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FIRST REPORT OF POLYCHAETES FROM THE GENUS *ORIOPSIS* (POLYCHAETA: SABELLIDAE) ASSOCIATED WITH THE JAPANESE ABALONE *HALIOTIS DISCUS HANNAI* AND OTHER NATIVE MOLLUSCS IN CHILE

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ABSTRACT The external morphology of sabellids polychaetes gathered from green abalone (*H. discus hannai*) and 2 species of Chilean native gastropods (*Fissurella* sp. and *Concholepas concholepas*) was studied. According to the taxonomic keys of Fauchald (1977) and Rozbaczylo (1980), all of these polychaetes belong to the family Sabellidae; subfamily Fabriciinae, and genus *Oriopsis* (according to Day 1967 and Fitzhugh 1989). This work constitutes the first report of the presence of sabellids of the genus *Oriopsis* forming tubes in the shell of the green abalone *Haliotis discus hannai*. The worms analyzed correspond to small sized sabellids (1–2 mm long). The body is fusiform, not sacciform like *T. heterouncinata*. The gill crown is constituted of three pairs of radiolae, unlike *T. heterouncinata* counting with 2 pairs of radiolae. Another important difference with this sabellid previously reported habiting abalone shells is the shape of the abdominal uncini, in *Oriopsis* are rasp-shaped plates, without main fang, defining a clear difference with the abdominal uncini acicular with a single main tooth crowned with shorter series of teeth, characteristic of *T. heterouncinata*.

KEY WORDS: abalone, boring polychaetes, eplbionts, *Oriopsis*, *Concholepas*, sabellid, shell damage

INTRODUCTION

Boring polychaetes frequently infest the shells of aquacultured mollusc species. These polychaetes can cause severe damage to the mollusc shells, affecting the fitness of their hosts (Blake & Evans 1973, Handley & Berquist 1997, Cáceres-Martínez et al. 1998, Martin & Britayev 1998, Read 2004, McDiarmid et al. 2004) and often causing financial loss to aquaculturists. At least three families of boring polychaetes have been reported in the literature: Spionidae, Sabellidae, and Cirratulidae. In particular, boring polychaetes of the spionid genera such as Boccardia, Dipolydora, Polydora, and the sabellid *Terebrasabella heterouncinata* Fitzhugh and Rouse cause serious economic problems for the aquaculture industry at a global level (see Evans 1969, Kuris & Culver 1999, Lleonart et al. 2003a, 2003b, Cárdenas & Cañete 2004, Read 2004, Radashevsky & Olivares 2005).

The infestation in abalone shells caused by the sabellid *Terebrasabella heterouncinata* Fitzhugh & Rouse 1999 is a common problem for the abalone farmers. Until now, this was the only sabellid species recognized as the causative of serious shell damage caused by burrow formation. *Terebrasabella heterouncinata* was endemic to South Africa, infesting several sub and intertidal gastropods and became a pest on cultured abalones in South Africa and California in the early 1990s (Culver et al. 1997, Fitzhugh & Rouse 1999).

Moreno et al. (2006) published a complete list of boring polychaete species present in Chile, with a review of the information regarding each species' status as a native or non-indigenous species (NIS). They recorded a total of nine boring polychaetes present along the Chilean coast including native and NIS. The only sabellid registered in abalone in Chile at that time was *Terebrasabella heterouncinata*.

There are 6 *Oriopsis* species registered in Chile: *O. alata, O. alatoides, O. ehlersi, O. limbata, O. magellanica, and O. taltalensis*. Like most of the worms belonging to this family are indirect deposit feeders as sedentary worms living in the sea bottom, none of this species has been described forming tubes in gastropod shells.

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MATERIAL AND METHODS

To determinate the presence of sabellid polychaetes in native gastropods, a sample of 142 native gastropods of the species *Concholepas concholepas* ($n = 62$) and *Fissurella* sp. ($n = 80$) were obtained from a sublittoral area in central Chile (33°29′S, 71°38′W). On the other hand, a single sample of 345 green abalone *Haliotis discus hannai* was collected from an abalone farm in Central Chile, all these individuals belong to a single batch and were not considered in the productive scheme of the farm, they were maintained in a single tank for research purposes. The aim of the study was to determine the presence of sabellid polychaetes in a abalone farm in central Chile and its potential presence in the surrounding sea environment.

