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A complex didemnid ascidian from Whangamata, New Zealand

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An undescribed species of the genus *Didemnum* (Didemnidae) reported from installations in Whangamata Harbour (Coromandel Peninsula), has a unique and conspicuous three-dimensional growth form (possibly associated with vertical and undersurfaces it occupies). It is also distinguished by a combination of the few characters available to define these small, simplified, convergent organisms. Its stellate spicules are sparse except for a patchy layer in the surface test, primary common cloacal canals are the full depth of the zooids, nine vas deferens coils surround the testis, the gut is long forming a double loop, and larvae have six pairs of ectodermal ampullae. Eleven species said to belong to this genus have previously been reported from New Zealand, but only six are valid *Didemnum* spp., and they all are distinguished readily from the present species. Nevertheless, there is no evidence that the new species is introduced, and the simplest explanation of it occurrence is that it is part of the little known indigenous didemnid fauna of New Zealand.

INTRODUCTION

Late in 2001 a large, rapidly growing species of the genus *Didemnum* (Ascidiacea, Tunicata) was found (by the Harbour Master, Mr M. Martin) in Whangamata Harbour, an estuarine location mainly used by recreational craft. The ascidian colonies dominate communities on 112 of the 130 mooring posts and on some of the infrequently-used anchored boats. Similar colonies had not been observed previously and this apparently sudden colonization raised fears that the species was introduced and a threat to the aquaculture industry. The New Zealand ascidian fauna, beyond intertidal and shallow sublittoral depths (see Brewin, 1946–1960) and the limited benthic habitats sampled in New Zealand oceanographic surveys (see Millar, 1982), has been neglected and localities accessible to SCUBA divers have not usually been explored for these organisms. At this stage there is no evidence that would suggest that the species is other than indigenous, although this would not preclude its status as a pest species and this is being monitored.

Although the species is undescribed, its growth form resembles that of other didemnids in similar habitats (see *Tridemnum vermiforme* Kott, 2001) on vertical substrates which do not obstruct a three dimensional habit and accommodate the rapid exponential growth that is not restricted by substrate availability. The habit of overgrowing and smothering other epibionts destabilizes the colonies and causes them to fall off the vertical substrata they have colonized. When firmly attached, the finger- and flag-like surface lobes are wafted about by the prevailing currents and surges, reminiscent of the behaviour of stalked ascidians in all taxa (see Kott, 1989). The growth form of this species on natural substrata is not known.

SYSTEMATICS

Didemnum vexillum sp. nov.
(Figures 1–10)

Type material

(Whangamata Harbour, Coramandel Peninsula, North Island, New Zealand).

Holotype: colony on wooden pile mooring, 0.3–0.5 m [MNZ AS259; QM G308589 (sample of holotype colony)]. Collected by B.T. Coffey 18 January 2002.

Paratype: collection data as for holotype [QM G308588].

