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The Marine Fauna of New Zealand: Ascidiacea

by

R. H. MILLAR

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The Marine Fauna of New Zealand: Ascidiacea

by

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ABSTRACT

An account is given of ascidians in hitherto undescribed collections from the waters of New Zealand and adjacent areas. Twenty-two of these are described as new species. Brief descriptions are also given of other species previously recorded.

Keywords: ascidians, taxonomy, new species, geographical distribution, New Zealand region.

INTRODUCTION

In the present century important contributions to our knowledge of New Zealand ascidians have been made, especially by Michaelsen (1922, 1924) who described material from Mortensen's Pacific Expedition 1914–1916 and reviewed earlier work, and by Brewin in a series of papers published between 1946 and 1960. A useful checklist of species was produced by Croxall (1972).

The following account deals principally with collections made in the course of the extensive sampling programme being carried out in New Zealand waters by the New Zealand Oceanographic Institute. In addition, specimens are included which were collected through the Portobello Marine Laboratory and the Zoology Department, University of Canterbury. The remaining species, previously recorded from the area but not represented in the new collections, are also described briefly.

The geographical area under consideration comprises the waters around the North and South Islands, Stewart Island, Chatham Islands, Campbell Island, Auckland Islands and Macquarie Island. Comparatively little collecting was done on the shore; most specimens are from the continental shelf in 10–150 m and a few were collected from greater depths.

Ascidians present many taxonomic problems, and identification of species is most reliable when based on an assemblage of features rather than on single key characters, because characters may vary considerably with age, environmental conditions, or phase of the life cycle. Dichotomous keys to ascidian species, therefore, can be deceptive and have not been prepared for the present account of New Zealand species. For generic identification the tabular keys of Monniot and Monniot (1972) should be consulted.

The following are described as new species:

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Inset 1

Clavelina michaelseni
Synoicum otagoensis
Synoicum occidentalis
Synoicum apectetum
Aplidium quadriversum
Aplidium pseudoradiatum
Aplidium unicornum
Aplidium glaphyrum
Aplidium amphibolum
Aplidium chthamalum
Aplidium orthium
Aplidium gilvum
Pharyngodictyon elongatum
Leptoclinides duminus
Ascidia stewartensis
Ascidia macropapilla
Cnemidocarpa rectofissura
Polycarpa zeteta
Styela gracilocarpa
Eugyra munida
Molgula bathamae
Molgula longivascula

LIST OF STATIONS

The following N.Z. Oceanographic Institute Station List is in abbreviated form, particularly in the field notes where records of individual occurrences of animals noted in the field but not relevant to this paper have been omitted.

"Z" numbers used within the N.Z. Oceanographic Institute denote material from other sources or material collected by staff members before their association with the Institute, but subsequently donated to the Institute.

Numbers enclosed in brackets following the species names indicate the number of specimens collected.

The following abbreviations for equipment are used: CG–gravity corer; DCM–cone dredge with cylindrical steel wire mesh bag; DCMB–cone dredge with cylindrical steel wire mesh bag with canvas bag as inner lining; DD–Devonport dredge (modified naturalist's dredge, rectangular, with steel wire mesh bag); DIS–ironsand dredge; GHO–Hayward orange-peel grab (with metal plates added); GLO–large orange-peel grab; GOP–orange-peel grab; TAL–Agassiz trawl with 6′ netting bag; TAM–Agassiz trawl with 4′ netting bag; TAS–Agassiz trawl with 3′ netting bag; TM–Menzies trawl.

NEW ZEALAND OCEANOGRAPHIC INSTITUTE (NZOI)

A694 (1 March 1962) 54°40.9′S, 158°54.8′E. Depth 95 m. DCMB.

Molgula macquariensis Kott (1)
Molgula longivascula sp.n. (1)

A695 (1 March 1962) 54°36.4′S, 158°57′E. Depth 91 m. DD.

Corella eumyota Traustedt (1)
Pyura pilosa Monniot & Monniot (>100)
Molgula macquariensis Kott (86)
Molgula pulchra Michaelsen (2)
Molgula longivascula sp.n. (38)

A696 (1 March 1962) 54°37.7′S, 158°57′E. Depth 433 m. DD.

Aplidium quadriversum sp.n. (11)
Aplidium pseudoradiatum sp.n. (5)
Didemnum studeri Hartmeyer (about 40)
Corella eumyota Traustedt (many)
Polyzoa reticulata (Herdman) (several colonies)
Oligocarpa megalorchis Hartmeyer (7)
Pyura pilosa Monniot & Monniot (1)
Molgula macquariensis Kott (6)
Molgula pulchra Michaelsen (9)
Molgula longivascula sp.n. (2)

A698 (1 March 1962) 54°29.3′S, 158°59.3′E. Depth 183 m. DCM.

Pyura pilosa Monniot & Monniot (1)
Molgula longivascula sp.n. (2)

A715 (5 November 1962) 47°41′S, 179°03′E. Depth 121 m. DCM.

Didemnum mortenseni Michaelsen (many)

A852 (28 August 1963) 47°16.5′S, 167°48.5′E. Depth 135 m. DCMB.

Ritterella sigillinoides (Brewin) (3, or pieces of a broken colony)

A853 (28 August 1963) 47°15′S, 167°55′E. Depth 101 m. DCMB.

Botryllus stewartensis Brewin (several colonies or pieces)

A862 (28 August 1963) 47°16.6′S, 167°20.7′E. Depth 146 m. DCMB.

Cystodytes dellechiajei (Della Valle) (2)

A887 (31 August 1963) 45°15.5′S, 171°27.5′E. Depth 135 m. DCMB.

Cnemidocarpa stewartensis Michaelsen (6)
Pyura trita (Sluiter) f. *typica* Michaelsen (1)
Pyura trita (Sluiter) f. *crinita* Michaelsen (5)

A891 (8 September 1963) 43°22′S, 177°11′E. Depth 263 m. DCMB.

Pyura trita (Sluiter) f. *typica* Michaelsen (1)

A892 (8 September 1963) 43°17′S, 177°11′E. Depth 253 m. DCMB.

Pyura trita (Sluiter) f. *typica* Michaelsen (6)

A907 (13 September 1963) 43°41′S, 179°18′W. Depth 412 m. DCM.

Adagnesia antarctica Kott (1)

A910 (13 September 1963) 43°04′S, 178°39′W. Depth 549 m. Manihiki dredge.

Polyclinum sp. (1)

A916 (15 September 1963) 43°58.5′S, 179°11′W. Depth 274 m. Manihiki dredge.

Pyura trita (Sluiter) f. *crinita* Michaelsen (4)

A917 (15 September 1963) 43°56′S, 179°15′W. Depth 203 m. Manihiki dredge.

Pyura trita (Sluiter) f. *crinita* Michaelsen (1)

B215 (20 May 1960) 46°50′S, 168°31.5′E. Depth 32 m. DIS.

Pyura pachydermatina (Herdman) (10)

B216 (20 May 1960) 46°50′S, 168°23′E. Depth 22 m GLO.

Cystodytes dellechiajei (Della Valle) (1)
Corella eumyota Traustedt (1)

B218 (21 May 1960) 46°50′S, 168°09.8′E. Depth 39 m. DIS.

Corella eumyota Traustedt (1)
Pyura trita (Sluiter) f. *typica* Michaelsen (3)
Molgula mortenseni (Michaelsen) (2)

B221 (21 May 1960) 46°40′S, 168°16.8′E. Depth 31 m. GLO, DIS.

Pareugyrioides filholi (Pizon) (2)

B222 (21 May 1960) 46°40.3′S, 168°24.2′E. Depth 27 m GLO, DIS.

Corella eumyota Traustedt (1)

B223 (21 May 1960) 46°45′S, 168°24.2′E. Depth 26 m. GLO, DIS.

Corella eumyota Traustedt (1)
Asterocarpa cerea (Sluiter) (1)
Pyura trita (Sluiter) f. *crinita* Michaelsen (1)
Pareugyrioides filholi (Pizon) (4)

B228 (22 May 1960) 46°45′S, 168°02.5′E. Depth 38 m. GLO, DIS.

?*Ascidia stewartensis* sp.n. (1)

B231 (22 May 1960) 46°55′S, 168°11.5.′E. Depth 21 m. GLO, DIS.

Corella eumyota Traustedt (2)

B233 (23 May 1960) 46°39.7′S, 167°48′E. Depth 37 m. GLO, DIS.

Cnemidocarpa bicornuta (Sluiter) (1)
Cnemidocarpa nisiotis (Sluiter) (3)
Pyura trita (Sluiter) f. *crinita* Michaelsen (2)
Molgula mortenseni (Michaelsen) (3)
Molgula herdmani Brewin (1)

B237 (23 May 1960) 46°35′S, 168°11′E. Depth 25 m. GLO, DIS.

Corella eumyota Traustedt (2)

B248 (26 May 1960) 46°25′S, 168°02.5′E. Depth 17 m. GLO, DIS.

?*Corella eumyota* Traustedt (1)

B250 (26 May 1960) 46°22.5′S, 168°06′E. Depth 11 m. GLO, DIS.

Pyura pachydermatina (Herdman) (4)
Pareugyrioides filholi (Pizon) (2)

B254 (27 May 1960) 46°37′S, 168°32.2′E. Depth 14 m. GLO, DIS.

Corella eumyota Traustedt (1)
Molgula mortenseni (Michaelsen) (1)

B255 (27 May 1960) 46°36.7′S, 168°38.3′E. Depth 12 m. GLO, DIS.

Pyura pachydermatina (Herdman) (3)

B256 (27 May 1960) 46°36.7′S, 168°45.3′E. Depth 21 m. GLO, DIS.

Pyura pachydermatina (Herdman) (1)

B258 (27 May 1960) 46°40′S, 168°38.3′E. Depth 19 m. GLO, DIS.

Pyura pachydermatina (Herdman) (10)

B264 (27 May 1960) 43°39.5′S, 168°07′E. Depth 17 m. DO, DIS.

Pyura pachydermatina (Herdman) (10)
Pareugyrioides filholi (Pizon) (2)

B265 (28 May 1960) 46°55.5′S, 168°09.8′E. Depth 23 m. GLO, DIS.

Pareugyrioides filholi (Pizon) (1)

B270 (29 May 1960) 46°42′S, 169°00′E. Depth 33 m. GLO, DIS.

Molgula mortenseni (Michaelsen) (3)
Molgula herdmani Brewin (1)

B271 (29 May 1960) 46°41.5′S, 168°52.8′E. Depth 21 m. GLO, DIS.

Molgula mortenseni (Michaelsen) (4)

B272 (29 May 1960) 46°44′S, 168°31.4′E. Depth 21 m. GLO, DIS.

Pyura pulla (Sluiter) (2)
?*Pyura trita* (Sluiter) f. *typica* Michaelsen (1)
?*Pyura trita* (Sluiter) f. *crinita* Michaelsen (1)

B540 (4 October 1962) 42°00′S, 174°15.5′E. Depth 126 m. DCM.

Pyura trita (Sluiter) f. *typica* Michaelsen (2)

B548 (5 October 1962) 43°19.2′S, 173°28.8′E. Depth 110 m. GLO, DCM.

Pyura trita (Sluiter) f. *typica* Michaelsen (4)

B563 (7 October 1962) 45°18.4′S, 171°15′E. Depth 71 m. DCM.

Cnemidocarpa stewartensis Michaelsen (1)
Cnemidocarpa bicornuta (Sluiter) (12)

B568 (8 October 1962) 46°00′S, 170°43.2′E. Depth 75 m. DCM.

Pyura trita (Sluiter) f. *crinita* Michaelsen (5)

Inset 1*

B665 (25 October 1962) 38°01.8′S, 174°00.8′E. Depth 126 m. TAL.

?*Didemnum lambitum* (Sluiter) (2)

B666 (25 October 1962) 38°02.0′S, 173°55.8′E. Depth 170 m. TAL.

Didemnum lambitum (Sluiter) (1)

B669 (25 October 1962) 37°18.7′S, 174°06.2′E. Depth 130 m. TAL.

Pareugyrioides filholi (Pizon) (2)

B672 (26 October 1962) 36°40′S, 174°03.3′E. Depth 75 m. TAL.

Pareugyrioides filholi (Pizon) (1)

B686 (28 October 1962) 40°16′S, 172°32.3′E. Depth 126 m. TAL.

