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## ***Polydora* and *Dipolydora* (Polychaeta: Spionidae) associated with molluscs on the south coast of South Africa, with descriptions of two new species**

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### ABSTRACT

Wild molluscs from five sites and farmed oysters and abalone from one site each along the south coast of South Africa were examined for shell-boring *Polydora* and *Dipolydora*. One new species each of *Dipolydora* and *Polydora* are described. *D. keulderae* sp. n. belongs to the *D. barbilla*/*D. bidentata* group and was present at all the sites sampled. *P. dинthwanyana* sp. n. belongs to the *P. ciliata*/*P. websteri* group and was recorded only at Haga Haga, the most easterly site sampled. In total, five *Dipolydora* species (*D. cf. armata*, *D. capensis*, *D. cf. giardi*, *D. keulderae* and *D. normalis*) and three *Polydora* species (*P. cf. ciliata*, *P. dинthwanyana* and *P. cf. hопlura*) were recorded. All but *D. normalis* bored into mollusc shells and while the rest of the worms showed no host preference, the larger, subtidal *Haliotis* spp. and *Turbo sarmaticus* usually hosted the largest number of species at each site. *D. normalis* and *P. dинthwanyana* were recorded only at Haga Haga, *P. cf. ciliata* only at Port Elizabeth and the rest at all the sites. This study extends the known distributions of *D. normalis*, *D. cf. armata* and *P. cf. ciliata* in South Africa.

**KEY WORDS:** Polychaeta, *Polydora dинthwanyana*, *Dipolydora keulderae*, South Africa, shell-boring, new species.

### INTRODUCTION

The *Polydora* complex (Polychaeta: Spionidae) includes some of the most important pests of cultured molluscs reported worldwide (e.g., Moreno *et al.* 2006; Simon *et al.* 2006; Sato-Okoshi *et al.* 2008; Walker 2011). It comprises nine recognised genera, all of which are characterised by a fifth chaetiger bearing modified spines (see reviews by Blake 1996; Walker 2011). Worldwide *Polydora* Bosc, 1802 and *Dipolydora* Verrill, 1879 are by far the most speciose, with nearly twice as many species as the related *Boccardia* Carazzi, 1895 and *Pseudopolydora* Czerniavsky, 1881 (Walker 2011). In South Africa, *Dipolydora* is represented by five species while *Polydora* is represented by three (Day 1967; Schleyer 1991; Nel *et al.* 1996; Simon *et al.* 2006; Simon & Booth 2007): *D. flava* (Claparède, 1870); *D. armata* (Langerhans, 1880); *D. cf. giardi* (Mesnil, 1896); *D. capensis* (Day, 1955); *D. normalis* (Day, 1957); *P. hопlura* (Claparède, 1870); *P. websteri* Hartman in Loosanoff & Engle, 1943; and *P. maculata* Day, 1963. Three additional species, *D. caeca* (Oersted, 1843), *P. ciliata* Johnston, 1838 and *P. colonia* Moore, 1907 (as *P. hопlura inhaca*), were recorded in Mozambique. Of these, *D. capensis*, *P. hопlura*, *P. maculata* and *P. websteri* were recorded boring into shell (Day 1967; Schleyer 1991; Nel *et al.* 1996).

Local interest in the polydorid worms has grown with the increase in abalone and oyster culture in South Africa over the last decade (Simon *et al.* 2006). This has led to the Abalone Farmers Association of South Africa, and later Marine and Coastal Management (now part of the Department of Agriculture, Forestry and Fisheries), funding the collection and identification of polydorid worms associated with wild molluscs. This is the last of three papers describing the polydorid worms associated with molluscs along the south coast of South Africa (Simon 2009; Simon *et al.* 2010).

Specimens collected during the original sampling trips in 2005 are here supplemented by worms collected from farmed oysters and abalone supplied by farmers in October 2009, and wild abalone collected during an epidemiological study conducted by the author and Dr Anna Mouton (Amanzivet) in August 2009. Here we provide information on the distribution and host ranges of the worms collected, with a redescription of *D. normalis* and descriptions of two new species.

#### MATERIAL AND METHODS

Wild molluscs were collected from intertidal and subtidal locations at five sites along the south coast of South Africa in February and March 2005 (Table 1; Fig. 1). Cultured abalone (*Haliotis midae*) were supplied by a farm in Haga Haga in April 2007 and October 2009, while oysters (*Crassostrea gigas*) were supplied by a farm in Port Elizabeth in October 2009. The worms were removed by immersing the shells in 0.05 % phenol in seawater for 3 h to overnight. The worms were fixed in 4 % seawater formalin, and stored in 70 % ethanol. Additional specimens of *Dipolydora keulderae* sp. n. (see below) were collected from Hermanus during an epidemiological survey currently underway (Dr Anna Mouton, Amanzivet, and the author). These worms were fixed *in situ* within the shell in 4 % seawater formalin, stored in 70 % ethanol and removed by dissolving the shell in 5 %  $\text{HNO}_3$  in 70 % ethanol.

Codens of museums where specimens are kept: SAMC (Iziko South African Museum, Cape Town) and BMNH (Natural History Museum, London).