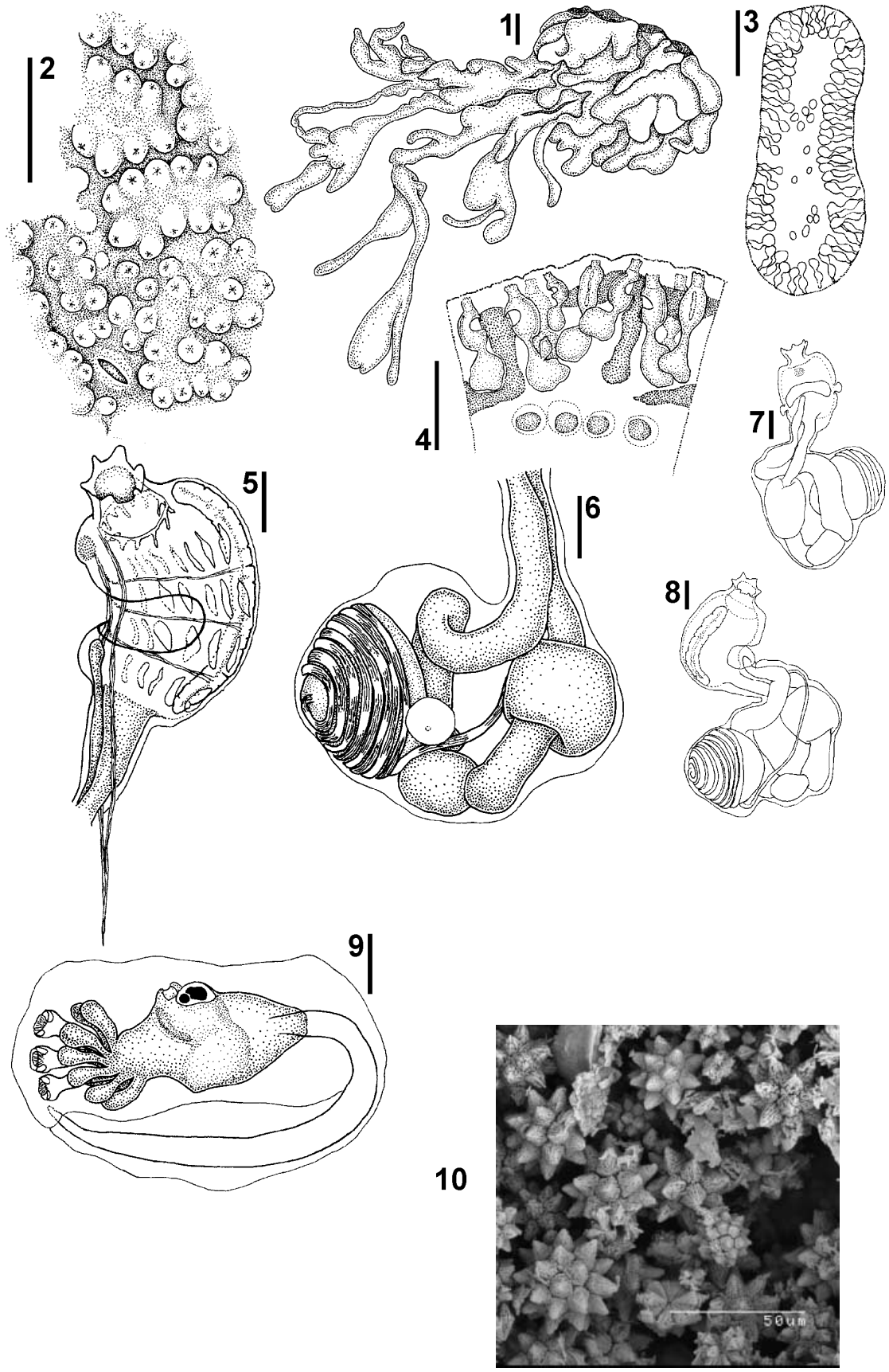
Further record

(Queen Charlotte Sound, South Island New Zealand). Colony from hull of barge 'Steel Mariner', 2 m [QM G308486]. Collected by M. Page 10 May 2002.

(Abbreviations for museums in which types are lodged: MNZ, New Zealand National Museum-Te Papa, Wellington, New Zealand; QM, Queensland Museum, Brisbane, Australia.)

Description

Colony. Colonies are extensive, thin sheets overgrowing themselves and other epibionts, fusing with other parts of their surface to enclose secondary spaces and form thick sponge-like masses. Flexible, irregular, long, flat, leaf-, frond- or flag-like, cylindrical and often branched outgrowths or processes project from the surface, sometimes separated from it by a narrow constriction. The outgrowths also may overgrow their own surface or appear to be folded with the apposed surfaces fused together. Some of the outgrowths result from the colony encrusting weed or worm tubes but many are solid with a firm gelatinous test core. Both have zooids opening all



Figures 1–10. (1) Outline of part of colony; (2) colony surface showing branchial apertures; (3) cross section of colony lobe showing zooid layer at surface, and embryos in test core; (4) vertical section of part of colony showing zooids, embryos and common cloacal canals (darkly shaded); (5) thorax; (6) abdomen; (7) whole zooid, dorsal view; (8) whole zooid ventro-lateral view; (9) larva; (10) spicules. Scale bars: 1, 1 cm; 2&3, 2.0 mm; 4, 1.0 mm; 5–10, 0.1 mm.

around their surface. Often they appear to have terminal common cloacal apertures, but these are the tips of overgrown substrate (sometimes worm-tubes) which have not been closed in by the growing ascidian colony. In living specimens, the outgrowths move with the currents and resemble macro-algal fronds.

Colonies are a yellowish cream, the yellow colour conferred by the yellow gut loop, eggs and embryos. Thoraces are white. Stellate calcareous spicules are unevenly distributed in a patchy layer in the surface and sometimes line the common cloacal cavities. They are sparse in the remainder of the test. They are up to 0.058 mm diameter with nine to 11 robust conical rays in optical transverse section. Zooids are small, arranged along each side of circular to long primary common cloacal canals that extend the full depth of the zooids. Shallow secondary canals penetrate amongst the thoraces in the areas surrounded by the primary canals. Randomly distributed sessile common cloacal apertures are sometimes only 1 cm apart.

Zooids. Zooids are about 1 mm overall, the abdomen about twice the size of the contracted thorax. The branchial syphon is short with six small pointed projections around the rim of the aperture. A large spherical clump of crowded spicules from the lateral organ projects from the test each side of the posterior end of the large sessile atrial aperture, which exposes most of the branchial sac directly to the common cloacal cavity. Eight or nine stigmata are in the anterior row of the branchial sac. A short retractor muscle projects from halfway down the moderately long oesophageal neck (about the same length as the thorax). Oesophageal buds are developing. The postpyloric part of the gut loop is long and flexed ventrally forming a double loop. It has the usual divisions—a cylindrical duodenal part, short posterior stomach and long rectum. Nine coils of the vas deferens surround the spherical to oval testis which, with a single egg ovary, lie against the dorsal side of the flexed part of the gut loop, i.e. almost behind it. Both testes and ovary appear to be mature in the examined specimens, but although some embryos are being incubated in the basal test or in the central test (of surface protuberances), only few are well advanced. The larval trunk is 0.6 mm long with the tail wound almost halfway around it (barely to its anterior end). Six long ectodermal ampullae are each side of the three antero-median adhesive organs. A large, yellow yolk mass is beneath the oozooid in less mature larvae.