The initial study included all the mollusc species detected in the area surrounding the farm, including bivalves and gastropods. The sample points were defined as a 36-point grid in the coast next to the farm. Of this, only 2 gastropod species show the presence of sabellids (unpublished data), so for this study it decided to focus in both species: *C. concholepas* and *Fissurella* sp.

All of the individual were measured (total length) and the shells were separated from soft tissues to examine the inner and outer face of the shells seeking for abnormalities associated to sabellids infestation. This observation was conducted using a Leica stereomicroscope model S6D. Once the shell examination was finished, all the sabellid positive shells were separated and decalcificated using an acid solution (5% HNO_3) for 12 h, and 5% $NaSO_4$ (12h) for acid neutralization (Vargas et al. 2005.).

TABLE 1.

The main morphological differences between *Terebrasabella heterouncinata* and the *Oriopsis* species detected in the present work.

Terebrasabella heterouncinata	*Oriopsis sp.*
Branchial crown with 2 pairs of radioles	Branchial crown with three to five pairs of radioles
The anterior half of the body is thinner than the rest	The body is thicker in the middle.
The posterior half of the body is lightly expanded	The posterior half of the body is pointed
Sacciform	Fusiform
With 8 thoracic segments	With 8 thoracic segments
With 3 abdominal segments	Abdomen with seven to nine setigers
Neuropodial uncini of setigers 2–6 are acicular and have a main tooth crowned by shorter teeth series	Inferior thoracic notosetae are bayonet setae, situated as simple row roughly parallel and posterior to superior notosetae. Thoracic uncini acicular; teeth above main fang unequal in size; hood present
Neuropodial uncini of setigers 7 and 8 are avicular, without main tooth, all the teeth with a uniform size	
Companion setae absent in the neuropods in the setigers 7 and 8	With companion setae in the neuropods of the setigers 7 and 8
Abdominal notopodial uncini are present in the setigers 9–11	Abdominal uncini as rasp-shaped plates, without main fang.
Abdominal notopodial uncini are acicular with a single main tooth crowned with shorter series of teeth	Abdominal neurosetae situated as simple row of modified, elongate, narrowly hooded setae

The obtained material was separated from shell particles and observed in a Leica stereomicroscope model S6D. Once observed some basic anatomical features like segmentation, body shape, and gill crown presence; the polychaetes were fixed in 5% glutaraldehyde for scanning electronic microscope (SEM), to identify external structures with taxonomic importance, like the neuropodial thoracic hooks, very difficult to illustrate using conventional light microscopy. The microscope used for SEM was a Zeiss 940 model.

The three mollusc species studied (Figs. 1, 2) were analyzed in the same way, in the case of the native gastropods, because of the lack of information regarding the effect produced in the shell, all the shells were exposed to acid decalcification.

The taxonomic determination was carried out according to the keys of Fauchald (1977), Rozbaczylo (1980), and Day (1967).

RESULTS

The average length of the gastropod shells analyzed was 6.03 (±0.94) for *Fissurella sp.*; 5.05 (±1.18) for *Concholepas concholepas* and 5.04 (±0.55) for *Haliotis discus hannai*.

In the inner face of the shell of the examined abalones it was possible to detect the small tubules characteristic of sabellid infestations (Fig. 1), very similar to those generated for *T. heterouncinata*. Shell deformities related to the severe sabellid infestation were not observed. Of the abalones analyzed, 241

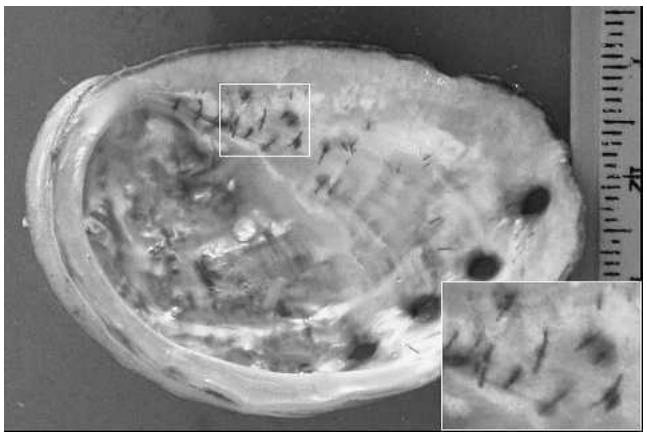

Figure 1. Green abalone *H. discus hannai*, showing the sabellid tubules on the inner face of the shell.