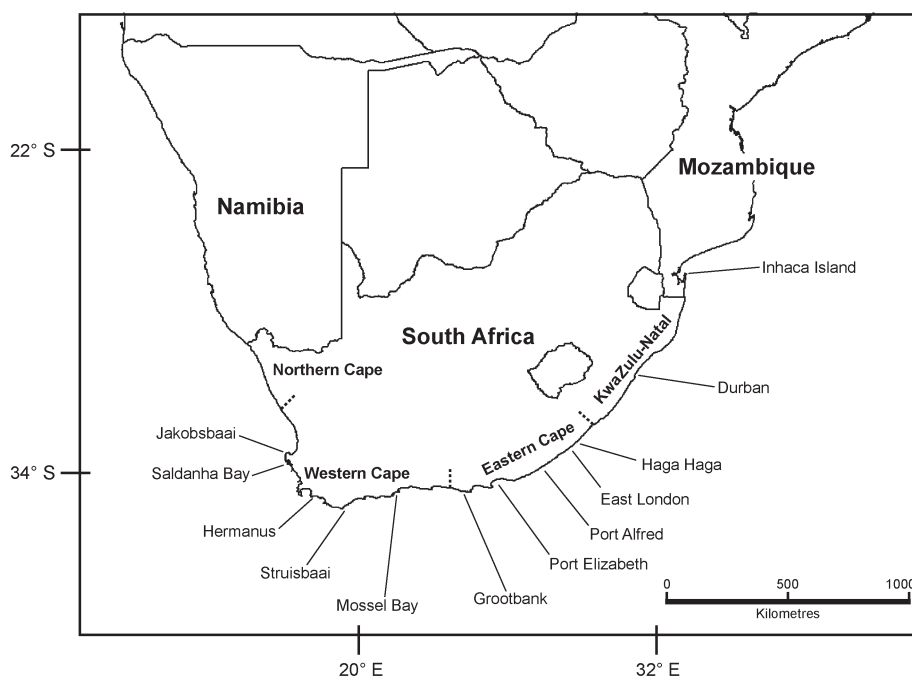


Fig. 1. Locations of the sample sites along the southern coast. Additional sites on the north-east and west coasts denote where *Polydora*-type worms were found in other studies and are referred to in the text.

TABLE 1

Distribution and hosts of *Polydora* and *Dipolydora* species associated with molluscs along the southern coast of South Africa. The sampling sites are listed from east to west. Abbreviations and notes: *Hm* – *Haliotis midae*, *Hs* – *Haliotis spadaciae*, *Ts* – *Turbo sarmaticus*, *Pm* – *Patella miniata*, *Sl* – *Scutellastra longicosta*, *Os* – *Oxystele sinensis*, *Bsp* – *Burnapena* sp., *Cg* – *Crassostrea gigas*, *Pp* – *Perna perna*, *Ul* – unidentified limpet; 1 – present, 0 – absent, blank cell – not sampled at that site; # – on wild and cultured abalone, \* – only on cultured oysters.

| Locality       | Species                             | Host species |           |           |           |           |           |            |           |           |           |
|----------------|-------------------------------------|--------------|-----------|-----------|-----------|-----------|-----------|------------|-----------|-----------|-----------|
|                |                                     | Gastropoda   |           |           |           |           |           |            |           | Bivalvia  |           |
|                |                                     | <i>Hm</i>    | <i>Hs</i> | <i>Ts</i> | <i>Pm</i> | <i>Sl</i> | <i>Os</i> | <i>Bsp</i> | <i>Ul</i> | <i>Cg</i> | <i>Pp</i> |
| Haga Haga      | <i>Dipolydora armata</i>            | 1#           |           | 1         |           |           | 0         |            | 0         |           | 0         |
|                | <i>Dipolydora capensis</i>          | 1            |           | 1         |           |           | 1         |            | 1         |           | 0         |
|                | <i>Dipolydora</i> cf. <i>giardi</i> | 1            |           | 1         |           |           | 0         |            | 1         |           | 0         |
|                | <i>Dipolydora keulderae</i>         | 1            |           | 0         |           |           | 0         |            | 0         |           | 0         |
|                | <i>Dipolydora normalis</i>          | 1#           |           | 0         |           |           | 0         |            | 0         |           | 0         |
|                | <i>Polydora dinthwanyana</i>        | 1            |           | 1         |           |           | 0         |            | 0         |           | 0         |
|                | <i>Polydora hoplura</i>             | 1            |           | 1         |           |           | 0         |            | 0         |           | 0         |
| Port Alfred    | <i>D. armata</i>                    |              | 1         | 1         | 1         |           |           |            | 1         |           | 0         |
|                | <i>D. capensis</i>                  |              | 1         | 1         | 1         |           |           |            | 1         |           | 0         |
|                | <i>D. cf. giardi</i>                |              | 1         | 0         | 0         |           |           |            | 0         |           | 0         |
|                | <i>D. keulderae</i>                 |              | 0         | 1         | 0         |           |           |            | 0         |           | 0         |
|                | <i>P. hoplura</i>                   |              | 1         | 1         | 0         |           |           |            | 1         |           | 0         |
| Port Elizabeth | <i>D. keulderae</i>                 |              |           |           |           |           |           |            |           |           | 1*        |
|                | <i>Polydora ciliata</i>             |              |           |           |           |           |           |            |           |           | 1*        |
|                | <i>P. hoplura</i>                   |              |           |           |           |           |           |            |           |           | 1*        |
| Grootbank      | <i>D. armata</i>                    | 1            |           | 1         |           |           |           |            | 0         |           |           |
|                | <i>D. capensis</i>                  | 1            |           | 1         |           |           |           |            | 1         |           |           |
|                | <i>D. cf. giardi</i>                | 1            |           | 0         |           |           |           |            | 0         |           |           |
|                | <i>D. keulderae</i>                 | 1            |           | 0         |           |           |           |            | 0         |           |           |
|                | <i>P. hoplura</i>                   | 1            |           | 1         |           |           |           |            | 1         |           |           |
| Mossel Bay     | <i>D. armata</i>                    | 0            |           | 1         |           |           | 0         | 0          |           |           | 0         |
|                | <i>D. capensis</i>                  | 1            |           | 1         |           | 1         | 1         | 0          |           |           | 1         |
|                | <i>D. keulderae</i>                 | 0            |           | 1         |           | 0         | 0         | 0          |           |           | 0         |
|                | <i>P. hoplura</i>                   | 1            |           | 1         |           | 1         | 0         | 1          |           |           | 1         |
| Struisbaai     | <i>D. armata</i>                    | 1            |           | 1         |           | 1         | 0         |            |           |           | 0         |
|                | <i>D. capensis</i>                  | 1            |           | 1         |           | 1         | 1         |            |           |           | 1         |
|                | <i>D. cf. giardi</i>                | 0            |           | 1         |           | 0         | 0         |            |           |           | 0         |
|                | <i>D. keulderae</i>                 | 0            |           | 1         |           | 0         | 0         |            |           |           | 0         |
|                | <i>P. hoplura</i>                   | 1            |           | 1         |           | 1         | 0         |            |           |           | 0         |