Didemnum lambitum (Sluiter) (45)
Cnemidocarpa madagascariensis Hartmeyer var. *regalis* Michaelsen (1)

B689 (29 October 1962) 40°40.2′S, 172°48.8′E. Depth 29 m. TAL.

Pareugyrioides filholi (Pizon) (3)

C439 (7 May 1960) 40°00′S, 173°49′E. Depth 88 m. CG, GOP.

Pyura trita (Sluiter) f. *typica* Michaelsen (1)

C622 (5 May 1961) 43°57′S, 176°31′W. Shore collection.

Pyura lutea (Sluiter) (2)

C730 (24 November 1961) 54°55′S, 158°47′E. Depth 110 m. DD.

Corella eumyota Traustedt (many)
Pyura pilosa Monniot & Monniot (16)

C732a (25 November 1961) 54°29.5′S, 158°58.5′E. Depth 77 m. DD.

Corella eumyota Traustedt (many)

C733 (25 November 1961) 54°25′S, 159°02′E. Depth 104 m. DD.

?*Sycozoa sigillinoides* Lesson (2)

C844 (1 March 1962) 41°38.3′S, 175°11.2′E. Depth 88 m. GHO, TAM.

Cnemidocarpa stewartensis Michaelsen (1)

C921 (10 February 1963) 41°04.9′S, 173°57.3′E. Depth 75 m. GHO.

Cystodytes dellechiajei (Della Valle) (1)

C957 (7 March 1963) 43°09′S, 175°15′E. Depth 123 m. TAS.

Aplidium scabellum (Michaelsen) (2)
Polyclinum sluiteri Brewin (2)

C958 (7 March 1963) 43°11′S, 175°27′E. Depth 119 m. TAS.

?*Pyura trita* (Sluiter) f. *crinita* Michaelsen (2)

D25 (29 April 1963) 54°40′S, 158°49′E. Depth 55 m. DCMB.

Polyzoa reticulata (Herdman) (1 colony)

D52 (9 May 1963) 50°40.09′S, 166°13.4′E. Depth 68 m. DCMB.

Corella eumyota Traustedt (33)

D65 (10 May 1963) 50°32.6′S, 166°13.3′E. Depth 20 m. TAS.

Corella eumyota Traustedt (3)

D74 (12 May 1963) 50°55.65′S, 165°54.8′E. Depth 168 m. DCMB.

Corella eumyota Traustedt (many)

D119 (11 October 1963) 43°45′S, 178°40′E. Depth 492 m. TM.

?*Botrylloides* sp. (6)

D121 (11 October 1963) 43°16.5′S, 177°10.5′E. Depth 210 m. TM.

Polyclinum sp. (1)
Corella eumyota Traustedt (1)
Pyura trita (Sluiter) f. *typica* Michaelsen (31)
Pyura trita (Sluiter) f. *crinita* Michaelsen (2)

D127 (7 January 1964) 46°42′S, 168°17.3′E. Depth 29 m. DCMB.

Pyura pachydermatina (Herdman) (1)

D136 (12 January 1964) 48°33.5′S, 169°10′E. Depth 713 m. DCMB.

Pharyngodictyon elongatum sp.n. (1)

D138 (13 January 1964) 48°32.0′S, 168°19.5′E. Depth 668 m. DCMB.

Pharyngodictyon elongatum sp.n. (1)

D148 (14 January 1964) 49°48.0′S, 167°02.5′E. Depth 146 m. DCMB.

Sycozoa sigillinoides Lesson (22)

D156 (16 January 1964) 48°01.5′S, 166°35.0′E. Depth 81 m. DCMB.

Ascidia stewartensis sp.n. (1)

D173 (21 January 1964) 50°53.0′S, 166°32.0′E. Depth 141 m. DCMB.

?*Asterocarpa cerea* (Sluiter) (1)

D176 (21 January 1964) 51°06.0′S, 167°48.5′E. Depth 216 m. DCMB.

Sycozoa sigillinoides Lesson (1)

D182 (22 January 1964) Carnley Harbour, Auckland Island. Depth 64 m. DCMB, TAM.

Corella eumyota Traustedt (1)

D184 (22 January 1964) Carnley Harbour, Auckland Island. Depth 62 m. DCMB, TAM.

Polyclinum sluiteri Brewin (5)

D198 (23 January 1964) 50°24.0′S, 166°14.0′E. Depth 141 m. DCMB, TAM.

Sycozoa sigillinoides Lesson (1)

D267 (6 October 1964) 40°50′S, 173°43′E. Depth 60 m. TAM.

Aplidium mernooensis (Brewin) (9)

D443 (5 May 1965) 41°15.7′S, 174°52.2′E. Depth 4 m. Dietz grab.

Cnemidocarpa nisiotis (Sluiter) (1)
Pyura pulla (Sluiter) (1)

D873 (25 March 1969) 43°34.5′S, 176°38′W. Depth 66 m. TAL.

Polyclinum cerebrale Michaelsen (1)
Corella eumyota Traustedt (1)
Botryllus stewartensis Brewin (1)
Cnemidocarpa bicornuta (Sluiter) (1)

D882 (26 March 1969) 43°41.5′S, 176°33.5′W. Depth 23 m. TAM.

Microcosmus hirsutus Sluiter (1)

E82 (26 March 1964) 43°22′S, 179°30′E. Depth 402 m. DCMB.

?*Molguloides ?vitreus* (Sluiter) (1)

E107 (11 October 1964) 43°45′S, 177°00′W. Depth 113 m. DCMB, TAM.

Sycozoa sigillinoides Lesson (1)
Aplidium phortax (Michaelsen) (3)
Corella eumyota Traustedt (1)
Amphicarpa michaelseni Brewin (2 colonies)
Pyura trita (Sluiter) f. *typica* Michaelsen (1)

E108 (12 October 1964) 43°29′S, 177°00′W. Depth 95 m. DCMB, TAM.

Aplidium phortax (Michaelsen) (1)
Synoicum stewartense (Michaelsen) (many specimens, or fragments)
?*Cnemidocarpa nisiotis* (Sluiter) (2)
Amphicarpa michaelseni Brewin (1 zooid)

E113 (12 October 1964) 43°30′S, 176°30′W. Depth 117 m. DCMB, TAM.

Pyura trita (Sluiter) f. *typica* Michaelsen (4)

E114 (13 October 1964) 43°35′S, 176°15′W. Depth 135 m. DCMB, TAM.

Aplidium amphibolum sp.n. (2)
Pyura trita (Sluiter) f. *typica* Michaelsen (18)

E116 (13 October 1964) 43°30′S, 176°44.5′W. Depth 77 m. TAM.

Molgula mortenseni (Michaelsen) (2)

E134 (16 October 1964) 44°10′S, 176°25′E. Depth 99 m. DCMB.

Polycarpa zeteta sp.n. (1)

E228 (24 February 1965) 54°41′S, 158°55′E. Depth 137 m. DCMB.

Corella eumyota Traustedt (46)
Polyzoa reticulata (Herdman) (1 colony)

E233 (26 February 1965) 54°29.5′S, 158°58.5′E. Depth 55 m. TAM.

Pyura pilosa Monniot & Monniot (1)

E234 (27 February 1965) 54°55.5′S, 158°47.5′E. Depth 220 m. DCMB.

Corella eumyota Traustedt (4)
Pyura pilosa Monniot & Monniot (1)

E235 (27 February 1965) 55°01.0′S, 158°42.5′E. Depth 357 m. DCMB.

Corella eumyota Traustedt (1)
Pyura pilosa Monniot & Monniot (7)

E236b (27 February 1965) 54°59.7′S, 158°36.4′E. Depth 174 m. TAM.

Corella eumyota Traustedt (1)
Cnemidocarpa rectofissura sp.n. (3)

E237 (27 February 1965) 54°51.0′S, 158°38.0′E. Depth 155 m. DCMB, TAM.

Corella eumyota Traustedt (>100)

E411 (10 October 1965) 46°38.5′S, 170°59′E. Depth 1275 m. TAM.

Ascidia macropapilla sp.n. (2)

E412 (11 October 1965) 45°10′S, 171°41′E. Depth 249 m. TAM.

Pyura trita (Sluiter) f. *crinita* Michaelsen (2)

E785 (17 October 1967) 44°00′S, 168°17.5′E. Depth 282–274 m. TAM.

Synoicum occidentalis sp.n. (4)

E809 (22 October 1967) 46°06.7′S, 166°40.6′E. Fishy Bay, Preservation Inlet. Shore collection.

?*Pyura trita* (Sluiter) f. *typica* Michaelsen (1)

E811 (22 October 1967) 46°07.1′S, 166°41.8′E. Depth 178–188 m. TAM.

Corella eumyota Traustedt (1)

E812 (22 October 1967) 46°02.4′S, 166°47.3′E. Depth 88–168 m. TAM.

Corella eumyota Traustedt (1)

E817 (23 October 1967) 46°13.5′S, 166°29′E. Depth 235–218 m. TAM.

Didemnum mortenseni Michaelsen (2)

E820 (23 October 1967) 46°35′S, 165°58′E. Depth 220 m. TAM.

Synoicum occidentalis sp.n. (1)

E828 (24 October 1967) 46°30′S, 166°49′E. Depth 220 m. TAM.

Didemnum mortenseni Michaelsen (3)

E834 (26 October 1967) 46°54′S, 168°07.7′E. Half Moon Bay, Stewart Island. Shore collection.

Corella eumyota Traustedt (1)
Molgula sluiteri (Michaelsen) (8)

E909 ——— 40°51′S, 173°49′E. Greville Harbour, D'Urville Island. Shore collection.

Cnemidocarpa nisiotis (Sluiter) (2)

F77 (12 January 1965) 47°00′S, 169°30′E. Depth 117 m. DCMB, TAM.

Pyura trita (Sluiter) f. *crinita* Michaelsen (4)

F83 (14 January 1965) 50°26′S, 166°54′E. Depth 117 m. TAM.

Sycozoa sigillinoides Lesson (2)

F99 (18 January 1965) 48°32′S, 168°54.5′E. Depth 706 m. TAM.

Polycarpa zeteta sp.n. (1)

F100 (18 January 1965) 49°02′S, 168°53.5′E. Depth 733–746 m. TAM.

Aplidium chthamalum sp.n. (9)
?Synoicum pererratum (Sluiter) (7)
Polyclinum sp. (1)

F102 (19 January 1965) 48°39′S, 169°51′E. Depth 810 m. TAM.

Aplidium chthamalum sp.n. (5)

F103 (19 January 1965) 48°03′S, 170°38′E. Depth 1280 m. TAM.

Corella eumyota Traustedt (3)
Styela gracilocarpa sp.n. (2)

F108 (21 January 1965) 48°19′S, 171°59′E. Depth 1108 m. TAM.

Styela gracilocarpa sp.n. (1)

F109 (21 January 1965) 49°11′S, 173°00′E. Depth 501 m. TAM.

Polycarpa zeteta sp.n. (1)

F110 (21 January 1965) 48°07′S, 174°02′E. Depth 1167 m. TAM.

Styela gracilocarpa sp.n. (1)

F122 (26 January 1965) 48°06′S, 179°57′W. Depth 252 m. TAM.

Polyclinum sp. (1)

F698 (5 December 1965) 40°06.2′S, 176°55.9′E. Depth 51 m. GHO.

?Cnemidocarpa nisiotis (Sluiter) (1)

F898 (8 October 1968) 36°13′S, 176°10′E. Depth 63–260 m. TAM.

Aplidium orthium sp.n. (2)

F922 (13 October 1968) 33°59′S, 172°16′E. 84–70 m. Manihiki dredge.

Aplidium glaphyrum sp.n. (1)

F924 (13 October 1968) 34°07.5′S, 172°47′E. Depth 315–439 m. TAM.

Aplidium unicornum sp.n.(2)

F931 (15 October 1968) 34°28′S, 173°03.5′E. Depth 51 m. TAM.

Synoicum apectetum sp.n. (more than 40 colonies or fragments)

F936 (7 October 1968) 36°09′S, 174°45′E. Depth 53 m. TAM.

Aplidium scabellum (Michaelsen) (1)
Polysyncraton chondrilla (Michaelsen) (7)

G656 (17 January 1970) 44°00′S, 172°00′E. Depth 13 m. TAM.

