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Three new species of *Glossobalanus* (Hemichordata: Enteropneusta: Ptychoderidae) from western North America

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Abstract

Twenty three enteropneust species have been described from the west coast of North America, including one species from the family Ptychoderidae, *Glossobalanus berkeleyi* from the Salish Sea, Vancouver Island. Here we use morphology to describe three additional species of acorn worms in the genus *Glossobalanus*: *G. williami* from Cape Arago, Oregon; *G. hartmanae* and *G. barnharti* from La Jolla, California. Notes on the habit and localization of each species as well as a dichotomous key to the genera of the family Ptychoderidae are provided.

Key words: Enteropneusta, acorn worms, Ptychoderidae, dichotomous key

Introduction

The hemichordate class Enteropneusta includes about 96 species of acorn worms distributed among the families Harrimaniidae, Spengelidae, Ptychoderidae and Torquaratoridae. Acorn worms have elongated bodies ranging from less than a millimetre (Worsaae et al. 2012) to 2.5 meters in *Balanoglossus gigas*. The body is tripartite, with a proboscis, collar and trunk. The anterior proboscis is most commonly elongated or spherical. A narrow, stiff, dorsal peduncle joins the proboscis to the dorsal buccal cavity of the collar. The collar is a hollow cylinder around the mouth and is closed by contracting the proboscis against its anterior lip. The trunk can be divided externally into a branchiogenital region, a hepatic region and a caudal region. The branchiogenital region, just posterior to the collar, possesses two dorsolateral rows of gill pores and houses the serial gonads, which are highly developed in ptychoderids, forming dorsolateral genital ridges (*Glossobalanus*) or wings (*Ptychodera* and *Balanoglossus*), and in some species the gonads continue into the next two regions. The hepatic region is characterized by a pair of dorsolateral outpocketings of the gut, externally visible in *Schizocardium* and all ptychoderids. The caudal region is very fragile and sometimes bears wart-like papillae that may contain biomineralized ossicles (Cameron & Bishop 2012).

The highly specialized regions of the enteropneust gut are most evident in ptychoderids. Pharyngeal walls are perforated by a paired series of gill slits that open into branchial sacs, or atrial cavities, and these empty via gill pores to the exterior. Primary gill bars elongate and separate adjacent gill slits, and secondary gill bars, or tongue bars, grow dorsoventrally into the slit. Multiple collagenous bridges, or synaptaculae, join the primary and secondary gill bars. Primary gill bars are solid whereas tongue bars contain an extension of the trunk coelom, the peribranchial coelom. Two longitudinal ridges, the parabranial ridges, separate the dorsal pharynx, with its gill slits, from the ventral digestive pharynx, giving the ptychoderid gut lumen a peanut shape in transverse section.

The family Ptychoderidae includes three genera: *Ptychodera*, *Balanoglossus* and *Glossobalanus*. Much of what we know about the ultrastructure of acorn worms comes from the extensive and detailed work of Jesús Benito and Fernando Pardos, who made *Glossobalanus minutus* (Fig. 1C), from the north of Spain their species of study (Benito 1975a,b; Pardos 1988; Pardos & Benito 1982, 1984, 1988a,b, 1989a,b, 1990, 1993; Benito & Pardos 1997). They characterized the cell types in the ciliated and densely glandular epidermis; the fibrillar layer of