## TAXONOMY

Family Spionidae Grube, 1850

Genus *Dipolydora* Verrill, 1879*Dipolydora normalis* (Day, 1957)

Figs 2A–D

*Polydora normalis*: Day 1957: 97, figs 6f–j; 1967: 471, figs 18.3k–l.

Morphology of new material: Up to 4.6 mm for 51 chaetigers. Prostomium bifid, with caruncle extending to posterior margin of chaetiger 3; no occipital tentacle; no eyes; no pigmentation (Fig. 2A).

Chaetiger 1 with well-developed notopodial lobes, two capillary notochoetae emerging anterior to notopodial lobe, not always obvious (Fig. 2A); chaetigers 2–4, notochoetae arranged in three tiers, first row short, slightly bent, unilimbate, second row slightly longer than first row, spear-shaped, third row long, lanceolate; chaetigers 6–10 similar to anterior chaetigers, but chaetae of first row more sharply bent; in subsequent chaetigers short chaetae fewer and longer, increase in number; no modified posterior notochoetae; chaetigers 1–4 with well-developed neuropodial lobes with two rows of neurochaetae, first row unilimbate, second row lanceolate, neuropodial lobes of chaetigers 6–7 smaller, neurochaetae of chaetiger 6 similar to chaetigers 1–4. Bidentate hooded hooks from chaetiger 7; with 3 or 4, 6 and 1 hooks per series on anterior, median and posterior chaetigers; maximum number 6 hooks; no constriction on shaft; in anterior chaetigers hooks with angle between main fang and shaft  $>90^\circ$ , but smaller than is usual for other *Dipolydora* species, angle between teeth approximately  $45^\circ$  (Fig. 2B); chaetigers 7–10 with 1–2 winged companion chaetae; with last 23 or 24 chaetigers with 1–2 inferior

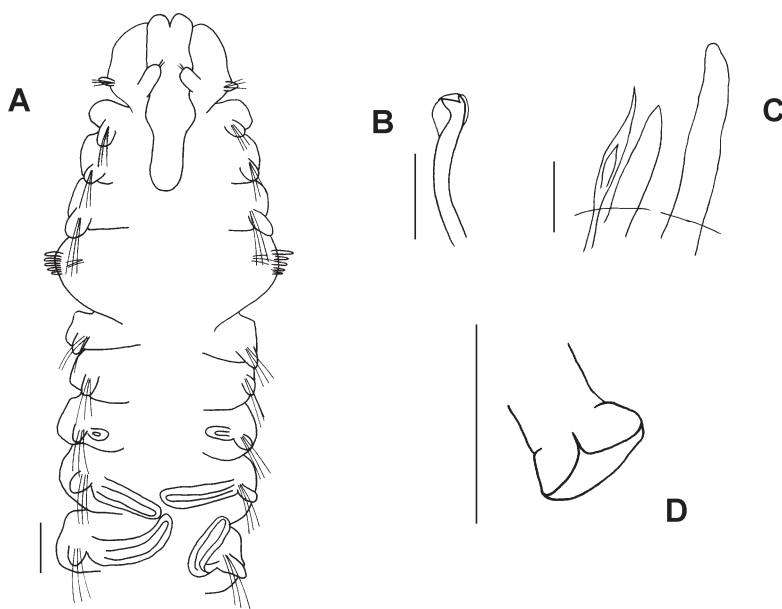


Fig. 2. *Dipolydora normalis*: (A) dorsal anterior; (B) hooded hook; (C) from left to right: bilimbate companion chaeta, pointed and worn modified spines of chaetiger 5; (D) pygidium. Scale bars: A = 0.1 mm, B and C = 0.02 mm, D = 0.5 mm.

needle-like companion chaetae; in one, possibly regenerating, specimen only six chaetigers with companion chaetae.

Chaetiger 5 1.5× length of preceding and succeeding chaetigers (Fig. 2A); chaetae include dorsal fascicle of 3–4 geniculate bilimbate chaetae, five modified spines alternating with spear-shaped companion chaetae and fascicle of short unilimbate neurochaetae; younger modified spines generally straight with sharp points, older spines worn, with slight concavity (Fig. 2C).

Branchiae from chaetiger 8 (Fig. 2A), (from chaetiger 9 in one specimen), depending on length, last 5–13 chaetigers abbranchiate, long anteriorly, overlap mid-dorsum, shorten posteriorly.

Pygidium cuff shaped with dorsal notch (Fig. 2D).

Comparison: New material mostly corresponding with original description and paratype examined (Day 1957); in the paratype the last 12 chaetigers are abbranchiate, falling within the range observed in the new material, posterior inferior companion chaetae are not mentioned in the description but are present in both the new material and the paratype, although they are present on fewer chaetigers in the latter. The specimens differ with respect to the length of the caruncle, which extends to the posterior edge of chaetiger 3 in the new material. In the original description it is described as extending to chaetiger 4, but in fig. 6f (Day 1957) and the paratype the caruncle extends to the beginning of chaetiger 4. The striated structure of posterior notochaetae described by Day (1957) was not observed. Although Day (1957) recorded seven modified spines on chaetiger 5, the paratype examined here only had five, in agreement with the new material. The structure of the spines is also similar; although fig. 6g (Day 1957) shows only a falcate spine; the paratype also has younger spines which are straight and pointed, as described for the new material. The concavities of older spines in the new material were never as pronounced as in the paratype. The differences observed here may be related to the smaller size of the new material examined.