Pyura pachydermatina (Herdman) (3)

G657 (17 January 1970) 44°08.2′S, 171°45.1′E. Depth 13 m. TAM.

Pyura pachydermatina (Herdman) (2)

G660 (18 January 1970) 44°25′S, 172°00′E. Depth 63 m. TAM.

Corella eumyota Traustedt (1)
Cnemidocarpa bicornuta (Sluiter) (3)
Pyura trita (Sluiter) f. *typica* Michaelsen (19)

G669 (19 January 1970) 44°57′S, 171°28′E. Depth 63 m. TAM.

Cnemidocarpa bicornuta (Sluiter) (5)
Pyura trita (Sluiter) f. *typica* Michaelsen (5)

G674 (19 January 1970) 45°27′S, 171°12′E. Depth 98 m. TAM.

Corella eumyota Traustedt (1)
Cnemidocarpa stewartensis Michaelsen (1)
Pyura trita (Sluiter) f. *typica* Michaelsen (3)

G679 (20 January 1970) 45°43′S, 171°05′E. Depth 148 m. TAM.

Cnemidocarpa stewartensis Traustedt (1)

G680 (20 January 1970) 45°43′S, 171°02.4′E. Depth 103 m. TAM.

Corella eumyota Traustedt (8)
Pyura trita (Sluiter) f. *typica* Michaelsen (3)

G685 (20 January 1970) 45°53′S, 170°48′E. Depth 68 m. TAM.

Corella eumyota Traustedt (12)
Cnemidocarpa bicornuta (Sluiter) (2)
Pyura trita (Sluiter) f. *typica* Michaelsen (5)

G689 (20 January 1970) 46°09′S, 170°48′E. Depth 133 m. TAM.

Pyura trita (Sluiter) f. *typica* Michaelsen (many)

G694 (21 January 1970) 46°20′S, 169°52′E. Depth 11 m. Pipe dredge.

Corella eumyota Traustedt (1)
Pyura pachydermatina (Herdman) (1)

G707 (24 January 1970) 45°48.2′S, 170°54.2′E. Depth 91 m. TAM.

Pyura trita (Sluiter) f. *typica* Michaelsen (many)

G879 (6 December 1970) 44°12.0′S, 173°05.0′E. Depth 100 m. Otter trawl.

Pyura trita (Sluiter) f. *typica* Michaelsen (many)

I3 (2 May 1975) 35°48.6′S, 175°03.7′E. Depth 139 m. Beam trawl.

Aplidium scabellum (Michaelsen) (9)

I47 (9 May 1975) 36°00.2′S, 174°39.6′E. Depth 48–46 m. Rock dredge.

?Sycozoa sigillinoides Lesson (5)

I55 (10 May 1975) 36°22.7′S, 175°03′E. Depth 47 m. Small pipe dredge.

Aplidium scabellum (Michaelsen) (4)

J41 (19 April 1970) 36°50′S, 170°13′E. Depth 2050–2060 m. TAM.

?Molguloides ?vitreus (Sluiter) (1)

J550 (17 December 1973) 49°04.0′S, 172°40.3′E. Depth 535 m. TAM.

?Aplidium scabellum (Michaelsen) (3)

P58 (5 February 1977) 35°07.2′S, 173°05.6′E. Depth 24 m. Beam trawl.

Didemnum sp. (1)

P64 (6 February 1977) 34°52.5′S, 172°34.4′E. Depth 155–163 m. Beam trawl.

Aplidium scabellum (Michaelsen) (1)

Z2034 (2 April 1965) Mernoo Bank. Depth 37 m.

Cnemidocarpa nisiotis (Sluiter) (5)

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UNIVERSITY OF CANTERBURY

K051I off Clarence River mouth, north of Kaikoura Peninsula. Depth 3.6 m

Alloeocarpa sp. (1 colony)

K061V off Kaikoura Peninsula. Depth 46–73 m.

?*Cnemidocarpa stewartensis* Traustedt (1)

K631 off Kaikoura Peninsula. Depth 366 m.

Synoicum otagoensis sp.n. (1)

PORTOBELLO MARINE LABORATORY

MU67-12 (6 February 1967) 46°29′S, 169°53′E – 46°29.5′S, 169°34′E. Depth 60–73 m. Agassiz trawl.

Aplidium gilvum sp.n. (2)

MU67-119 (7 November 1967) 45°47′S, 170°54′E. Depth 78 m. Agassiz trawl.

Pyura picta Brewin (2)

MU67-120 (7 November 1967) 45°47′S, 170°57′E. Depth 97 m. Agassiz trawl.

Cnemidocarpa stewartensis Michaelsen (many)

MU67-124 (10 November 1967) 45°50.5′S, 170°48.5′E. Depth 37 m. Agassiz trawl.

Polyclinum sluiteri Brewin (1)

MU67-128 (16 November 1967) 45°49′S, 170°54′E. Depth 91 m. Agassiz trawl.

Distaplia marplesi Brewin (1)

MU67-142 (30 November 1967) 45°51′S, 171°02′E. Depth 730 m. Agassiz trawl.

Leptoclinides duminus sp.n. (2)

MU68-13 (27 February 1968) 45°56′S, 171°00′E. Depth 480 m. Salpa dredge.

Molgula bathamae sp.n. (3)

MU68-22 (22 March 1968) 45°50′S, 170°55′E. Depth 101 m. Agassiz trawl.

Cnemidocarpa bicornuta (Sluiter) (several)

MU68-26 (27 March 1968) 45°51′S, 171°05′E. Depth 710 m. Circular dredge.

Polycarpa zeteta sp.n. (7)

MU68-38 (14 August 1968) 45°49.5′S, 170°54′E. Depth 92 m. Agassiz trawl.

Distaplia marplesi Brewin (1)

MU68-86 (18 December 1968) 45°53′S, 171°04′E. Depth 750 m. Agassiz trawl.

Synoicum otagoensis sp.n. (3)

MU71-103 (25 May 1971) 45°46′S, 171°05′E. Depth 640 m. Agassiz trawl.

Polycarpa zeteta sp.n. (2)

MU71-250 (16 July 1971) 45°55.5′S, 171°00.4′E. Depth 500 m. Agassiz trawl.

Pharyngodictyon elongatum sp.n. (2)

MU71-266 (10 August 1971) 45°45′S, 171°06′E. Depth 620–540 m. Agassiz trawl.

Clavelina michaelseni sp.n. (5)
Synoicum otagoensis sp.n. (1)
Aplidium chthamalum sp.n. (8)
?*Pseudodistoma cereum* Michaelsen (3)
Polycarpa zeteta sp.n. (4)

MU74-92 (24 March 1974) 45°51′S, 171°01′E. Depth 420–320 m. Agassiz trawl.

?*Pseudodistoma cereum* Michaelsen (3)
Polycarpa zeteta sp.n. (3)

MU74-95 (25 March 1974) 45°46′S, 171°05′E. Depth 660–600 m. Agassiz trawl.

Leptoclinides duminus sp.n. (3)

MU76-169 (26 November 1976) 45°47′S 170°45′E. Depth 12 m. Agassiz trawl.

Eugyra munida sp.n. (6)

DESCRIPTION OF SPECIES

Family CLAVELINIDAE Forbes and Hanley, 1848

Podoclavella Herdman, 1890

Podoclavella kottae Millar, 1960

Podoclavella kottae Millar, 1960: 65-68, text-figs 16, 17, pl.2 fig. 1.

PUBLISHED RECORDS, NEW ZEALAND: North Cape (Millar 1960).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Millar 1960): Colony with zooids united only by small basal stolon; thorax short, abdomen very long and slender; atrial opening terminal, oral opening about middle of thorax; 13–27 rows stigmata; oesophagus very long; stomach smooth; gonads unknown.

Clavelina Savigny, 1816

Clavelina claviformis (Herdman, 1899)

Colella claviformis Herdman, 1899: pl. Dist. 3, figs 1–15.
Amaroucium anomalum Herdman, 1899: 76–77.
Clavelina sigillaria Michaelsen, 1924: 269–277.
Clavelina claviformis. Kott, 1957a: 88–89. Millar, 1960: 68–70.

PUBLISHED RECORDS, NEW ZEALAND: Cape Maria van Diemen (Michaelsen 1924), North Cape (Millar 1960).
PUBLISHED RECORDS, ELSEWHERE: East coast of Australia.
DESCRIPTION (from published records): Colony a group of stalked heads arising from a small basal mass; head transparent, cylindrical to pyriform, containing the completely embedded zooids arranged in longitudinal lines; siphons close together, equal, and both opening directly on surface; 8–14 rows of up to 50 stigmata; abdomen varies in length with reproductive state; oesophagus long; stomach ovoid to cylindrical with four folds; gonads beside lower part of intestinal loop; testis a bunch of small follicles; ovary ovoid to tubular, beside testis.

Clavelina michaelseni sp.n. Fig. 1

MATERIAL EXAMINED: Portobello Stn MU71-266 (5 specimens).
HOLOTYPE: a specimen 2.4 cm long, in collection of the National Museum of New Zealand, Wellington, New Zealand, type number ASC 17.
PARATYPES: NMNZ, type number ASC 18, four specimens from same sample as holotype.
TYPE-LOCALITY: Portobello Stn MU71-266, continental slope east of Otago, South Island, 45°45′S, 171°06′E, 620–540 m.
DESCRIPTION: Each specimen is a single zooid attached at the base to broken shell or a small mass of bottom material. The largest zooid is about 2.6 cm long and each is finger-like and soft, with translucent test enclosing the contracted body of the zooid. A typical zooid, when removed from the test, is 2.1 cm long, comprising a thorax of 6 mm and abdomen of 15 mm. The oral siphon and slightly narrower atrial siphon are close together. Numerous longitudinal body wall muscles cover the thorax and pass down each side of the abdomen. About 14 oral tentacles are present, alternating in length. The small dorsal tubercle has a narrow, longitudinal oval slit. The rows of stigmata number about 30 and are separated by tall transverse bars, but the stigmata in each row could not be counted owing to the contraction of the thorax. The oesophagus and rectum are long, occupying the long narrow anterior part of the abdomen. The stomach is ovoid, somewhat flattened and smooth-walled. The post-stomach and mid-intestine are distinct. The gonads, consisting of a small compact ovary and larger more diffuse testis of many small follicles, lie in the intestinal loop. The lower part of the sperm duct is irregularly contorted.

REMARKS: The only species of *Clavelina* hitherto recorded from New Zealand, *C. claviformis*, has a quite different colonial organisation in which each head contains many zooids.

Polycitorella Michaelsen, 1924

Polycitorella mariae Michaelsen, 1924

Polycitorella mariae Michaelsen, 1924: 279, 285, figs 5, 6.

PUBLISHED RECORDS, NEW ZEALAND: Cape Maria van Diemen (Michaelsen 1924).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Michaelsen 1924): Colony of uncertain shape, coated with debris except apical part; test contains stellate or irregular calcareous spicules; zooids to 20 mm long, embedded, abdomen considerably longer than thorax; both siphons six-lobed and opening directly on surface; 12 rows stigmata; oesophagus long; stomach with four(?) folds; gonad beside lower part of intestinal loop; testis of about 12 follicles; ovary beside testis; no brood pouch; incubation starts in abdominal part of oviduct.

Sycozoa Lesson 1830

Sycozoa sigillinoides Lesson, 1830 Fig. 2

Sycozoa sigillinoides Lesson, 1830: 436, pl. Moll. 13, figs 15, 15b. For synonymy see Michaelsen 1924; Van Name 1945 and discussion in Kott 1972d: 234–235.

MATERIAL EXAMINED: NZOI Stns ?C733 (2 specimens), D148 (22 specimens), D176 (1 specimen), D198 (1 specimen), E107 (1 specimen), F83 (2 specimens), ?I47 (5 specimens).
PUBLISHED RECORDS, NEW ZEALAND: Locality unknown (Michaelsen 1924), North Auckland (Brewin 1957), Napier (Brewin 1952b), ?Chatham Islands (Sluiter 1900).
PUBLISHED RECORDS, ELSEWHERE: Antarctic (numerous localities), Subantarctic (including Heard Island and Macquarie Island (Kott 1954)).
DESCRIPTION: This species is known to vary considerably in colony form in Antarctic and Patagonian Shelf specimens (Millar 1960). The same is true of the new material from New Zealand. Many specimens are simple, having a single long slender stalk ending in a single head, but in other specimens the upper end of a common stalk breaks up into several secondary stalks each with its own head. Most colonies are attached basally to a dead shell or other solid object.

