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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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. dinthwanyana 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. dinthwanyana and P. cf. hoplura) 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. dinthwanyana 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 dinthwanyana, 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. hoplura (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. hoplura inhaca), were recorded in Mozambique. Of these, D. capensis, P. hoplura, 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% HNO₃ 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.](https://bioone.org/journals/African-Invertebrates/issue/52(1)/2011/PDF/2011-0000052011-0000000046.pdf)
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 spadacae*, *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.

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**TAXONOMY**

Family Spionidae Grube, 1850

Genus *Dipolydora* Verrill, 1879

*Dipolydora normalis* (Day, 1957)

**Figs 2A–D**


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 notochaetae emerging anterior to notopodial lobe, not always obvious (Fig. 2A); chaetigers 2–4, notochaetae 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 notochaetae; 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°, but smaller than is usual for other *Dipolydora* species, angle between teeth approximately 45° (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.](https://bioone.org/journals/African-Invertebrates on 09 Jun 2020 Terms of Use: https://bioone.org/terms-of-use)
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 abranchiate, 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 abranchiate, 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.


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 notochaeta emerging anterior to lobe (Fig. 3A; lobes orientated posteriorly to show short notochaetae), neuropodial lobe small, inconspicuous, tuft of unilimbate neurochaetae; chaetigers 2–4, notochaetae 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 notochaetae. 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°, angle between teeth approximately 45°, 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× 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 notochaeta; (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.
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 in specimens with 40 to 60 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.

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,
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° 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 fascicile 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.


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 Polycladura 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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