Paratype (examined): MOZAMBIQUE: Inhaca Island: BMNH 1961.16.56, J.H. Day.

Additional material examined: SOUTH AFRICA: *Eastern Cape*: SAMC A60058 (4), SAMC A60059 (ethanol specimens), Haga Haga, from surface of *Haliotis midae*, 26.iv.2007, C.A. Simon.

Distribution: Previously found along the north-east coast of southern Africa, with its southernmost distribution at Durban. In the current study the distribution range is extended further south, and it was found only at Haga Haga in the Eastern Cape Province.

Habitat: Found in tubes on the surface of farmed *Haliotis midae* shells.

### ***Dipolydora keulderae* sp. n.**

Figs 3, 4

Etymology: This species is named for Felicia Keulder who helped with the sampling.

Description: Small species, body equal width along length, narrows for last five chaetigers. Holotype 7.5 mm for 82 chaetigers and 0.4 mm wide at chaetiger 5 (Paratypes ranging from 4 mm for 45 chaetigers to 6 mm for 61 chaetigers). Prostomium notched, caruncle extends to posterior margin of chaetiger 3, but to end of chaetiger 2 in one specimen; no occipital tentacle; in holotype two pairs of eyes arranged in trapezoid, 0–2 pairs in others, posterior pair larger; no pigmentation (Fig. 3A). Palps extend back approximately to chaetiger 14.

Chaetiger 1 with finger-like notopodial lobes that usually obscure single, fine noto-chaeta emerging anterior to lobe (Fig. 3A; lobes orientated posteriorly to show short noto-chaetae), neuropodial lobe small, inconspicuous, tuft of unilimbate neurochaetae; chaetigers 2–4, noto-chaetae arranged in three tiers, first row short, slightly bent and unilimbate, second row slightly longer than first row and spear-shaped, third row long and lanceolate; chaetigers 6–10 as on anterior chaetigers, but chaetae of first row more sharply bent; in subsequent chaetigers short chaetae fewer, with longer chaetae increasing in number; no modified posterior noto-chaetae. Neuropodial lobes of chaetigers 2–4, 6 small, neurochaetae unilimbate. Bidentate hooded hooks from chaetiger 7; 3, 5 and 1 per series on anterior, median and posterior chaetigers in holotype; 3–4, 6–7, 1 in paratypes; no constriction on shaft, in anterior hooks angle between main fang and shaft  $>90^\circ$ , angle between teeth approximately  $45^\circ$ , accessory tooth decreasing in size until hooks in final eight (up to 11 in other specimens) chaetigers unidentate without hoods (Fig. 3F), number of chaetigers with unidentate hooks apparently not proportional to total number of chaetigers (Fig. 4); no companion chaetae with anterior hooded hooks in holotype, but present on one ramus each on chaetigers 7 and 8 in one specimen; last two chaetigers with fine capillary companion chaeta.

Chaetiger 5  $1.5\times$  length of preceding and succeeding chaetigers; five modified spines alternating with bilimbate companion chaetae (Fig. 3B), modified spines falcate with collar on convex side of curved end of spine, in worn spines collar appears as a narrow

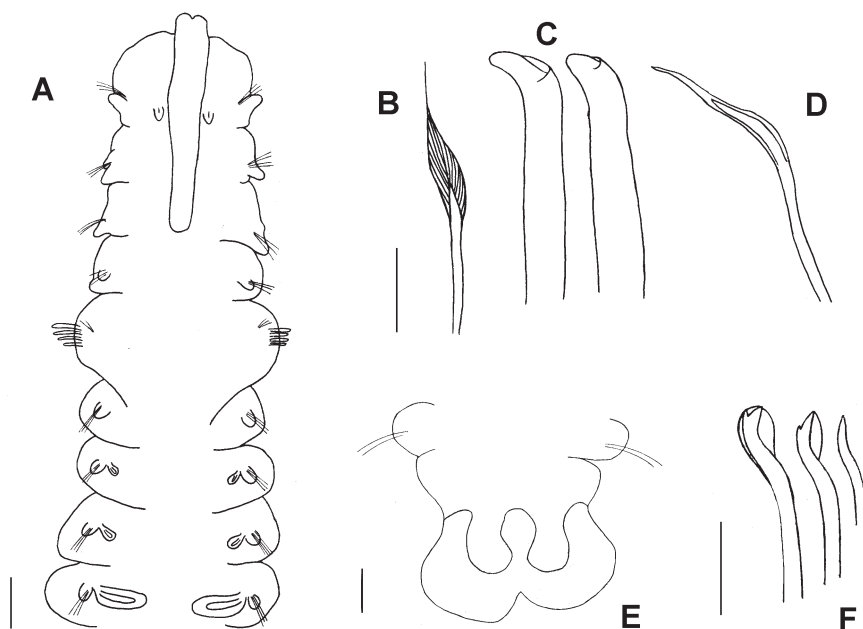


Fig. 3. *Dipolydora keulderae* sp. n., SAMC A60060: (A) dorsal anterior; (B–D) chaetiger 5: (B) winged companion chaeta, (C) modified spines on chaetiger 5 with collar on convex side, the collar may be worn and appear as a line in more worn spines, as in the spine on the right, (D) long noto-chaeta; (E) pygidium with four lobes; dorsal pair smaller than ventral; (F) from left to right, hooded hooks, from anterior, late middle and posterior chaetigers. Scale bars: A = 0.05 mm, B–F = 0.02 mm.