The arrangement of the openings of the common cloacal canals has been used as one character distinguishing *S. sigillinoides* from the Australian *S. tenuicaulis* (Herdman) which, according to Kott (1972d), is a synonym of *S. pedunculata* (Quoy and Gaimard). In *S. tenuicaulis* the openings are said to be arranged round the apex of the head and to discharge directly on the surface (Brewin 1953): in *S. sigillinoides* the openings lead into an apical annular space which itself discharges to the exterior by a single large

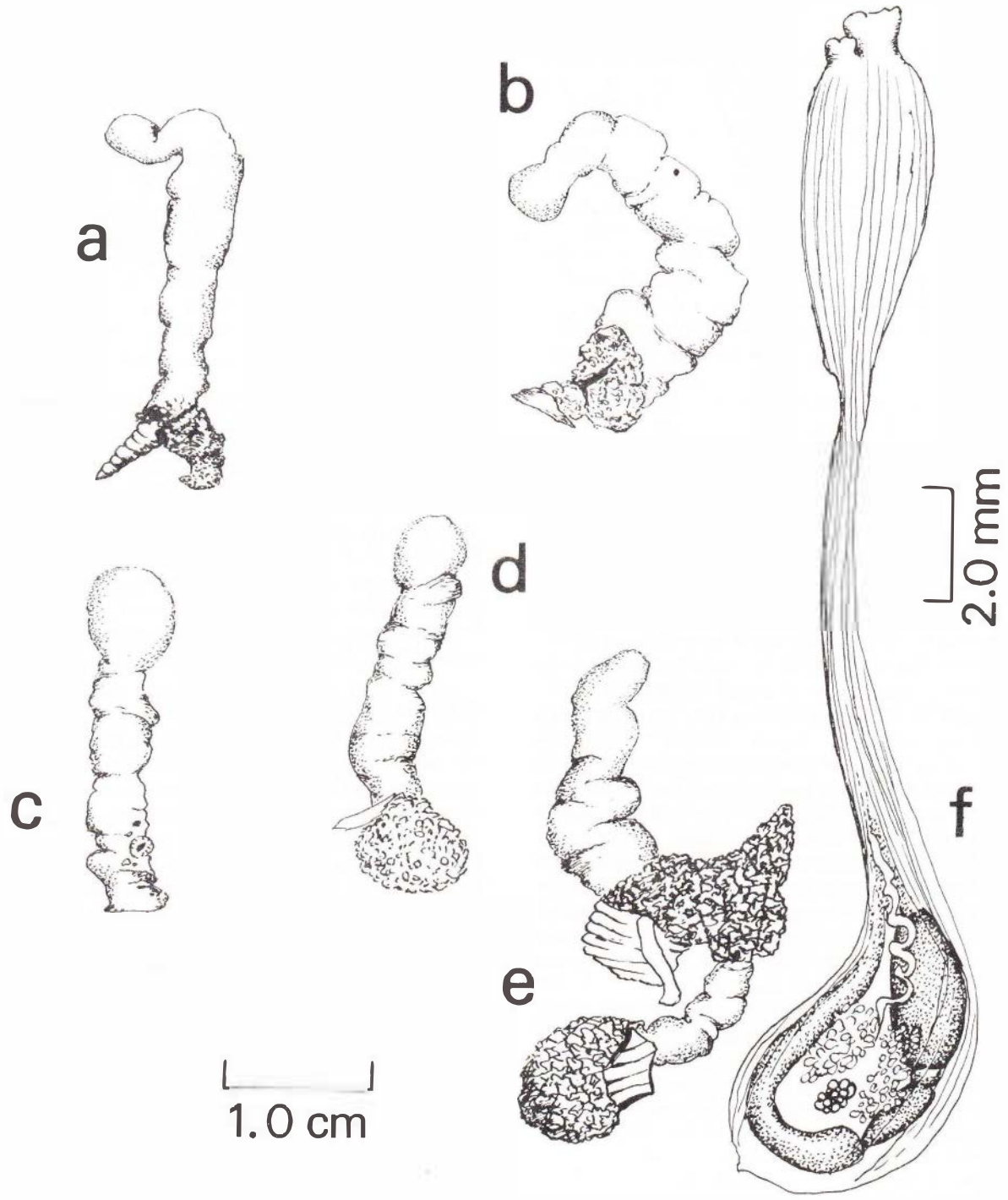

FIG. 1. *Clavelina michaelseni* sp.n.: *a–e*, colonies (*c*, the holotype); *f*, zooid.

opening. This character, however, may not be entirely satisfactory, since the upper end of the head varies and it is sometimes difficult to decide whether the individual ducts open into a very shallow annular common space or directly on the surface. Kott (1969a) also doubted the validity of the character. In the present material it has been impossible to determine which arrangement exists, in some cases because the specimens are distorted and in others because the apex of the head has undergone natural disintegration.

Inset 2

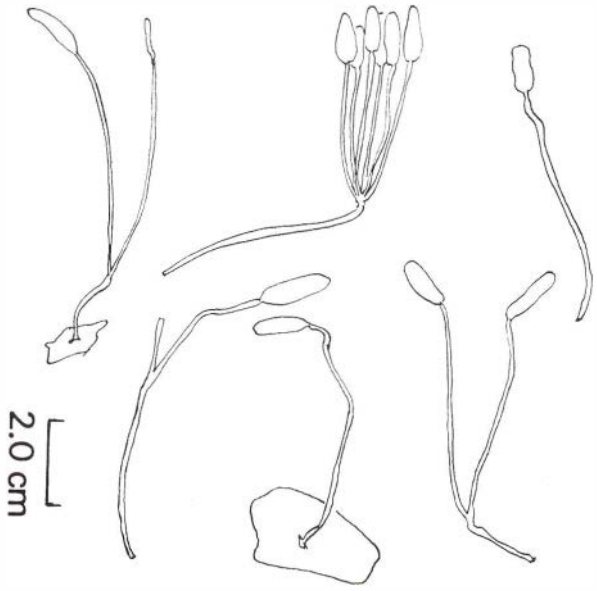

FIG. 2. *Sycozoa sigillinoides* Lesson: some forms of colony in the collections.

S. tenuicaulis has fibrous anchoring processes on the lower part of the stalks, but no such processes were found in the present New Zealand specimens.

The length of the larval tail has also been used as a distinguishing character (Kott 1972d). The new specimens show a tail of varying length, but in some fully developed larvae the length is as great as that used to characterise *S. sigillinoides*. The trunk is 0.40–0.76 mm long, with a black otolith and no ocellus.

Zooid (from published records, confirmed in new material): six-lobed oral siphon, atrial opening with variable lappet, four rows of about 20 stigmata, stomach smooth-walled, testis a group of pear-shaped follicles beside intestinal loop, large thoracic brood pouch with several embryos and larvae.

REMARKS: I find no satisfactory reason to separate these specimens from *S. sigillinoides* as known in more southerly areas. It is, nevertheless, surprising that the species extends so far north, and the possibility remains that New Zealand specimens are of a different but closely similar species.

Sycozoa anomala Millar, 1960

Sycozoa anomala Millar, 1960: 75–77, fig. 20, pl. 3 fig. 6.

PUBLISHED RECORDS, NEW ZEALAND: North Cape (Millar 1960).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Millar 1960): Known only from three simple stalked heads and one branched colony; differs from *S. sigillinoides* in the colonies being hermaphrodite (although zooids are unisexual), and in the gonad projecting from the body below the intestinal loop.

Distaplia Della Valle, 1881

Distaplia knoxi Brewin, 1954

Distaplia knoxi Brewin, 1954: 133–135, fig. 1; 1960: 119.

PUBLISHED RECORDS, NEW ZEALAND: Cook Strait (Brewin 1954, 1960).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1954): Colony cushion-shaped (sessile) or a stalked head (with oblique junction of stalk and head); zooid systems round or oval; atrial lappet wide, undivided; stomach with 14 folds; gonad in small narrow-stalked sac far below zooid; testis of up to nine follicles; ovary beside posterior part of testis; brood pouch narrow-stalked, arising from thorax.

Distaplia taylori Brewin, 1950

Distaplia taylori Brewin, 1950b: 346–347, fig. 1; 1951: 104.

PUBLISHED RECORDS, NEW ZEALAND: Christchurch (Brewin 1950b), Hauraki Gulf (Brewin 1951).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1950b): Colony flat; systems round or oval; atrial lappet wide, and toothed distally; stomach with low, sometimes broken ridges; gonad in posterior part of intestinal loop; testis a rosette of 4–6 follicles, ovary beside posterior part of testis; brood pouch from thorax, with narrow stalk.

Distaplia marplesi Brewin, 1952

Distaplia marplesi Brewin, 1952a: 453–454, fig. 2.

MATERIAL EXAMINED: Portobello Stns MU67–128 (1 specimen), MU68–38 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: Otago coastal waters (Brewin 1952a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: The colonies are flat, soft, smooth, and orange-coloured to clear in preservative but vermilion in life according to the collector's note. The type material was bright orange. Small star-shaped systems of zooids are clearly seen. The zooids are vermilion in glycerine-preserved specimens, and show the general structure common in the genus. The stomach has 12–16 convoluted folds in the type specimens and about the same number of more or less distinct folds in the new specimens. The gonads lie beside the intestinal loop and comprise about seven small male follicles (10–14 in the type material) and a few adjacent oocytes.

Hypsistozoa Brewin, 1953

Hypsistozoa fasmeriana (Michaelsen, 1924)

Distaplia fasmeriana Michaelsen, 1924: 297–309, figs. 7–10. Brewin, 1946: 89; 1950b: 344; 1952b: 187.

Hypsistozoa fasmeriana Brewin, 1953: 56; 1956c: 435–454; 1958a: 440; 1959: 575–589. Millar, 1960: 80–82.

PUBLISHED RECORDS, NEW ZEALAND: North Cape (Millar 1960), Cape Kidnappers (Brewin 1952b), Portobello Peninsula (Brewin 1946), Christchurch (Brewin

1950b), Stewart Island (Michaelsen 1924, Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Michaelsen 1924, and papers by Brewin): Colony a stalk and wider ovoid head; systems linear, radiating from common cloacal openings scattered over the head; zooids much as in *Distaplia* but gonad below gut, in anterior end of right side of vascular process extending below zooid; testis of 8–16 follicles, ovary beside testis; stomach with 14–20 folds; narrow-stalked brood pouch in which single ovum develops to larva.

Cystodytes von Drasche, 1884

Cystodytes dellechiajei (Della Valle, 1877)

Distoma dellechiajiae Della Valle, 1877: 40.
Cystodytes draschii Herdman, 1886: 137–140.
Cystodytes aucklandicus and *C. perspicuus* Nott, 1892: 323–326 and 326–327.
Cystodytes draschei. Michaelsen, 1924: 286–288.
Cystodytes dellechiajei. Brewin 1948: 119–121; 1951: 104; 1952a: 452; 1956b: 122; 1958a: 440; 1960: 119. Millar, 1960: 82. For further synonymy see Van Name 1945.

MATERIAL EXAMINED: NZOI Stns A862 (2 specimens), B216 (1 specimen), C921 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: North Cape (Millar 1960), Hauraki Gulf (Michaelsen 1924, Brewin 1948, 1951), Auckland (Nott 1892), Chatham Islands (Brewin 1956b), Cook Strait (Michaelsen 1924, Brewin 1960), Otago Peninsula (Brewin 1952a), Stewart Island (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: Widely distributed in warm waters throughout the world.

DESCRIPTION (from various published accounts, confirmed by new material): This is a well-known species recorded from many parts of the world. The colony is a fleshy mass, brown, violet or whitish with the white capsules which surround the zooids showing through the semi-transparent test. The species is most easily recognised by the large plate-shaped spicules (up to 0.5 mm diameter) grouped round the zooids.

