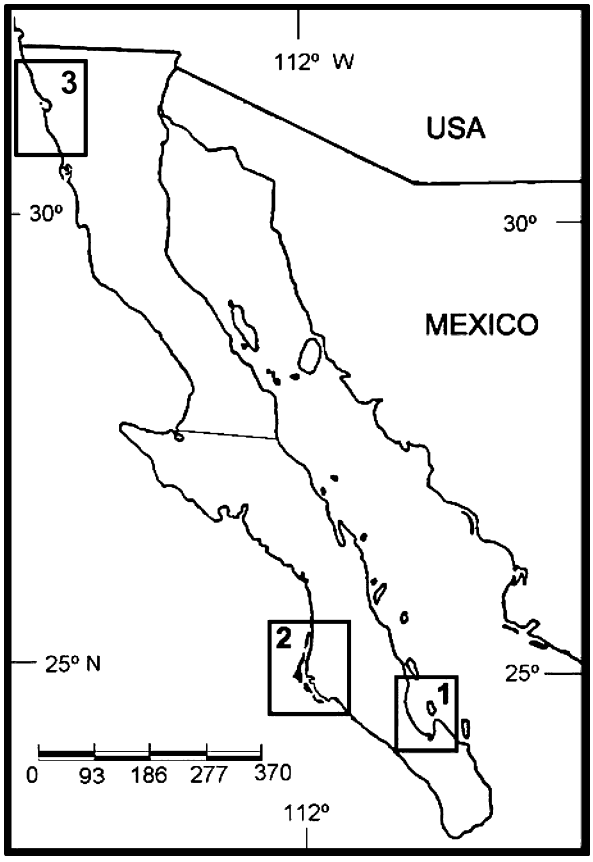

Fig. 1. Bahía de La Paz (1), Bahía Magdalena (2), and Bahía de Todos Santos (Ensenada, 3), a bay where *P. spinosus* was reported in previous studies (source: Cáceres-Martínez et al., 1996; Cáceres-Martínez et al, 1999).

2.1. Macroscopic and histopathological analyses

For macroscopic analysis, scallops were cleaned of fouling material and placed in Petri dishes; specimens were then opened and the inter-valve water was recovered in the same Petri dish. Both inter-valve water and soft tissues were examined under a dissecting microscope for the presence of copepods. Copepods were recovered and fixed in 70% ethanol and their number recorded to calculate, at each sampling time, their prevalence and the ratio of copepods to scallop (Margolis et al., 1982). The condition index (CI) was calculated according to Villalejo-Fuerte and Ceballos-Vázquez (1996) following the formula: CI = (soft tissues wet weight/total wet weight) × 100.

For histopathological evaluations, scallops were fixed in a formaldehyde solution (10%) for 24 h. An anterior transverse section was taken in such a way that mantle, muscle, gonad, digestive gland, gills, kidney, and foot were included in the body section. Samples were dehydrated through an increasing ethanol concentration series and processed by routine in paraffin histology. Deparaffinized sections (5 μm thick) were stained with hematoxylin and eosin, and examined by light microscopy (Bancroft et al., 1990). Images were captured with a Panasonic GP-KR222 camera and were observed (digitalization Win/TV, Hauppage Computer Works) using the software Sigma Scan (Handel).

2.2. Environmental parameters

At every sampling, 12 L of raw seawater was collected at 20 cm above the sandy bottom from the study areas in clean plastic containers and transported to the laboratory. The water was screened through a 180 μm Nitex mesh to eliminate large zooplankton and debris, then filtered through six washed and precombusted 4.7 cm diameter Whatman GF/C filters under gentle vacuum. Three filters were dried in an oven at 80 °C for 24 h for seston determination. These filters were weighed and combusted at 475 °C for 4 h. Filters were reweighed after cooling in a dessicator. Weight of particulate organic matter (organic seston) was obtained by difference in the two weights. The three remaining filters were used for chlorophyll *a* determinations. Each filter was ground in 10 ml acetone (90%) for pigment extraction (Strickland and Parsons, 1972). Temperature,