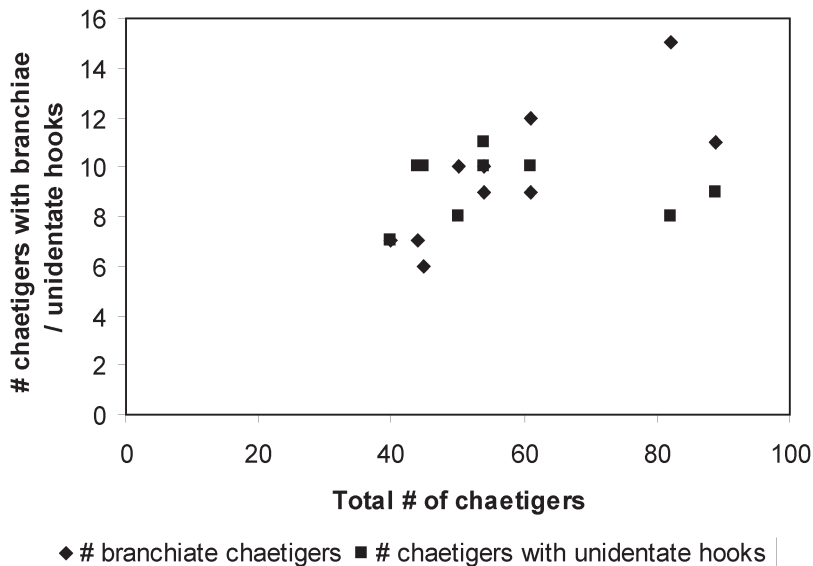


Fig. 4. *Dipolydora keulderae* sp. n., the relationships between number of branchiate chaetigers/chaetigers with unidentate hooks and total number of chaetigers.

ridge or cuff (Fig. 3C); dorsal fascicle of 3 or 4 geniculate bilimbate chaetae (Fig. 3D); fascicle of short unilimbate neurochaetae.

Branchiae from chaetiger 7 (Fig. 3A), first two pairs very small, first obvious pair on chaetiger 9; finger-like, individual branchiae not meeting at dorsal midline; 15 branchiate chaetigers in holotype, 6–12 in paratypes, in specimens with 40 to 60 chaetigers, number of branchiate chaetigers generally proportional to total number of chaetigers (Fig. 4), with longest worm with 89 chaetigers not having more branchiate chaetigers.

Pygidium reduced, with four lobes, dorsal pair smaller than ventral pair (Fig. 3E), in some specimens looks cuff-shaped.

Comparison: *D. keulderae* sp. n. belongs to the *D. bidentata*/*barbilla* group (*sensu* Blake, 1996). The species resembles all other members of this group in having a notched or bilobed prostomium, modified spines with a collar on the convex side of the curved end of the spine, and hooded hooks from chaetiger 7. *D. keulderae* most closely resembles *D. barbilla* Blake, 1980 and *D. pilocollaris* Blake & Kudenov, 1978. Generally, the length of the caruncle is the same in all three species. Common to *D. keulderae* and *D. barbilla* are the maximum number of hooded hooks and the loss of the second tooth in the hooded hooks; however, *D. barbilla* has heavy posterior notopodial spines (Blake 1980) that are lacking in *D. keulderae*. *D. keulderae* and *D. pilocollaris* are similar in the start of the branchiae and the absence of posterior notopodial spines, but differ with respect to the maximum number of hooded hooks per fascicle and the presence of unidentate hooks posteriorly (Blake & Kudenov 1978). *D. keulderae* differs from both species with respect to the fine structure of the modified spines on chaetiger 5 and companion chaetae: in both *D. barbilla* and *D. pilocollaris* the falcate spines have bristled collars, while the latter also has hastate companion chaetae. *D. keulderae* also has companion chaetae accompanying the hooded hooks for only the last two chaetigers

(the presence of a winged chaeta with only the hooded hooks on the right neuropodia on chaetigers 7 and 8 in one specimen suggests that this is an anomaly), while the other two species have companion chaetae with the anterior hooded hooks. *D. pilocollaris* also lacks notochaetae on chaetiger; in *D. keulderae* these notochaetae are present but very inconspicuous.

Holotype: SOUTH AFRICA: *Eastern Cape*: SAMC A60060, Canon Rocks, Port Alfred, coralline algae, 28.i.2005, C.A. Simon.

Paratypes: SOUTH AFRICA: *Western Cape*: SAMC A60061 (2), Struisbaai, host *Turbo sarmaticus*, 7.iii.2005, C.A. Simon; SAMC A60071 (6), Hermanus, host wild *Haliotis midae*, Anna Mouton (shells processed by Simone Neethling). *Eastern Cape*: SAMC A60062 (ethanol specimens), Port Elizabeth, host *Crassostrea gigas*, 21.x.2009, C.A. Simon.

Distribution: Found at Haga Haga, Canon Rocks and Kowie Rocks (Port Alfred), Port Elizabeth, Grootbank (Tsitsikamma), Mossel Bay, Struisbaai and Hermanus.

Habitat: Holotype found in coralline algae, but paratype found boring in the shells of *Crassostrea gigas* (Thunberg, 1793), *Turbo sarmaticus* L., 1758 and *Haliotis midae* L., 1758.

Genus *Polydora* Bosc, 1802  
***Polydora dinthwanyana* sp. n.**

Fig. 5

Etymology: From isiXhosa *dinthwa* (spot) and *-nyana* (diminutive suffix), referring to the pigmented spots that resemble freckles.

Description: Only two specimens, holotype complete, in two fragments, paratype anterior fragment. Holotype 7.5 mm for 70 chaetigers, 0.4 mm wide at chaetiger 5. Squat peristomium, width 0.2 mm, length 0.1 mm (Fig. 5A); body narrows posteriorly, penultimate chaetiger 0.2 mm wide (Fig. 5B). Prostomium rounded, entire; caruncle extending to end of chaetiger 2; no occipital tentacle; holotype with three eyes (Fig. 5A), paratype with four eyes, arranged in trapezoid. Pigmentation: prostomium, caruncle, peristomium and chaetigers 1–3 with yellow-brown spots; in holotype last three chaetigers without pigmentation, preceding 17 chaetigers spotted with yellow-brown pigment, but decreasing in intensity anteriorly (Figs 5A, 5B).