Eudistoma Caullery, 1909

Eudistoma circumvallatum (Sluiter, 1900)

Distoma circumvallatum Sluiter, 1900: 8–9, pl. 1 fig. 4, pl. 2 fig. 6.
Polycitor (Eudistoma) circumvallatum. Brewin, 1946: 102–103, fig. 8; 1951: 104; 1952b: 187; 1958a: 440; 1960: 119.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1951), Cape Kidnappers (Brewin 1952b), Cook Strait (Sluiter 1900, Brewin 1960), Portobello Peninsula (Brewin 1946), Stewart Island (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1946): Colony a group of small white gelatinous flat-topped masses; zooids without good distinguishing features; with long narrow waist; 6–9 stigmata in each of the three rows; 12–18 male follicles.

Atapozoa Brewin, 1956

Atapozoa marshi Brewin, 1956

Atapozoa marshi Brewin, 1956a: 31–32, fig. 1. Millar, 1960: 83–84, fig. 24. Kott, 1967: 188; 1972b: 168, figs 8, 9.

PUBLISHED RECORDS, NEW ZEALAND: North Cape (Millar 1960).

PUBLISHED RECORDS, ELSEWHERE: Western and southern Australia.

DESCRIPTION (from Brewin 1956a): Colony an ovoid stalked head; zooids with six-lobed oral and atrial siphons; three rows of 28 or 29 stigmata; smooth-walled stomach; testis a rosette of 8–14 pear-shaped follicles beside intestinal loop; thoracic brood pouch; larval trunk about 2.8 mm long, with two elongate anterior suckers (papillae).

REMARKS: The sole record from New Zealand is based on an uncertain identification (Millar 1960).

Family POLYCLINIDAE Verrill, 1871

Synoicum Phipps, 1774

Synoicum stewartense (Michaelsen, 1924) Fig. 3

Macroclinum stewartense Michaelsen, 1924: 413–421, figs 26, 27, 28.

MATERIAL EXAMINED: NZOI Stn E108 (many specimens, or fragments).

PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Michaelsen 1924).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: The specimens are pillar-like lobes often arising in groups of two or three from a common base. The lobes, usually 2–3 cm in height, are often somewhat laterally flattened, and gradually expand from the base to the truncate upper end which is slightly concave. A single common cloacal opening is excentrically placed on the upper end, and is surrounded by a low upstanding rim. Michaelsen (1924) noted a central position for the cloacal opening and made this one of the characters distinguishing the species from *S. arenaceum*. A distinct, irregular ridge surrounds the upper end of the lobe and a few similar ridges pass down the sides of the lobes. The dull purple colour of the colonies is characteristic but may be more or less obscured by adhering sand which is thickest on the base and on the lower parts of the lobes.

REMARKS: Other distinguishing features confirmed in the new material are the purple colour of most tissues in the zooids, and the numerous rows of stigmata (21 in this material; 23–25 in Michaelsen's type material). The known geographical range is extended from Stewart Island to Chatham Rise.

?**Synoicum pererratum** (Sluiter, 1912) Fig. 4

Macroclinum pererratum Sluiter, 1912: 458; 1914: 30–32, pl. 3 fig. 36, pl. 4 fig. 45.
Synoicum pererratum. Van Name, 1945: 61–62. Kott, 1969a: 71.

MATERIAL EXAMINED: NZOI Stn F100 (7 specimens).

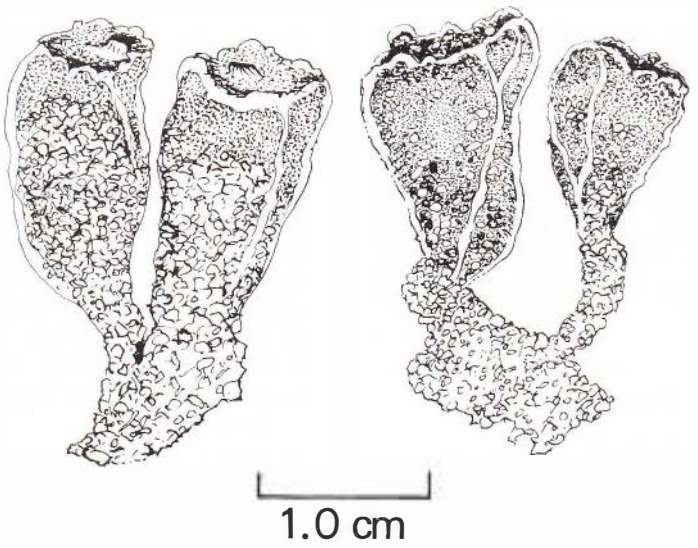

FIG. 3. *Synoicum stewartense* (Michaelsen): two colonies or pieces of colonies.

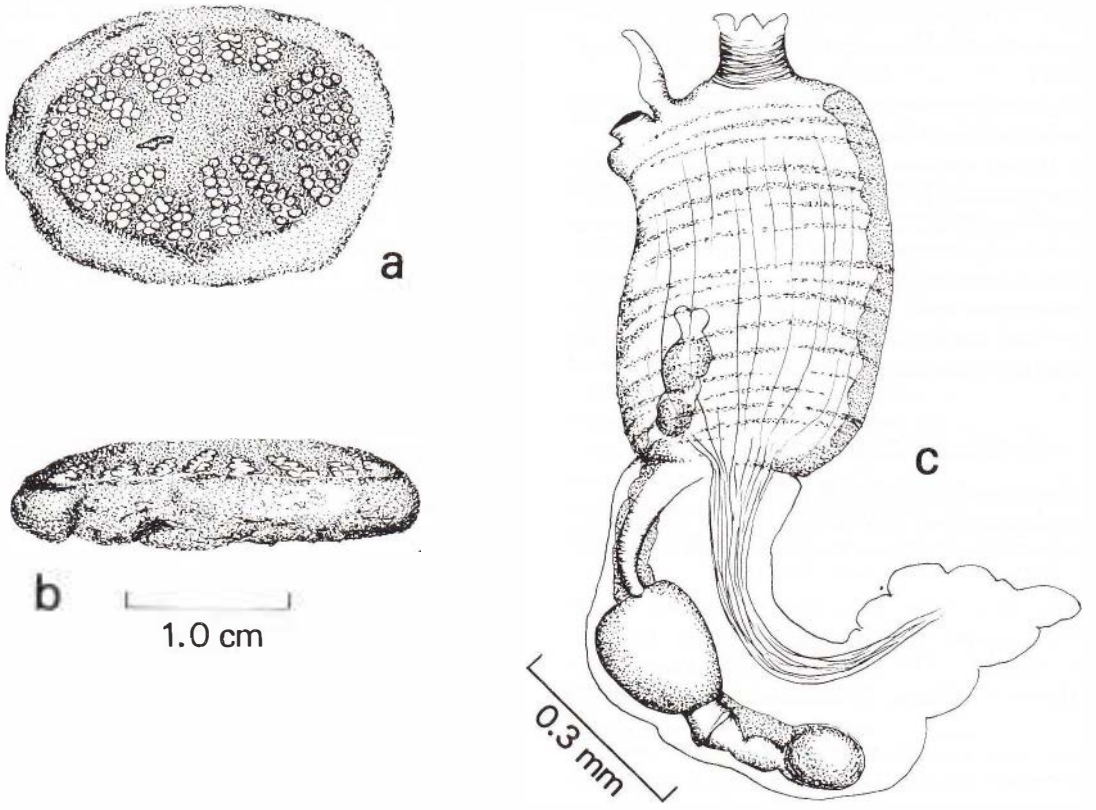

FIG. 4. *Synoicum pererratum* (Sluiter): *a*, colony from above; *b*, colony from side; *c*, zooid.

PUBLISHED RECORDS, NEW ZEALAND: None.
PUBLISHED RECORDS, ELSEWHERE: South Shetland Islands (Sluiter 1912), Antarctic Peninsula (Kott 1969a).
DESCRIPTION: All colonies have a characteristic appearance. They are round or oval in outline, relatively flat, and are coated and impregnated with sand which gives them an ochreous colour. Sand is least abundant on the flat upper surface, to which the systems of zooids are confined. The systems are long and narrow, appearing as close straight double rows of zooids, and have a conspicuous radial arrangement. Generally a single, roughly oval common cloacal opening is present, with a slightly upstanding rim. In a few specimens the existence of additional openings is suspected. The largest colonies are about 2.7 by 2.2 cm in diameter and about 5 mm thick.

All zooids examined were quite strongly contracted, and in this state measure only about 1.3 mm long. The oral siphon has strong circular muscles and six blunt or pointed lobes. A very short tubular atrial siphon with a round opening lies behind the simple atrial lappet. A number of longitudinal thoracic muscles condense into a thick band on each side of the abdomen and post-abdomen. It is difficult to see the branchial structure, but about 17 rows of stigmata were counted in one zooid. The curved and tapering oesophagus enters the smooth-walled stomach at its anterior end. The usual divisions of the lower gut are present, and the anus, situated about the eighth row of stigmata from the posterior end, has two lips. No gonads were found in any zooid examined, and the post-abdomen is short, possibly in consequence of the non-breeding state of the zooids.
REMARKS: Sluiter (1912, 1914) first described *S. pererratum* (as *Macroclinum pererratum*) from the South Shetland Islands in the Antarctic, and the species was found again by Kott (1969a) at 68°30′S, 68°30′W (Antarctic Peninsula). The new specimens are considerably smaller than the largest of Sluiter's colonies, which reached 10 cm in diameter. They also differ in having straight, instead of curved, double rows of zooids. Despite these differences and the geographic separation I think it best to treat the New Zealand specimens as *S. pererratum*, but have given a detailed description so that any future material can be compared. The considerable depth (733–746 m) of the new specimens makes it easier to accept them as belonging to an Antarctic species.

Synoicum otagoensis sp.n. Fig. 5
MATERIAL EXAMINED: University of Canterbury Stn K631 (1 specimen); Portobello Stns MU68–86 (3 specimens), MU71–266 (1 specimen).
HOLOTYPE: A specimen 4 cm long, in collection of the National Museum of New Zealand, Wellington, New Zealand, type number ASC 06.
PARATYPE: NMNZ, type number ASC 05, one specimen from Portobello Stn MU71–266.
TYPE-LOCALITY: Portobello Stn MU68–86, continental slope east of Otago, South Island, 45°53′S, 171°04′E, 750 m.
DESCRIPTION: The colony in three specimens is an elongate upright head which is rounded or somewhat flattened at the upper end and tapered at the lower end to join a short stalk, the end of which may be expanded. The fourth specimen is almost mushroom-shaped, with a broad ovoid head and narrow short stalk. The head is bare or lightly coated with sand, and the stalk heavily coated with sand which is densest on the basal expansion. Some scattered sand grains may be present within the colony matrix. The upper end has either one or two oval common cloacal openings. Systems of long parallel rows of zooids extend up the sides of the colony and converge towards the apex, but some systems reach only part of the way up the sides of the colony. In the preserved state the colour is dark brown, reddish-orange or yellow, but in life is deep red, according to a collector's note. Large upright colonies are about 4 cm long and 2 cm wide. Zooids measure about 9 mm in length, but may vary with the stage of the reproductive and asexual cycles. The oral siphon has six pointed lobes and the atrial opening is large and sessile, with a long simple tapering lappet. Longitudinal muscles are thin and widely spaced on the thorax but converge at its base and pass along the abdomen and post-abdomen as a single band on each side. There are 15 or 16 rows of branchial stigmata with only about six wide oval stigmata per row. The oesophagus is tapered, the stomach ovoid and smooth, and the usual divisions of post-stomach and intestine are present. The two-lipped anus is opposite the fifth row of stigmata from the posterior end. In all zooids examined the post-abdomen is narrow and much longer than the abdomen and shows no obvious gonads. One or two embryos or larvae lie in the atrial cavity of some zooids. The larval trunk is about 0.54–0.66 mm long and has three papillae, four pairs of lateral and four single median ampullae, an ocellus and otolith.
REMARKS: The species is characterised by the shape (and colour?) of the colony and the shape and alignment of the systems of zooids. It is conspicuous and unlikely to have been overlooked, and may be confined to deep water.