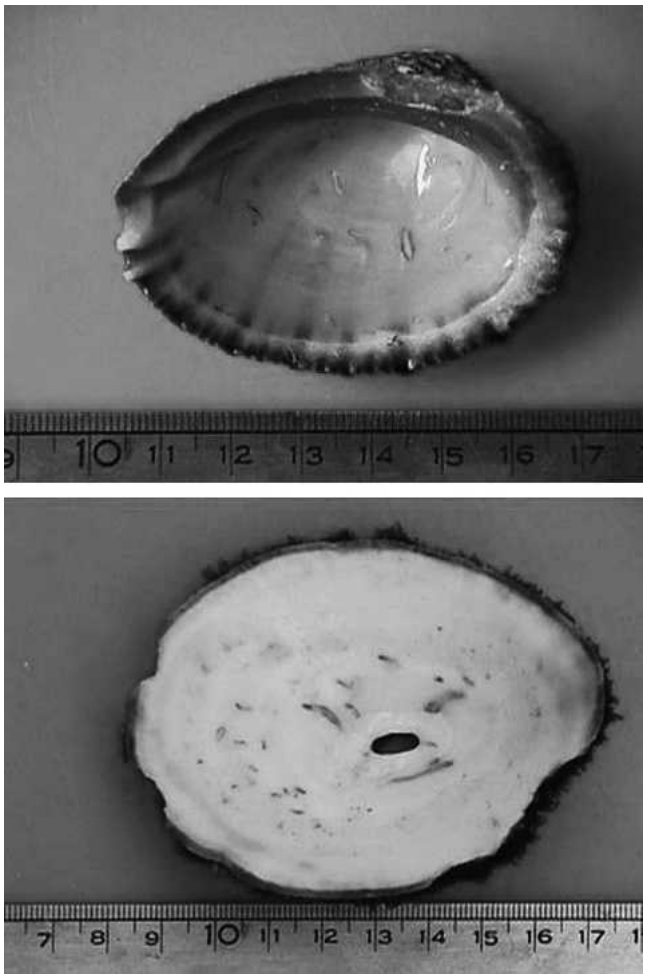

Figure 2. Picture showing the native gastropod species analyzed. The upper picture shows the inner side of a *C. concholepas* shell. The lower image shows the same face of the shell in *Fisurella* sp. In both pictures one can see small tubes, most of this belonging to spionid polychaetes.

showed the presence of sabellid tubules on the inner face of the shells (70% of total sample). The mean intensity of tubes detected in the abalone sample was 2.6 per infected shell. The tubes were about 250 μm wide and 2 mm length, these were distributed in the shell margin and also in the pores and central area of the inner face of the shell.

In the case of the native gastropod examined (Fig. 2), they do not show the presence of sabellids tubules or shell deformities, but the shell decalcification allowed to collect many sabellids worms, counting 161 individuals in the total sample (76 obtained from *C. concholepas* and 85 from *Fissurella* sp.), corresponding to 1.22 worms per shell analyzed in case of *C. concholepas* and 1.06 in *Fisurella sp*. Giving the collection technique used, it is not possible to determine what part of the shell was being occupied by the sabellids.

The worms analyzed correspond to small sized sabellids (1–2 mm long). The body is fusiform (Figs. 3, 4, 5A), the gill crown is constituted of three pairs of radiolae, and it has 8 thoracic segments and 7–9 abdominal setigers. The thoracic notosetae are present in the setigers 2–8 (Fig. 5B). All of the thoracic neurosetae are long arm hooks with a single long tooth under another shorter tooth, crowned by many denticles (Fig. 5D). The neuropodial setae are not accompanied with bristles. The notopodial bristles of the abdomen (Fig. 5C) are subquadrangular uncinus with a short base containing approximately 8 lines of teeth with approximately 8 teeth on each (See Table 1).

DISCUSSION AND CONCLUSION

According to the keys of Fauchald (1977) and Rozbaczylo (1980), the analyzed worms belong to the family Sabellidae. Based on Day 1967 and Fitzhugh 1989, the thoracic neurosetae forming a single row of long handled hooks indicate that they belong to the subfamily Fabriciinae.