Chaetiger 1 notochaetae absent, with rounded notopodial lobes; chaetigers 2–4 notopodial lobes prominent, small, inconspicuous from chaetiger 6 and posteriorly. Chaetigers 2–4, 6–8, notochaetae arranged in three tiers, chaetae of first tier short, slightly bent, unilimbate chaetae, second tier with longer, straight unilimbate chaetae, third tier with long lanceolate chaetae; posterior chaetigers with only simple capillary chaetae of two lengths. No posterior modified spines. Chaetigers 1–6, neurochaetae unilimbate, of approximately equal lengths, neuropodial lobes well-developed. Bidentate hooded hooks from chaetiger 7, 5, 8 and 1 per series on anterior, middle and posterior chaetigers, last two chaetigers without hooded hooks. Hooks with constriction on shaft, with main tooth at a 90° angle to main shaft, 45° between main and accessory teeth (Fig. 5C). Single, fine companion chaeta accompanying hooded hooks only on last three chaetigers of paratype.

Chaetiger 5 1.5× size of preceding chaetigers; dorsal chaetae absent; five modified spines present alternating with long winged companion chaetae (Fig. 5D), spines curved with lateral flange visible in ventral view, resembling a tooth in some angles of view,

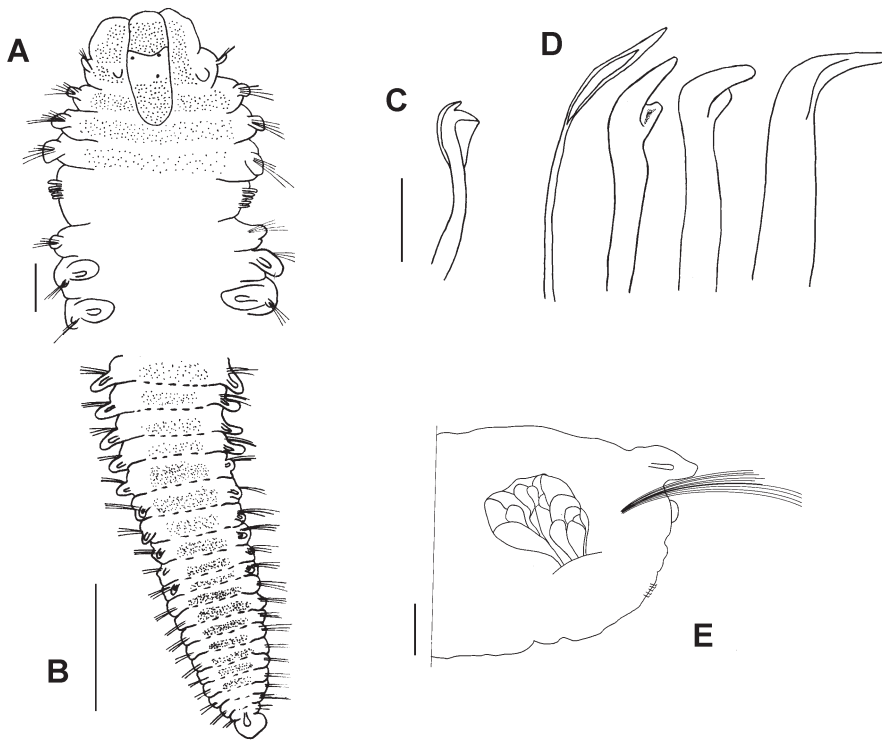


Fig. 5. *Polydora dinthwanyana* sp. n., SAMC A60067: (A) dorsal anterior; (B) dorsal posterior; (C) hooded hook; (D) chaetiger 5, from left to right: long bilimbate companion chaeta, ventral view of modified spine, modified spines from different angles; (E) cross-section of chaetiger 8. Scale bars: A = 0.1 mm, B = 0.5 mm, C–D = 0.02 mm, E = 0.05 mm.

or not visible, unworn spines sharply curved with sharp point (Fig. 5D); small tuft of neuropodial chaetae present.

Branchiae from chaetiger 7 (Fig. 5A); first two pairs short, with succeeding branchiae longer and thicker, tending to project outwards at  $90^\circ$  to axis of body (Figs 5B, 5E), 75% of chaetigers branchiate.

Pygidium small, rounded (Fig. 5B).

Glands in chaetigers 7–10 in paratype, with large sacs (Fig. 5E).

Comparison: *P. dinthwanyana* sp. n. belongs to the *P. ciliata* / *P. websteri* group (Blake 1996). It resembles *P. woodwicki* Blake & Kudenov, 1978 and *P. umangivora* Williams, 2001 with respect to the shape of the prostomium and peristomium, length of the caruncle, and the absence of an occipital tentacle and posterior modified notochaetae. All three species are shell-borers. *P. dinthwanyana* further resembles *P. woodwicki* in the shape of the notopodial lobes from chaetigers 1–4, the presence of a flange on the modified spines of chaetiger 5, number of eyes, maximum number of hooded hooks and in having a small pygidium, although the shape differs. Differences include the arrangement of anterior notochaetae in two tiers and the presence of superior dorsal fascicle of geniculate chaetae on chaetiger 5 in *P. woodwicki* (Blake & Kudenov 1978). *P. dinthwanyana* resembles *P. umangivora* in the arrangement of anterior notochaetae in

three tiers, the number of modified spines on chaetiger 5 and the absence of notochaetae on chaetiger 5; they differ with respect to the shape of the notopodial lobes of chaetiger 1, the modified spines of chaetiger 5 have flange not lateral tooth, size of the pygidia, the maximum number of hooded hooks and lack of bristles on hoods (Williams 2001). *P. dinthwanyana* differs from both species by having greatly curved unworn modified spines on chaetiger 5, companion chaetae with the hooded hooks of the last three chaetigers and 75 % of the chaetigers being branchiate.

