

Redescription of *Scoliorhapis lindbergi* comb. nov. (Echinodermata: Holothuroidea: Apodida: Chiridotidae), with Special Reference to the Ultrastructure of Sigmoid Bodies

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We reclassify and redescribe the apodid holothurian *Scoliodotella uchidai* Oguro, 1961 as *Scoliorhapis lindbergi* (D'yakonov in D'yakonov *et al.*, 1958) comb. nov., based on newly collected topotypes of the former from Akkeshi Bay, Japan. We confirm the previously proposed, but not widely recognized, synonymy between these two nominal species. Scanning electron microscopy of 968 sigmoid bodies from 17 specimens of *S. lindbergi* from Akkeshi Bay revealed that 12.0% of them possessed spinelets, which varied in size, number, and arrangement, and that 0.8% were anchor-shaped, resembling ossicles characteristic of Synaptidae.

Key Words: Apodida, *Scoliorhapis*, spinelets, sigmoid bodies, Synaptina, anchor ossicles.

Introduction

Apodida, one of the six orders generally recognized in the class Holothuroidea, with about 270 species known worldwide (Kerr 2001), is a basal group of holothurians. A recent molecular phylogenetic analysis based on 18S rRNA gene sequences from species representing all six orders indicated that Apodida is the sister taxon to all other holothurians (Lacey *et al.* 2005). Apodids are vermiform in shape, ranging from a few cm up to 3 m (Kerr 2001) in body length, and commonly lack tube feet, respiratory trees, and radial water canals (Kerr 2001; Pawson *et al.* 2010).

The apodid nominal species *Scoliodota lindbergi* D'yakonov in D'yakonov *et al.*, 1958 was described from the Sea of Okhotsk as the second known species of *Scoliodota* Heding, 1928 (*q.v.*); the genus had previously contained only *S. theelii* Heding, 1928, and the generic diagnosis based on this species included the possession of 10 tentacles and body-wall ossicles comprising only sigmoid bodies, and no wheels. *Scoliodota* Heding, 1928 is a junior homonym of *Scoliodota* Clark, 1908 (*q.v.*), and Clark (1946) replaced the former with *Scoliorhapis* Clark, 1946. Oguro (1961), unaware of either Clark (1946) or D'yakonov *et al.* (1958), described a new genus and species, *Scoliodotella uchidai* Oguro, 1961, from Akkeshi Bay, Hokkaido, Japan. *Scoliodotella uchidai* was later synonymized with *Scoliodota lindbergi*, first by Utinomi (1965) and subsequently independently by Levin (1982), who, not knowing of Clark's (1946) replacement name, referred to the species as *Scoliodotella*

lindbergi (Utinomi 1965; Levin 1982). Because Utinomi's (1965) and Levin's (1982) works were published in the Japanese and Russian languages, respectively, these have not been cited in the English literature (*e.g.*, overlooked by Kerr 2001; O'Loughlin and VandenSpiegel 2010; Paulay 2010).

O'Loughlin and VandenSpiegel (2010) synonymized *Scoliodotella* with *Scoliorhapis*, but for some reason did not combine the generic name *Scoliorhapis* with the specific names *lindbergi* and *uchidai*, listing "*Scoliodota lindbergi*" and "*Scoliodotella uchidai*" as separate members of *Scoliorhapis*, as though these were two different species. Although the morphology (Oguro 1965) and development (Oguro 1976) of *Scoliodotella uchidai* have been thoroughly described, the taxonomic identity of this species and its valid name have remained obscure.

The body-wall ossicles of most apodids in the Chiridotidae comprise wheels and sigmoid bodies or hooks. Exceptions include *Scoliorhapis* with only sigmoid bodies, *Paradota* with only rod-shaped ossicles, and *Kolostoneura*, which lacks ossicles in the body wall. O'Loughlin and VandenSpiegel (2007) found small spines, or spinelets, on the sigmoid bodies in three new and two known species of Chiridotidae and used this character in distinguishing species. Because these small spines are hardly recognizable by light microscopy, the distribution among taxa and utility of these small spines in distinguishing species is still largely unknown for the remaining chiridotids.

The goal of our study was to evaluate the validity of Utinomi's (1965) and Levin's (1982) synonymization of the two nominal species *Scoliodota lindbergi* and *Scoliodotella*