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Mudworm *Polydora lingshuiensis* sp. n is a new species that inhabits both shell burrows and mudtubes

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Abstract

A new polydorin species, *Polydora lingshuiensis* **sp. n.**, which is found not only in burrows of pearl oyster shells (shell-boring type) but also in mudtubes on the surface of pearl oyster cages (tube-dwelling type), is described with the use of light microscopy, scanning electron microscopy, and molecular phylogeny. Morphological and molecular distinctions between *P. lingshuiensis* and other related species reveal that *P. lingshuiensis* is a valid new species. The reproduction characteristic that the eggs of *P. lingshuiensis* are gathered together in one hollow cylinder is another piece of evidence confirming that it is indeed a valid new species. Sequence comparisons based on nuclear 18S rDNA, 28S rDNA, and mitochondrial 16S rDNA show that strains of the shell-boring type possess as high as 99.9% to 100% sequence identity relative to those of the tube-dwelling type. This finding evidently indicates that these species types are conspecific. We also find that a comparison of mitochondrial 16S rDNA sequences can provide a higher resolution of polydorin species than those of the nuclear 18S rDNA because the former has a higher interspecific/intraspecific difference ratio. Phylogenetic analyses based on 18S rDNA sequences indicate that all *P. lingshuiensis* samples group together to forming a sister clade to *Polydora uncinata* and thus fall within *Polydora aura/P. uncinata* clade.

Key words: *Polydora lingshuiensis* **sp. n.**, shell burrows, mudtubes, 18S rDNA, 28S rDNA, 16S rDNA, sequence identity, genetic distance

Introduction

Polydorins, once collectively called *Polydora*-complex, refer to spionids having special major spines in the modified fifth setiger and represent an assemblage of more than 140 species (Blake 1996; Walker 2011; Radashevsky 2012). Polydorins can survive not only in soft substrata, such as mud deposits and sponges (Sato-Okoshi 2000; David & Williams 2012), but also in hard calcareous materials, such as corals, coralline algae, and mollusk shells (Blake & Evans 1973; Sato-Okoshi 1999). Of the polydorins inhabiting a variety of substrata, the shell-boring species have attracted the most attention because of the significant damage to their host species (Handley & Bergquist 1997; Sato-Okoshi 1999; Radashevsky *et al.* 2006; Sato-Okoshi & Abe 2012). These shell-boring species can bore into the calcareous shells of abalones, oysters, mussels, and scallops to build a large number and a wide variety of burrows inside the shells (Handley & Bergquist, 1997; Radashevsky *et al.* 2006; Riascos *et al.* 2009; Teramoto *et al.* 2013). This boring activity may distort the shell shape, weaken the integrity of the host shell to delay the growth rate of the host, or even cause mass mortality with heavy infestation in their hosts (Handley & Bergquist 1997; Simon *et al.* 2009; Read 2010).

The morphology of adult worms has often been used as the sole criterion for the taxonomy of species in polydorins and their separation in terms of genera and species (Blake & Kudenov 1978; Blake 1996). The shape of

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