Remarks

Eleven species from New Zealand have been assigned to the genus *Didemnum*. This includes the records of Nott (1892), Sluiter (1900), Michaelsen (1924), Brewin (1946–1960) and Millar (1982). Of these, three are *Polysyncraton* spp., viz *P. lithostrotum* (Brewin, 1956), *P. mortenseni* (Michaelsen, 1924) and *P. densum* (Nott, 1892). *Didemnum studeri* Hartmeyer, 1911 has two testis follicles; *D. lambitum* (Sluiter, 1900) has distinctive colony lobes with terminal common cloacal apertures; and *D. tuberatum* (Nott, 1892) has small (to 0.03 mm diameter) spicules, with distinctive sharply pointed rays, crowded throughout. The other *Didemnum* spp., viz *D. candidum* (see below), *D. chilense*: Brewin, 1950c, *D. maculatum* (Nott, 1892) and *D. niveum* (Nott, 1892) are less readily distinguished.

Many *Didemnum* colonies from New Zealand have been assigned to *D. candidum* by Brewin (Brewin, 1946, 1948, 1950a,b,c, 1951, 1952, 1956, 1957, 1958a,b, and 1960) but there is no evidence that any of these specimens are, or are anything like, either *D. candidum* Savigny, 1816, or the Whangamata specimens. Only the specimens from Otago (Brewin, 1946) were described, but the description may be of a mixture of species. Millar (1982) also suggested, that specimens from Otago with spicules, 8–12 stigmata per row and one, two or three testis follicles (Brewin, 1946) are not specimens of *D. candidum* if, indeed, they are conspecific (see also Kott, 2001 for a discussion of *D. candidum*). *Didemnum chilense*: Brewin, 1950c is probably misidentified and maybe conspecific with one or another of the specimens she assigned to *D. candidum* in other works.

Didemnum maculatum (Nott, 1892) from Auckland Harbour is an encrusting colony, light brown with spicule patches (dull white spots) above the zooids. Like the specimens from Whangamata, it also has a layer of spicules just beneath the upper surface. However, although their exact spicule size is not known, spicules of *D. maculatum* appear to be about 0.03 mm in diameter (if it is assumed that the spicules of *D. niveum* are not more than 0.1 mm diameter), zooids have especially long oesophageal necks, and the Whangamata species does not appear to be conspecific.

Michaelsen (1924) thought *D. niveum* (Nott, 1892) to be a junior synonym of *D. candidum* (on the basis of its variable spicules). However, neither *D. niveum* nor *D. candidum* have either a diversity of spicules or variable ones (see Nott, 1892; Kott, 2001). Nevertheless, although both species have spicules crowded throughout the test, they are different species, *D. candidum* having a horizontal cloacal cavity only while *D. niveum* has well developed cloacal canals in the upper layer of test and numerous large canals in the lower layer (below the zooids). Some of these common cloacal spaces in *D. niveum* open to the exterior and may reflect complex folding of the colony such as that found in the newly recorded—but much more complex—colonies, which also have stellate spicules to about 0.06 mm diameter, eight or nine stigmata per row and nine coils of the vas deferens. However although the colony form of the Whangamata material with protrusions from the surface with narrow constrictions at their base may be the result of the habitat in which it is growing, the sparse distribution of spicules in the lower half of the colony and the uneven patchy layer at the surface constitute a significant distinction from what is known of *D. niveum*.

The spicules of the newly recorded colonies are similar to but larger than those of *D. spadix* Kott, 2001 which has spicules to 0.045 mm diameter and more numerous vas deferens coils and stigmata. *Didemnum sucosum* Kott, 2001 has similar but larger spicules. Species recorded from other geographical areas with the same combination of zooids, spicules, larvae and colonies are not known (see Kott, 2001).

With one exception (the Antarctic *D. studeri*), the species of *Didemnum* known from New Zealand are all indigenous. Species with a wider geographical range could be found to occur following more extensive exploration of habitats available to SCUBA divers and when the specimens previously assigned to *Didemnum candidum* are revised.

I am grateful to Dr Brian T. Coffey for sending beautifully narcotized and fixed material, notes on the habit and habitat of the organism in its type location and a video film of the living colony *in situ*. My investigations on this organism as a consultant to the New Zealand Ministry of Fisheries were initiated by Dr C. O'Brien, Chief Technical Officer, Marine Biosecurity. Subsequent work on its relationships and the preparation of this paper were done while I was in receipt of a grant from the Australian Biological Resources Survey (ABRS). I am also grateful to my assistant, Daniel Schmidt, who prepared the figures and the scanning electron micrograph of the spicules.

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