According to Day (1967) and Fitzhugh (1989) all the analyzed sabellids gathered from the mollusc shells described belong to the genus *Oriopsis*.

We conclude that the sabellid specimens found in *H. discus hannai*, *Fissurella* sp. and *Concholepas concholepas* in central Chile correspond to a single species of the genus *Oriopsis*.

This work constitutes the first report of the presence of sabellids of the genus *Oriopsis* forming tubes in the shell of the green abalone *Haliotis discus hannai* and the first record of sabellids associated with shells of two commercially important native gastropods, *C. concholepas* and *Fissurella* sp.

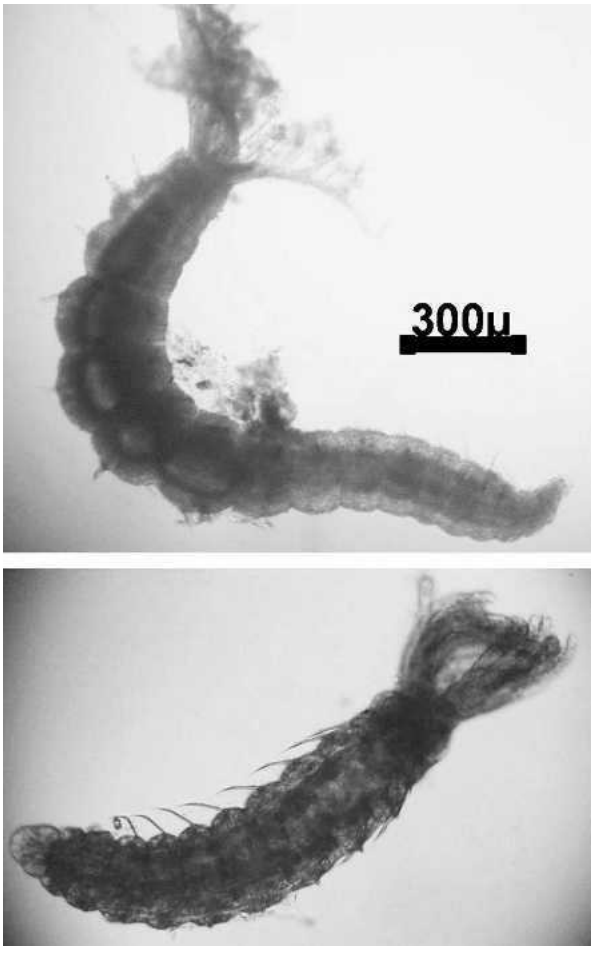

Figure 3 . Light stereomicroscope image of *Oriopsis* sp. of green abalone *H. discus hannai*.