Synoicum occidentalis sp.n. Fig. 6
MATERIAL EXAMINED: NZOI Stns E785 (4 specimens), E820 (1 specimen).
HOLOTYPE: A colony of maximum diameter 4.5 cm, in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H–274.
PARATYPES: NZOI, type number P–537, three specimens, from same sample as holotype; P–538, one specimen, from NZOI Stn E820.
TYPE-LOCALITY: NZOI Stn E785, off west coast of South

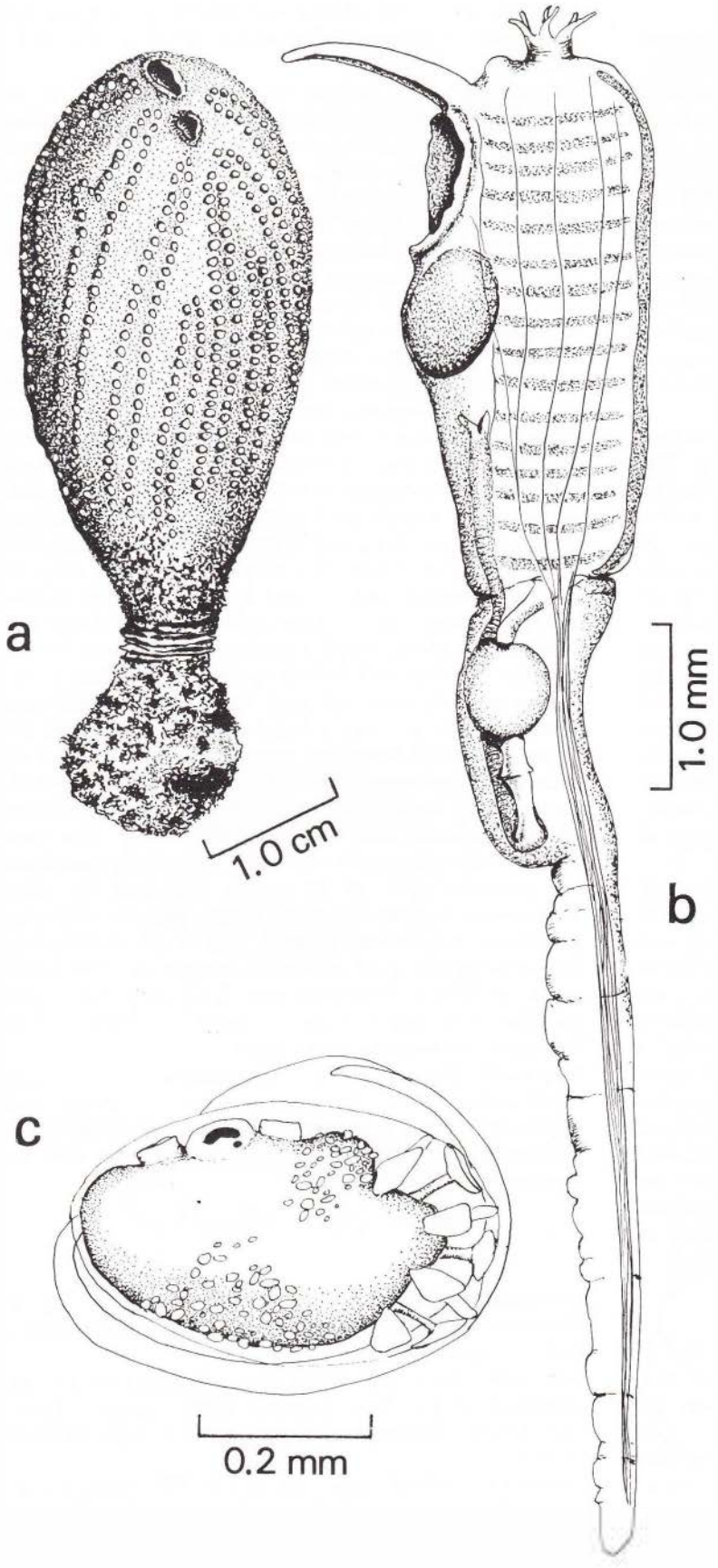

FIG. 5. *Synoicum otagoensis* sp.n.: *a*, colony; *b*, zooid; *c*, larva.

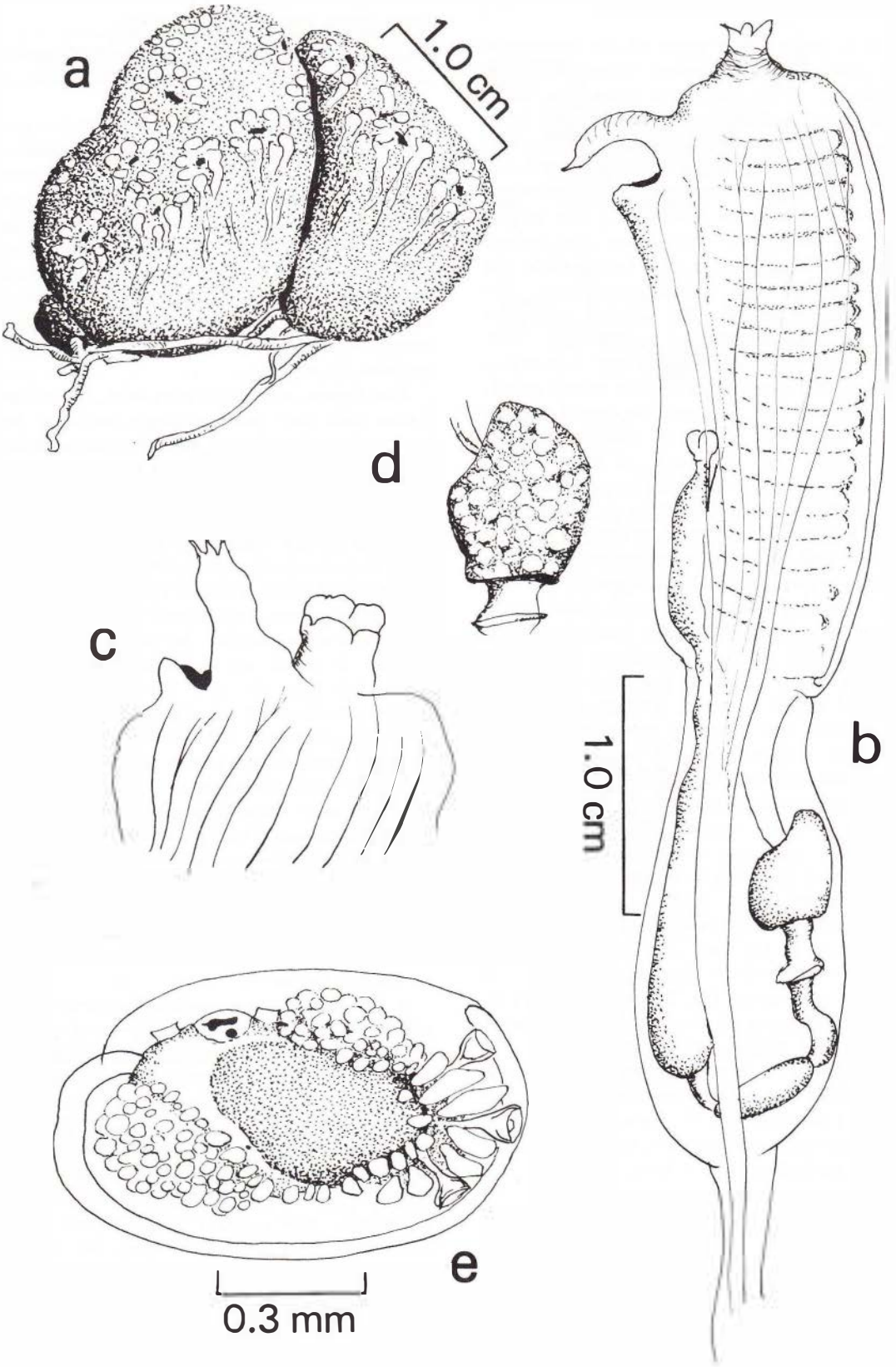

FIG. 6. *Synoicum occidentalis* sp.n.: *a*, colony, Stn E820; *b*, zooid, Stn E785; *c*, anterior end of another zooid; *d*, marbled form of stomach; *e*, larva, Stn E785.

Island near Jacksons Head, 44°00′S, 168°17.5′E, 282–274 m.

DESCRIPTION: It is uncertain if some of the specimens are complete colonies or detached lobes of larger compound colonies. The specimen from Stn E820 comprises two ovoid and somewhat flat-topped lobes fused at the base. One specimen from Stn E785 has two almost globular masses united by short narrow basal stalks, and the remaining two from the same station are individual ovoid masses. The holotype is the largest specimen (4.5 cm diameter). In colour the colony varies from dull greenish-grey to dark brown, and the consistency is fleshy and moderately firm. No encrusting matter is present on the surface, except at the base, and none is embedded in the test. Low papillae on the otherwise smooth surface sometimes mark the position of the zooids. The pale brown zooids are visible through the test, arranged in several roughly circular systems each with a central common cloacal opening. The thorax and abdomen, of about equal width, are about 2.8 and 2.0 mm long respectively in a typical zooid, and the much narrower post-abdomen extends to over 4 mm. The oral siphon has six pointed or rounded lobes, and the atrial opening, a simple hole without a siphon, is surmounted by a lappet which may be pointed or provided with three small distal teeth. About 12 narrow longitudinal muscles pass along each side of the thorax and are condensed into one wider band on each side of the abdomen and post-abdomen. In well expanded zooids 21 rows of stigmata can be counted. The curved and tapering oesophagus opens obliquely into the stomach, whose walls are either marbled or quite smooth and plain. The usual divisions of the lower gut are present, and the two-lipped anus lies opposite the seventh row of stigmata from the posterior end. No gonads are developed in any zooid examined, but larvae are present in the material from Stn E785. The larval trunk of two well-developed larvae measures 0.76 and 0.81 mm, from the end of the papillae to the base of the tail. The lateral anterior ampullae which flank the three papillae are divided to form numerous smaller ampullae, and large masses of antero-dorsal and postero-ventral vesicles are conspicuous. Both otolith and ocellus are present.

REMARKS: The species is distinguished from known New Zealand species and from others described in the present paper by a combination of characters: shape of colony, arrangement of zooid systems, number of rows of stigmata, size and structure of larva.

Synoicum apectetum sp.n. Fig. 7

MATERIAL EXAMINED: NZOI Stn F931 (more than 40 colonies or fragments).

HOLOTYPE: A fragment with maximum cormidium height 1.1 cm, in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H–272.

PARATYPE: NZOI, type number P–536, one specimen, from same sample as holotype.

TYPE-LOCALITY: NZOI Stn F931, continental shelf near northern tip of North Island, 34°28′S, 173°03.5′E, 51 m.

DESCRIPTION: A sand-coated basal stolon gives rise to a few cormidia each consisting of a slender sand-coated and usually sinuous stalk surmounted by an expanded head which is bare, smooth and pale orange in colour. Cormidia vary widely in height, but seldom exceed 1 cm. The head is often approximately pear-shaped but may have the upper end quite wide and nearly flat. The zooids, which are visible through the test of the head, are usually grouped in a single system with a central common cloacal opening, but some heads have two systems of zooids.

The thorax is about 4 mm long, the abdomen about 2 mm and the post-abdomen variable but may be longer than the thorax and abdomen together. The oral siphon is sometimes prominent, sometimes short, and has six pointed lobes. The atrial opening is on a short siphon, and surmounted by a simple atrial lappet which varies in length according to the distance of the zooid from the common cloacal opening. Body wall muscles are thin and often scarcely visible. There are usually 13 rows of stigmata, but in one zooid only 12 rows were counted and in another the posterior row was partially divided to make an incomplete 14th row. Each row appears to have about 15 stigmata. The oesophagus is curved, narrow and quite long, and enters the stomach obliquely. In most zooids the wall of the stomach is smooth, but occasionally appears to have a few indistinct and incomplete folds. The lining of the stomach may show irregular rows of small papillae. Further division of the gut into post-stomach, intestine and rectum follow the usual synoicid pattern. The anus, opposite the fourth or fifth row of stigmata from the posterior end, has two lobes. The ovary is some distance behind the lower limit of the gut, and the testis comprises a linear series of ovoid to block-like follicles extending below the ovary.

A few larvae are present in the atrial cavities of some zooids. The trunk of one fully-developed specimen is 0.56 mm in length, from the end of the papillae to the base of the tail. Three papillae, median and lateral anterior ampullae, dorsal and ventral epidermal vesicles, ocellus and otolith are all present.

