
Boccardia proboscidea

A burrowing spionid worm

Phylum: Annelida

Class: Polychaeta, Sedentaria, Canalipalpata

Order: Spionida, Spioniformia

Family: Spionidae

Taxonomy: *Boccardia proboscidea*'s senior subjective synonym, *Polydora californica* (Treadwell, 1914) and an un-typified name, *Spio californica* (Fewkes, 1889) were both suppressed in 2012 by the International Commission on Zoological Nomenclature (ICZN, case 3520). The widely cited and used name, *Boccardia proboscidea* (Hartman, 1940) was conserved (ICZN 2012).

Description

Size: Specimens up to 30–35 mm in length and 1.5 mm in width, where length extends with age (Hartman 1940). The illustrated specimen has approximately 130 segments (Fig. 1).

Color: Yellow-orange with red branchiae and dusky areas around prostomium and parapodia (Hartman 1969). Sato-Okoshi and Okoshi (1997) report black pigment following the prostomial ridge and palpal grooves.

General Morphology: Spionid polychaete with thick anterior palps, conspicuous segmentation.

Body: Long, depressed, somewhat flattened body that tapers posteriorly (Hartman 1940). First setiger small capillary setae in bunches (Fig. 5a). Setiger five is modified with two kinds of dark, strong setae in notopodia. Setiger five is almost twice the length of setiger four (Figs. 2, 3) (Hartman 1940).

Anterior: Prostomium long, rounded, without medial groove and snout-like (species *proboscidea*, Hartman 1940). Caruncle (sensory organ) present and extends to setiger three (Fig. 3) (Hartman 1969).

Trunk:

Posterior: Pygidium is a round, flaring disc with four unequal lobes where dorsal lobes are smaller (Fig. 4) (Hartman 1969).

Parapodia: Biramous after first setiger. Podia on the first setiger are not lobed, small and inconspicuous. The second setiger's parapodial lobes become twice as large as the first's, and continue to worm posterior.

Setae (chaetae): All setae are simple and include bunches of short, capillary spines to setiger six (except for modified setiger five) (Figs. 5a, b). A transverse row of approximately eight neuropodial uncini (hooded hooks) with bifid (two-pronged) tips begins on setiger seven and continues to posterior end (Fig. 5e), with bunches of capillary setae below them (until setiger 11). Notosetae of setiger five are heavy, dark and arranged vertically in two rows of five with pairs of long, falcate spines (Fig. 5c) and shorter brush-topped clubs (Fig. 5d) while the neurosetae are capillary (Hartman 1969). All notosetae are capillary except for those of setiger five.

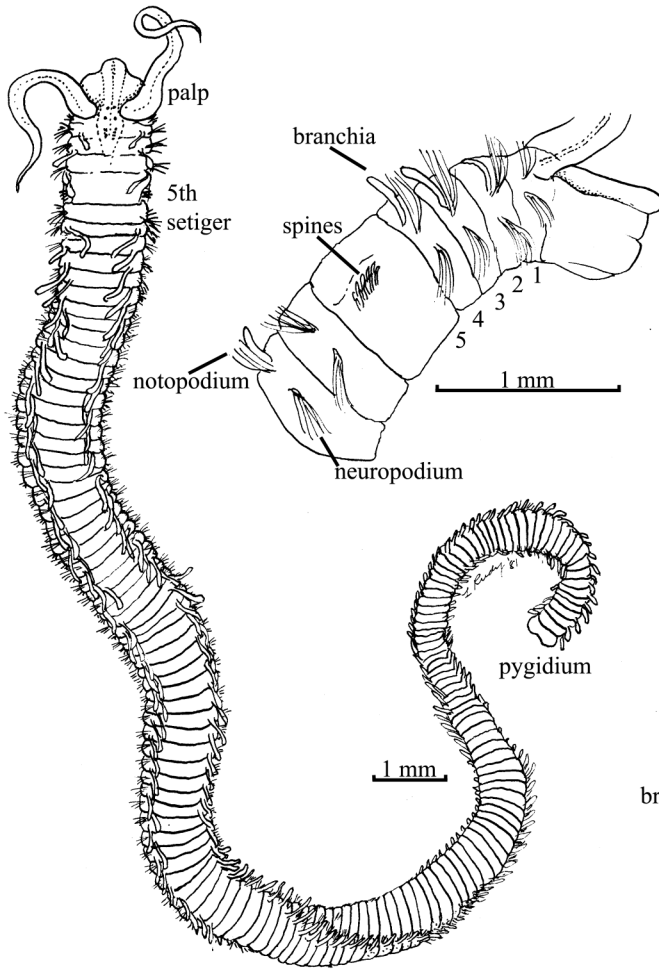
Eyes/Eyespots: Up to six (4–6) eyespots between palpal bases (Fig. 3).