Holotype: SOUTH AFRICA: *Eastern Cape*: SAMC A60067 (in two pieces), Haga Haga, host *Haliotis midae*, 25.ii.2005, C.A. Simon.

Paratype: same data as for holotype, SAMC A60070 (fragments, slides), host *Turbo sarmaticus*.

Distribution: Found only at Haga Haga on the east coast.

Habitat: Both specimens found boring into mollusc shells (*H. midae* and *T. sarmaticus*).

## RESULTS AND DISCUSSION

Five *Dipolydora* species (*D. cf. armata*, *D. capensis*, *D. cf. giardi*, *D. keulderae* sp. n. and *D. normalis*) and three *Polydora* species (*P. cf. ciliata*, *P. dinthwanyana* sp. n. and *P. cf. hoplura*) were recorded (Table 1). All but *D. normalis*, which was found in tubes on the shell surface, bored into the host shell. Species richness appears to decrease westwards, from seven species at Haga Haga, to five species each at Port Alfred and Grootbank and four each at Mossel Bay and Struisbaai. The farmed oysters at Port Elizabeth had only three species. Two species, *D. normalis* and *P. dinthwanyana*, were recorded only at Haga Haga, while *P. cf. ciliata* was found only on the farmed oysters in Port Elizabeth. The rest of the species were found at most sites sampled, suggesting that they do not have discrete distributions. The distribution of *D. capensis* and *D. cf. giardi* in the current study corresponds with that given by Day (1967), while the records of *P. cf. hoplura* in Haga Haga correspond with earlier distribution records (Day 1967; Nel *et al.* 1996; Simon *et al.* 2006). In contrast, the records of *D. normalis* at Haga Haga and *P. ciliata* at Port Elizabeth represent a southward expansion of the ranges of these species. Day (1967) considered the single record of *D. cf. armata*, from an unknown locality, as dubious, yet it occurred commonly in the wild hosts sampled here, and was present on farmed abalone in Haga Haga. The absence of *D. cf. flava* and *D. maculata* in the current study is not surprising; the former species inhabits sandy sediments while the latter is associated with hermit crabs (Day 1967).

Most shell-boring polydorid species do not show host specificity (e.g., Moreno *et al.* 2006; Sato-Okoshi *et al.* 2008), and the results of the current study support this. *Polydora cf. hoplura* and *D. capensis* were the most catholic with respect to their host preferences, infesting seven hosts each (excluding the unidentified limpets) and were also the most abundant. The other species were recorded on one to three hosts, and seldom in great numbers. The two *Haliotis* species and *Turbo sarmaticus* hosted the most species; one or the other would host all the species recorded at each site compared to the other hosts. These results suggest that infestation of a host is a function of its size and habitat—the *Haliotis* species and *Turbo sarmaticus* are larger, and possibly longer-lived, than the other host species sampled and occur in the subtidal where they could be exposed to potential settling larvae almost continuously. In older or longer-lived animals the diversity of shell-borers can also increase due to the presence of secondary borers

(Evans 1969). As the shell ages, it is eroded by the boring activity of primary borers. When these polychaetes die, they can be replaced by secondary borers which will settle in the abandoned burrows, often enlarging them as they grow.

Previous studies identified polydorid worms commonly infesting farmed abalone and oysters as far west as Saldanha Bay and Jakobsbaai: common to both are *Polydora* cf. *hoplura* and *Boccardia proboscidea*, while the abalone are often also infested by *Dipolydora capensis* (Nel *et al.* 1996; Simon *et al.* 2006; Simon & Booth 2007; Haupt *et al.* 2010). In the current study farmed oysters were also infested by *P.* cf. *ciliata*, a common borer of molluscs in other locations (e.g., Radashevsky *et al.* 2006; Walker 2011), and a few individuals of *Dipolydora keulderae*, while farmed abalone were also infested by low numbers of *Dipolydora* cf. *armata* and *D. normalis*. Thus the species that have been recorded as problematic, or which have the potential to become problematic, are either cryptogenic (*P.* cf. *ciliata* and *P.* cf. *hoplura* were first recorded locally in the 1950s, although the latter species is considered invasive (Day 1955, 1957; Haupt *et al.* 2010)) or a recent invader (*B. proboscidea*, Simon *et al.* 2009). In South Africa, cultured oysters are often moved between farms and geographical zones (Dr K. Christison, Marine Aquaculture Diseases, Department of Agriculture, Forestry and Fisheries, pers. comm.), which could inadvertently spread the worm, as occurred with *B. proboscidea* on abalone (Simon *et al.* 2009). The presence of *P.* cf. *ciliata* in Port Elizabeth and *B. proboscidea* in Saldanha Bay (Haupt *et al.* 2010) therefore suggests that caution should be exercised with continued movement of oysters. Detailed epidemiological surveys of internal parasites and polydorid worms associated with oysters and abalone from different zones in South Africa are currently underway. The results should provide more information towards formulating policies governing the movement of oysters.

Of the eight species recorded in this study, three species are considered cosmopolitan (*D.* cf. *armata*, *P.* cf. *ciliata* and *P.* cf. *hoplura*), while the identification of *D.* cf. *giardi* still needs to be clarified. There is increasing evidence to suggest that many records of cosmopolitan species may in fact be erroneous. For example, *P.* cf. *ciliata* has been demonstrated to be a complex of several morphologically similar species (Manchenko & Radashevsky 1998), while *P.* cf. *hoplura* and *P. uncinata* are easily confused (cf. Day 1967; Blake & Kudenov 1978; Sato-Okoshi 1998). Similarly, the cosmopolitan distribution of *D.* cf. *armata* has also been questioned (Delgado-Blas & Salazar-Silva 2011). A systematic review, including detailed morphological descriptions and molecular investigations of these species, is therefore being conducted to clarify their identifications and invasive status. Similarly, examination of the specimens identified as *D. capensis* suggest that there may in fact be several morphologically similar species. This, too, will be addressed later.