REMARKS: The known species which this most resembles is *S. arenaceum*, recorded by Michaelsen (1924) from North Cape and Stewart Island. In particular, the general colony form, the stomach, branchial structure (15 rows of stigmata in *S. arenaceum*) and position of the ovary are points of similarity, but the head of the cormidium appears to be different, being markedly flat-topped in *S. arenaceum* and pear-shaped in *S. apectetum*. There must remain some doubt, however, on the distinctness of the two species. Neither is yet known from a series of specimens taken in a variety of places and habitats, so

the range of variation is unknown, and more material might show that the two species are merely variations in a single species, *S. arenaceum.*

Synoicum arenaceum (Michaelsen, 1924)

Macroclinum arenaceum Michaelsen, 1924: 406–413, figs 23, 24, 25.

PUBLISHED RECORDS, NEW ZEALAND: North Cape (Michaelsen 1924), Stewart Island (Michaelsen 1924).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Michaelsen 1924): Colony sand-encrusted, of basal branching strands from which arise finger-like flat-topped lobes; on apex of each lobe a system of zooids and one excentric common cloacal opening; atrial opening on short siphon; atrial lappet long and narrow; 15 rows of stigmata; long narrow oesophagus enters obliquely to side of smooth-walled stomach; testis a long irregular double row of follicles; ovary anterior to testis but some distance behind gut.

REMARKS: Several authors (Millar 1960, Kott 1963, Croxall 1972) have doubted whether *S. arenaceum, S. herdmani* and *S. kuranui* are distinct, and the question remains unresolved. Kott (1969a) also considered this species to be synonymous with *Aplidium recumbens* (Herdman), which she recorded from Macquarie Island.

Synoicum hypurgon (Michaelsen, 1924)

Macroclinum hypurgon Michaelsen, 1924: 401–406, fig. 22.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Michaelsen 1924).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Michaelsen 1924): Colony rounded, tapering to base, free of sand except at base; atrial siphon very short; atrial lappet pointed; 12–14 (?) rows of stigmata; stomach with smooth wall; testis in posterior half of post-abdomen, with follicles loosely arranged; ovary slightly anterior to testis and considerably behind gut.

?**Synoicum fungosum** (Herdman, 1886)

Polyclinum fungosum Herdman, 1886: 190–193, pl. 14 figs 15–23. Sluiter, 1900: 10, pl. 1 fig. 6.

Macroclinum fungosum. Michaelsen, 1924: 421.

REMARKS: According to Michaelsen (1924) it is very doubtful if Sluiter (1900) was correct in identifying specimens from Chatham Islands as Herdman's species which was collected at Port Jackson, Australia. Michaelsen thought that they might belong to one of the other species of *Synoicum*.

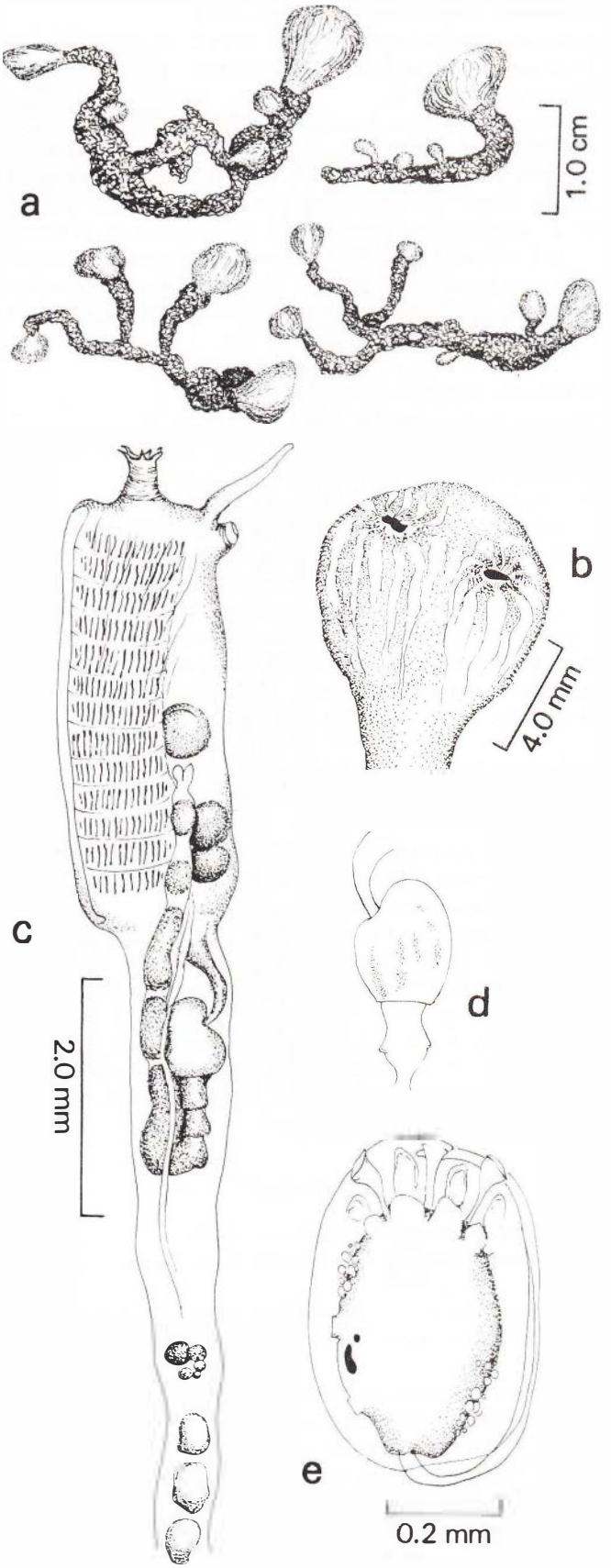

FIG. 7. *Synoicum apectetum* sp.n.: *a*, colonies; *b*, head of colony with two common cloacal openings and systems of zooids; *c*, zooid; *d*, stomach with appearance of incomplete folds; *e*, larva.

Synoicum haurakiensis Brewin, 1951

Synoicum haurakiensis Brewin, 1951: 106–107, fig. 2.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1951).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1951): Colony small, globose and sometimes with short stalk; without sand except some on stalk; test transparent; atrial lappet long; longitudinal muscles on post-abdomen concentrated on one side; 12 or 13 rows of stigmata; stomach with areolated wall; testis of 10–18 follicles in posterior half of post-abdomen; ovary immediately anterior to testis but considerably behind gut.

Synoicum herdmani Brewin, 1956

Synoicum herdmani Brewin, 1956b: 123–124, fig. 1.

PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands (Brewin 1956b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin, 1956b): Colony small with wide flat-topped head tapering down to narrow stalk; test transparent but impregnated with sand and shell; systems numerous, circular, on flat top of head; atrial lappet simple, fleshy; 14 rows of stigmata; stomach smooth but with faint internal folds; testis of up to 21 follicles in posterior half to two-thirds of post-abdomen; ovary anterior to testis.

Synoicum kuranui Brewin, 1950

Synoicum kuranui Brewin, 1950c: 355–356, fig. 1. Millar, 1960: 49–51, fig. 8B.

PUBLISHED RECORDS, NEW ZEALAND: Great Barrier Island (Brewin 1950c), North Cape (Millar 1960).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1950c, Millar 1960). Colony of narrow sandy flat-topped lobes joined by basal membrane; systems round, on flat areas; atrial lappet with a few terminal teeth or lobes; 10–14 rows of stigmata; stomach with low areolations; testis of up to 16 follicles, in posterior third of post-abdomen; ovary immediately anterior to testis but far behind gut.

Aplidium Savigny, 1816

Aplidium mernooensis (Brewin, 1956) Fig. 8

Amaroucium (Aplidium) mernooensis Brewin, 1956b: 132–134, fig. 4A.

MATERIAL EXAMINED: NZOI Stn D267 (9 specimens).

PUBLISHED RECORDS, NEW ZEALAND: Chatham Rise (Brewin 1956b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: A large specimen from Station D267 is about 3.2 cm in greatest diameter and about 1.2 cm high. Other specimens are much smaller and may be small colonies or fragments of a broken colony. Lobes numbering up to about 30 arise from a common basal mass and are upright and crowded, with flat and somewhat expanded upper ends. The whole colony is coated with sand except the areas immediately over the zooids. The zooids open only on the upper ends of the lobes and are arranged on each lobe in a circular system with a small central common cloacal opening.

The colonies originally described by Brewin (1956b) were much smaller and simpler and were illustrated with one or two lobes, but the characteristics of the lobes and of the zooids are essentially the same as in the new material.

The oral siphon has eight lobes (an unusual feature in *Aplidium*). The atrial opening is surmounted by a lappet with a large central and two small lateral teeth. Five rows of branchial stigmata, a long oesophagus, a stomach with five folds, and the ovary situated amongst the male follicles, instead of anterior to them, are further features of the type material confirmed by the present specimens.

Aplidium phortax (Michaelsen, 1924) Fig. 9

Amaroucium phortax Michaelsen, 1924: 389–400, figs 20, 21.
Aplidium (Amaroucium) phortax. Brewin, 1946: 92–94, fig. 2.
Aplidium phortax. Kott, 1963: 109, figs 23, 24.

MATERIAL EXAMINED: NZOI Stns E107 (3 specimens), E108 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: Tauranga (Michaelsen 1924), D'Urville Island (Sluiter 1900, as *Amaroucium ritteri*), Otago (Brewin 1946), Stewart Island (Michaelsen 1924), Chatham Islands (Sluiter 1900, as *Amaroucium obesum*).

PUBLISHED RECORDS, ELSEWHERE: Eastern Australia, Solomon Islands.

DESCRIPTION: The colonies examined vary from a fan-shaped stalked specimen to a hemispherical broadly based specimen. Little or no sand is present on the surface or within the test, except on the base or stalk. Zooids can be seen through the cloudy semi-transparent test but no arrangement in systems was distinguished. Most zooids are contracted, so obscuring details of the branchial sac, but there appear to be not more than 14 rows of stigmata. The atrial opening has a long central lappet with two small basal lobes. The stomach is remarkable in having up to 33 folds. No gonads or larvae were present.

REMARKS: A slight difference between the new material and existing accounts of the species is the number of stomachal folds. Michaelsen (1924) found this to be 23–26 in typical specimens from New Zealand and 29–32 in material from Stewart Island (Michaelsen's var. *ptychodes*).

Aplidium quadriversum sp.n. Fig. 10

MATERIAL EXAMINED: NZOI Stn A696 (11 specimens).

HOLOTYPE: A specimen about 1.2 cm long, in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H–265.

PARATYPES: NZOI type number P–524, ten specimens from same sample as holotype.