Anterior Appendages: Long, simple, longitudinally grooved tentacle-like palps (family Spionidae) (Fig. 1).

Branchiae: The gill-like structures in this species are long, single vascular processes that are present on setigers 2–4, and from setiger seven to (almost) the worm posterior end (Figs. 2, 3).

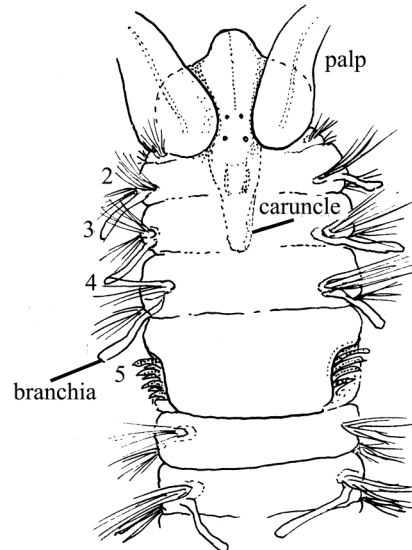
Burrow/Tube: Individuals build vertical, U-shaped burrows in rocky shale or amongst and within bivalve shells (Bailey-Brock 2000).

Boccardia proboscidea

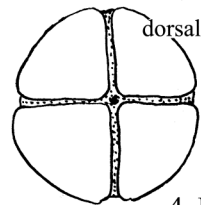


1. *Boccardia proboscidea* x12: typical spionid palps; body flattened, depressed; pygidium a flaring disk.

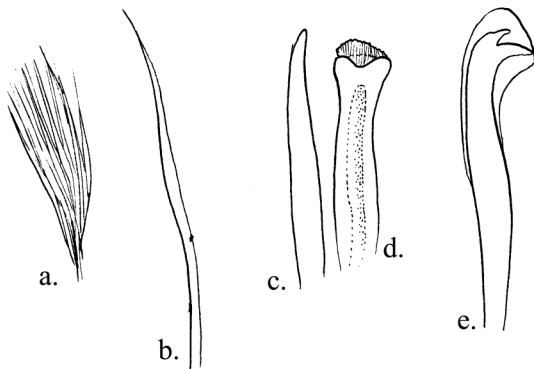
2. Anterior (lateral view) x30: biramous parapodia with branchiae; fifth setiger wide, modified, with stout dorsal spines.



3. Anterior (dorsal view) x30: prostomium rounded, snout-like; 4-6 eyes; inconspicuous parapodia on first setiger; setiger 5 with dorsal spines; caruncle obvious.



4. Pygidium (posterior view) x40: dorsal lobes smaller.



5. Setae:
 a. neuropodial fascicle.
 b. capillary from a.
 c. falciger from setiger 5.
 d. brush-topped club, setiger 5.
 e. neuropodial hooded hook.

Pharynx:
Genitalia:
Nephridia:

Possible Misidentifications

Spionid polychaetes are distinguished by their long palps. Two other polychaete families have long palps: the Magelonidae, with adhesive palps (not long and flowing) and with flattened spade-like prostomiums and the Chaetopteridae which have palps, but their bodies are very obviously divided into three quite different regions.

The genus *Boccardia* contains 22 species (Simon et al. 2010) and members of this genus and the genus *Boccardiella* have branchiae on setigers anterior to setiger five. These two local genera differ in the kinds of modified setae on the fifth setiger, *Boccardiella* species have one (simple and falcate) while *Boccardia* have two (one simple and falcate and the second expanded and club-like) (Blake and Ruff 2007).

Boccardiella hamata (= *Boccardia uncata*) has recurved spines, rather than straight bifid uncini, on its posterior parapodia and the pygidium has two lappets (Hartman 1969). It is common in oyster beds and builds tubes in mudflats or bores holes into hermit crab and bivalve shells and is reported from central California to Oregon (Blake and Ruff 2007) and in Vancouver Island, Canada (Sato-Okoshi and Okoshi 1997). *Boccardiella truncata* is green in color, has a saucer-like pygidium and a truncate anterior end. It is not usually estuarine and is, instead, more common intertidally in sandstone cliffs in northern California (Blake and Ruff 2007).

Two species of *Boccardia* have both falcate and brush-topped setae on setiger five as seen in *B. proboscidea*. *Boccardia berkeleyorum* is reported from central

California and has no notosetae on setiger one, only neurosetae (Blake and Ruff 2007). Its bristle-topped setae (on setiger five) have a small accessory tooth at the distal end and the posterior notopodia have acicular setae (Blake 1975). This species bores in coralline algae, hermit crab shells and the jingle shell *Pododesmus sp.* *Boccardia columbiana* resembles *B. proboscidea* most closely. Its chief difference is that the fascicles of fine setae on setiger one are long and fanned forward, where they are short on *B. proboscidea*. This species is reddish-brown, and bores into wood pilings and coarse algae. *Boccardia proboscidea* was the only member of this genus found in Oregon by Hartman and Reish (Hartman and Reish 1950).