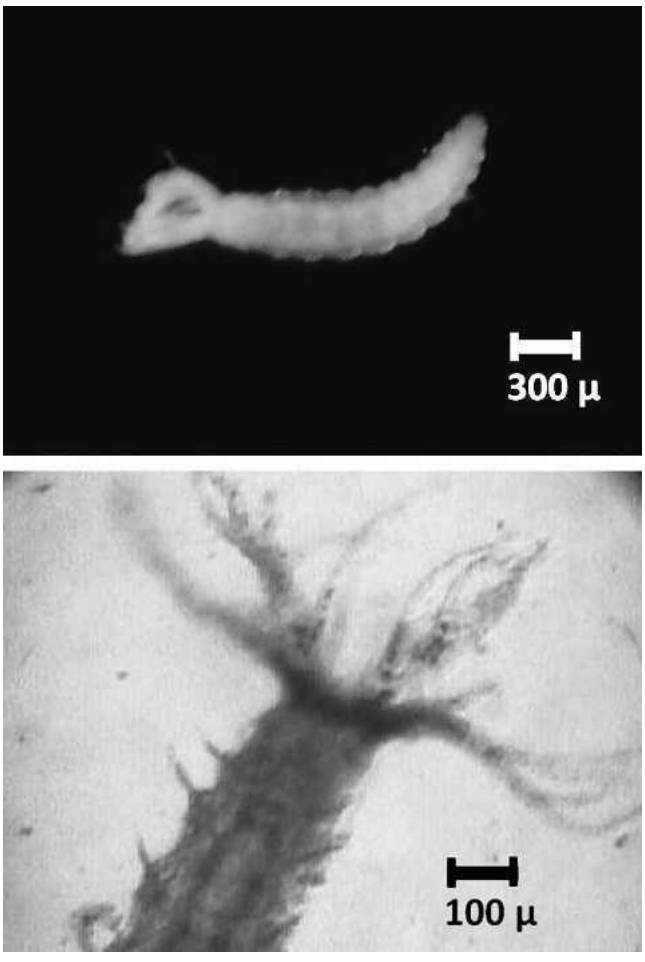

Figure 4. Light stereomicroscope image of *Oriopsis* sp. of native gastropods. The upper image shows a general view of the sabellid, and the lower picture shows a detail of the radioles and first segments.

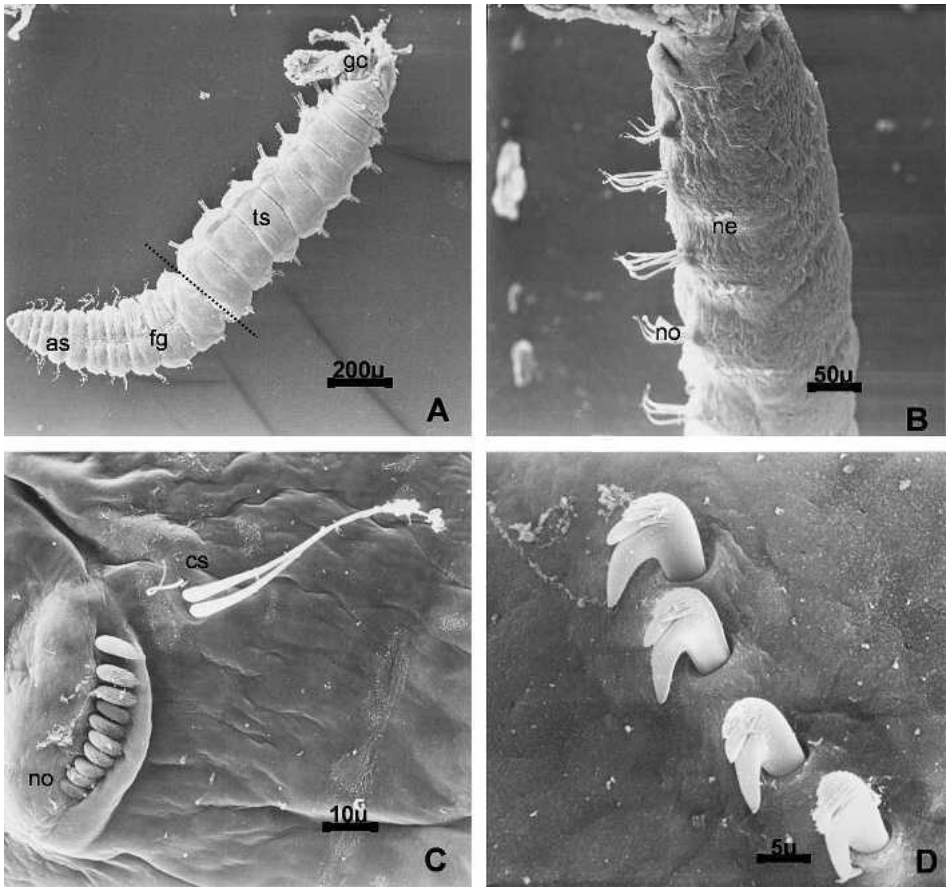

Figure 5. SEM images of *Oriopsis* sp. A, General anatomy of *Oriopsis* sp. The segmented line separates the thoracic segments (ts) of the abdominal segments (as). It is also observed the fecal groove (fc) and gill crown (gc). B, First thoracic segments, (no) notopodial setae, (ne) neuropodial setae. C, Abdominal segment, (no) notopodial setae, (cs) companion setae. D, Detail of neuropodial thoracic hooks.

Apparently, the species of *Oriopsis* detected in this study is native and has a low preference by substrates because they were detected living in abalone shells, exotic mollusc, cultivated in Chile for more than a decade. Probably the low maintenance condition in which the abalone sampled for this study were kept in the tanks helped to increase the transmission of the sabellids between the individuals.

We suggest controlled infestations laboratory tests to elucidate the susceptibility of the abalones to *Oriopsis* infestations and the potential effects on the abalone production systems.

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