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## REFERENCES

- BLAKE, J.A. 1980. *Polydora* and *Boccardia* species (Polychaeta: Spionidae) from western Mexico, chiefly from calcareous habitats. *Proceedings of the Biological Society of Washington* **93**: 947–962.
- 1996. Family Spionidae Grube, 1850. In: Blake, J.A., Hilbig, B. & Scott, P.H., eds, *Taxonomic atlas of the benthic fauna of the Santa Barbara Basin and Western Santa Barbara Channel*. Vol. 6. The Annelida. Part 3. Polychaeta: Orbiniidae to Cossuridae. Santa Barbara, Ca., USA: Santa Barbara Museum of Natural History, pp. 81–224.
- BLAKE, J.A. & KUDENOV, J.D. 1978. The Spionidae (Polychaeta) from south-eastern Australia and adjacent areas with a revision of the genera. *Memoirs of the Natural Museum of Victoria* **39**: 171–280.
- DAY, J.H. 1955. The Polychaeta of South Africa. Part 3. Sedentary species from Cape shores and estuaries. *Journal of the Linnean Society, Zoology* **42**: 407–452.
- 1957. The Polychaeta fauna of South Africa. Part 4. New species and records from Natal and Moçambique. *Annals of the Natal Museum* **14** (1): 59–129.
- 1967. *Polychaeta of Southern Africa. Part 2 Sedentaria*. London: Trustees of the British Museum (Natural History).
- DELGADO-BLAS, V.H. & SALAZAR-SILVA, P. 2011. Taxonomic catalogue of the Spionidae (Annelida: Polychaeta) of the Grand Caribbean. *Zootaxa* **2782**: 39–66.
- EVANS, J.W. 1969. Borers in the shell of the sea scallop, *Placopecten magellanicus*. *American Zoologist* **9**: 775–782.
- HAUPT, T.M., GRIFFITHS, C.L., ROBINSON, T.B. & TONIN, A.F.G. 2010. Oysters as vectors of marine aliens, with notes on four introduced species associated with oyster farming in South Africa. *African Zoology* **45** (1): 52–62.
- MANCHENKO, G.P. & RADASHEVSKY, V.I. 1998. Genetic evidence for two sibling species within *Polydora* cf. *ciliata* (Polychaeta: Spionidae) from the Sea of Japan. *Marine Biology* **131**: 489–495.
- MORENO, R.A., NEILL, P.E. & ROZBACZYLO, N. 2006. Native and non-indigenous boring polychaetes in Chile: a threat to native and commercial mollusc species. *Revista Chilena de Historia Natural* **79**: 263–278.
- NEL, R., COETZEE, P.S. & VAN NIEKERK, G. 1996. The evaluation of two treatments to reduce mud worm (*Polydora hoplura* Claparede) infestation in commercially reared oysters (*Crassostrea gigas* Thunberg). *Aquaculture* **141**: 31–39.
- RADASHEVSKY, V.I., LANA, P.C. & NALESSO, R.C. 2006. Morphology and biology of *Polydora* species (Polychaeta: Spionidae) boring into oyster shells in South America with the description of a new species. *Zootaxa* **1353**: 1–37.
- SATO-OKOSHI, W. 1998. Three new species of polydorids (Polychaeta, Spionidae) from Japan. *Species Diversity* **3**: 277–288.
- SATO-OKOSHI, W., OKOSHI, K. & SHAW, J. 2008. Polydorid species (Polychaeta: Spionidae) in south-western Australian waters with special reference to *Polydora uncinata* and *Boccardia knoxi*. *Journal of the Marine Biological Association of the United Kingdom* **88**: 491–502.
- SCHLEYER, M.H. 1991. Shell-borers in the oyster, *Striostrea margaritacea*: pests or symbionts? *Symbiosis* **10**: 135–144.
- SIMON, C.A. 2009. *Pseudopolydora* species associated with mollusc shells on the south coast of South Africa, with the description of *Ps. dayii*, sp nov. *Journal of the Marine Biological Association of the United Kingdom* **89** (4): 681–687.
- SIMON, C.A. & BOOTH, A.J. 2007. Population structure and growth of polydorid polychaetes that infest the cultured abalone, *Haliotis midae*. *African Journal of Marine Science* **29**: 499–509.
- SIMON, C.A., LUDFORD, A. & WYNNE, S. 2006. Spionid polychaetes infesting cultured abalone, *Haliotis midae*, in South Africa. *African Journal of Marine Science* **28** (1): 167–171.
- SIMON, C.A., THORNHILL, D.J., OYARZUN, F. & HALANYCH, K.M. 2009. Genetic similarity between *Boccardia proboscidea* from Western North America and cultured abalone, *Haliotis midae*, in South Africa. *Aquaculture* **294**: 18–24.
- SIMON, C.A., WORSFOLD, T.M., LANGE, L. & STERLEY, J. 2010. The genus *Boccardia* (Polychaeta: Spionidae) associated with mollusc shells on the south coast of South Africa. *Journal of the Marine Biological Association of the United Kingdom* **90** (3): 585–598.
- WALKER, L.M. 2011. A review of the current status of the *Polydora* complex (Polychaeta: Spionidae) in Australia and a checklist of recorded species. *Zootaxa* **2751**: 40–60.
- WILLIAMS, J.D. 2001. *Polydora* and related genera associated with hermit crabs from Indo-West Pacific (Polychaeta: Spionidae), with descriptions of two new species and a second polydorid egg predator of hermit crabs. *Pacific Science* **55** (4): 429–465.