Boccardia polybranchia and *B. tricuspata* have two kinds of setae on setiger five. *Boccardia polybranchia* is green to reddish-yellow in color and has a notched prostomium. Its first setiger lacks notosetae, it has only 60–80 segments and a pygidium that is a thick ring. *Boccardia polybranchia* is a cosmopolitan species that lives in estuarine mud and is reported in western Canada (Hartman 1969) but not between central California and Oregon (Blake and Ruff 2007). *Boccardia tricuspata* has two kinds of setae on setiger five, which are falcate and tridentate (not bristle-topped). Its branchiae are anterior to setiger five and are small and inconspicuous. It bores in molluscs and is usually a more southern species than *B. proboscidea*.

Ecological Information

Range: Type locality is Caspar, California. NE Pacific range, western Canada south to southern California (Hartman 1969).

Local Distribution: Coos Bay distribution includes the outer rocky coast and offshore (Hartman and Reish 1950).

Habitat: Burrows are found amongst *Mytilus* spp. (mussel) colonies and individuals inhabit a variety of niches (Hartman 1940).

Salinity: Collected at 30 and exhibits a great toleration for salinity variation (Hartman 1940).

Temperature: *Boccardia proboscidea* residence in tidepools is evidence of a wide temperature tolerance (Hartman 1940).

Tidal Level: High rocky intertidal pools and in high intertidal crevices (Blake 1975).

Associates: *Mytilus* spp. and its accompanying organisms in rocky crevices. An additional associate is the small, red harpacticoid copepod, *Tigriopus* sp. (Hartman 1940).

Abundance: The only *Boccardia* species found in Oregon by Hartman and Reish, (1950) where it is the most common member of a common family (Hartman 1940).

Life-History Information

Reproduction: Eggs, in five or more capsules of 50 eggs each, are deposited in a tube and aerated during development by adult's rhythmic movement (Hartman 1940). Egg capsules are present from August to October in Barkley Sound, Canada (Sato-Okoshi and Okoshi 1997). Embryonic development is rapid and easily occurs in the lab where capsules in the same tube often exhibit different development modes. For this reason, the larval development of *B. proboscidea* is a model for poecilogony (differing developmental strategies within the same species, Gibson et al. 1999) among spionids (Blake and Ruff 2007). Woodwick (1977) reported two egg sizes, 100 and 150 μm , which emerge as planktotrophic (emerging at 3-setiger stage) and lecithotrophic (emerging at up to 15-setiger stage) larvae, respectively. Later, Blake and Kudenov (1981) observed nurse eggs within capsules which are ingested by and support larvae within the capsule, coupled with

adelphophagy (consumption of one embryo by another) on smaller larvae. These developmental strategies were summarized by Oyarzun et al. (2011) and consists of females which produce capsules with 1) planktotrophic larvae, 2) planktotrophic larvae and nurse eggs and 3) planktotrophic larvae, nurse eggs and adelphophages larvae. The variation in capsule composition depends on female behavior and latitude, where individuals at higher latitudes produce more adelphophages larvae which emerge at advanced stages and settle quickly (Oyarzun et al. 2011).

Larva: Larval stages found in plankton in the summer (Hartman and Reish 1950) and larval development is described (Blake and Kudenov 1981; Gibson and Smith 2004). Larvae develop through trochophore and metatrochophore stages and have a single dorsal chromatophore in young stages and two beginning at the 5-setiger stage (Blake and Kudenov 1981). Larvae also possess three pairs of black eyes. Once larvae reach the nectochaete stage, they can be identified by adult characters (e.g. modified setae on setiger five, branchiae beginning on setiger) (Crumrine 2001).

Juvenile: Metamorphosis is gradual and occurs between the 13–15 setiger stages where larval structures are lost and juvenile features are gained. Juvenile features include setal morphology like that of the adults where the length and number increase with growth. Branchiae develop first on setigers 7–9 and appear later in anterior and posterior setigers. The juvenile pygidium is like that of the adult, comprising four lobes (Gibson and Smith 2004).

Longevity:

Growth Rate:

Food: Spionids feed by sweeping their tentacles across the surface of substrate where particles are collected and wiped on the underside of prostomium (Dales 1967). *Boccar-*

dia proboscidea eats small copepods (Hartman 1940) and is a voracious predator on algal particles, Bryozoa, Hydrozoa, other attached and free-swimming animals (Hartman 1940).

Predators:

Behavior: A colonial burrower, *B. proboscidea* can be seen with tentacles protruding from burrow (Ricketts and Calvin 1971).

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