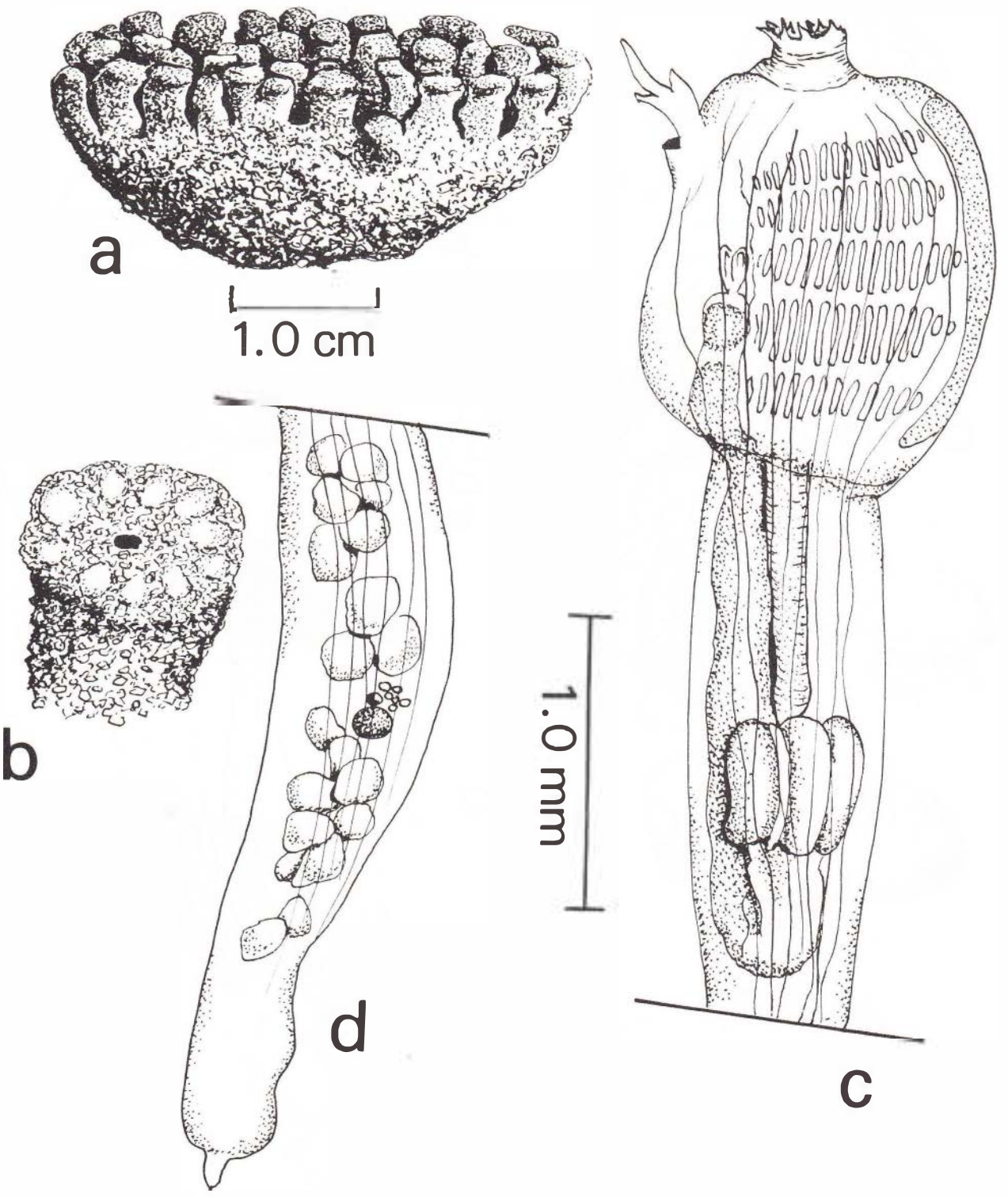

FIG. 8. *Aplidium mernooensis* (Brewin): *a*, colony; *b*, apex of lobe of colony; *c*, zooid (thorax and abdomen); *d*, zooid (post-abdomen).

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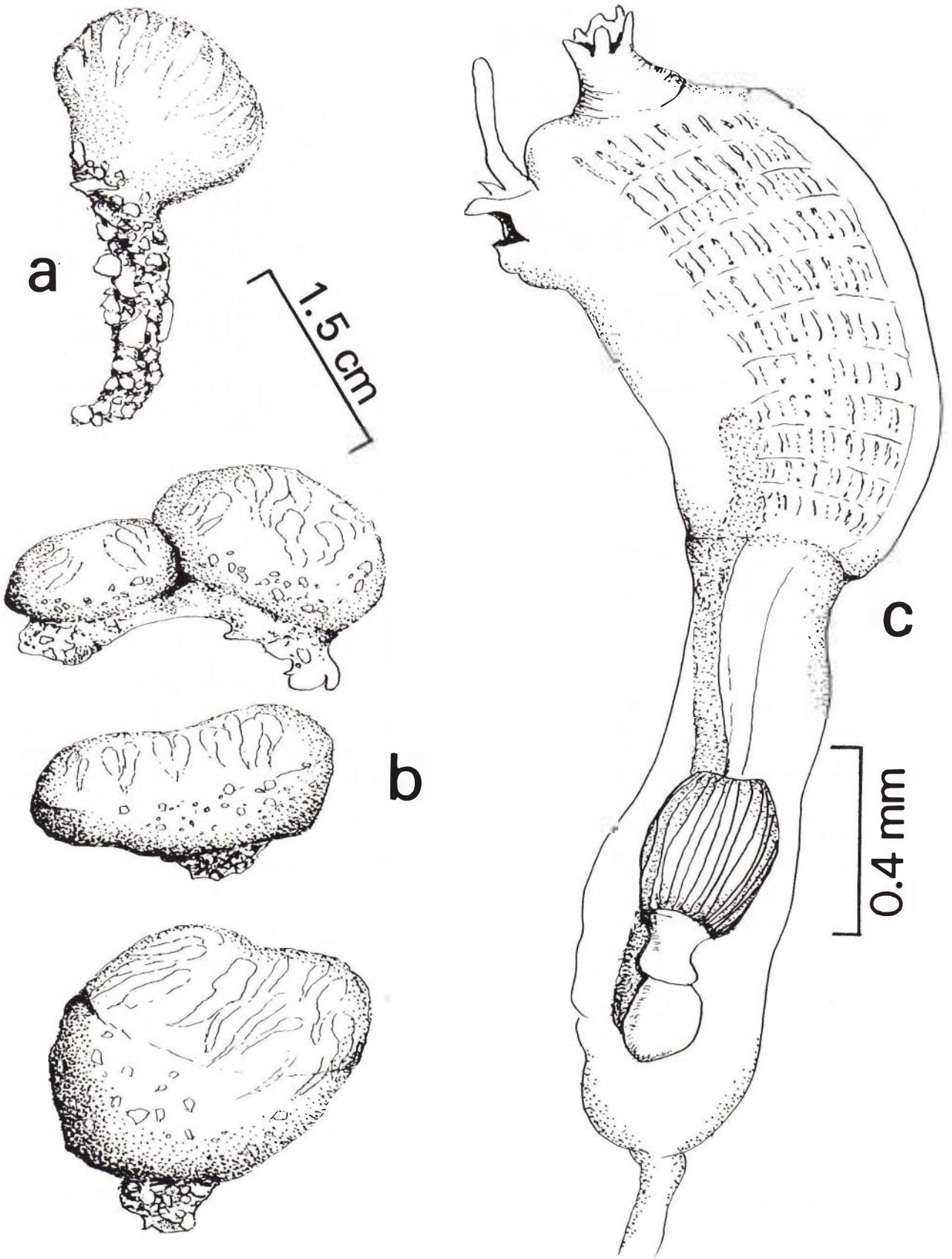

FIG. 9. *Aplidium phortax* (Michaelsen): *a*, colony, Stn E108; *b*, three colonies, Stn E107; *c*, zooid.

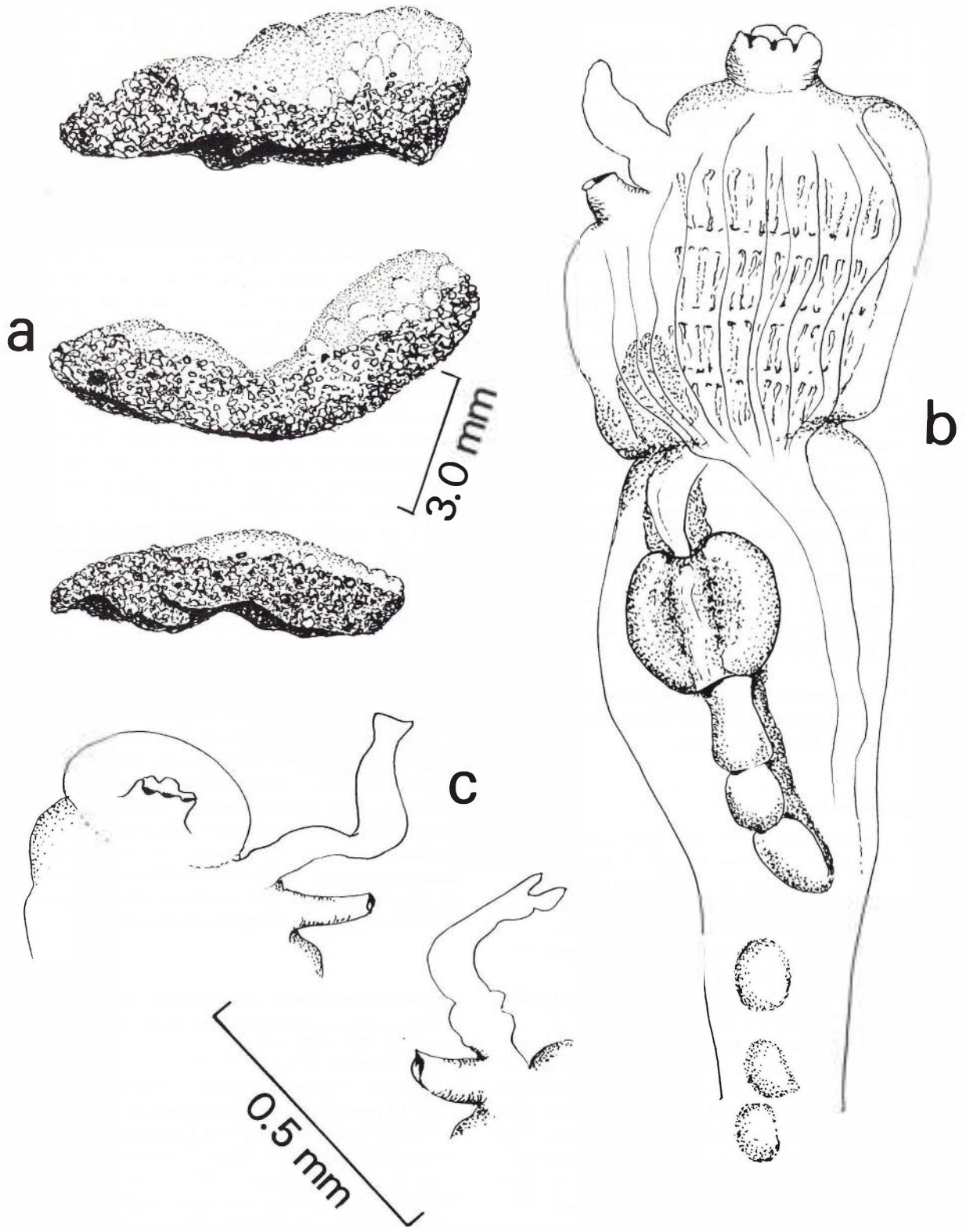

FIG. 10. *Aplidium quadriversum* sp.n.: *a*, colonies; *b*, zooid; *c*, other forms of atrial siphon and lappet.

TYPE-LOCALITY: NZOI Stn A696, near Macquarie Island, 54°37.7′S, 158°57′E, 433 m.

DESCRIPTION: The colonies are small, elongate, pillow-shaped or rounded masses, up to about 1.5 cm long. They are impregnated with sand but remain soft and flexible, and are also sand-coated although only lightly so over the area occupied by zooids. No arrangement of zooids in systems is apparent. On a few colonies one common cloacal opening was seen, with a slightly projecting border.

The zooids are often distorted, either the thorax or the post-abdomen being bent away from the abdomen. The thorax is shorter than the abdomen, and their combined length is usually 1.5–2.0 mm. The post-abdomen varies in length considerably. The lobes of the oral siphon are often indistinct but appear to number six. The atrial opening is on a narrow tubular to conical siphon surmounted by a strap-like lappet with a blunt or bifid end. Longitudinal body wall muscles on each side of the thorax converge to form a band passing down the ventral half of each side of the abdomen. Four rows of stigmata are present, leaving a quite large unperforated area at the anterior end of the branchial sac. The three dorsal languets are short and stout. The stomach is short and wide, with four or five unbroken folds. The usual divisions of the post-stomach, intestine and rectum are distinct. Few zooids examined have well-developed gonads, at most three or four rounded male follicles being present. No larvae were found.

REMARKS: The species is distinguished by the four rows of stigmata, four or five stomachal folds, tubular atrial siphon, and sandy, but soft colony.

Aplidium pseudoradiatum sp.n. Fig. 11

MATERIAL EXAMINED: NZOI Stn A696 (5 specimens).

HOLOTYPE: A specimen 8 mm wide and 5.5 mm high, in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H–264.

PARATYPES: NZOI, type number P–523, four specimens from same sample as holotype.

TYPE-LOCALITY: NZOI Stn A696, near Macquarie Island, 54°37.7′S, 158°57′E, 433 m.

DESCRIPTION: The typical shape of the colony is a squat cylinder slightly expanded at the base and with a flat upper end bordered by a low rounded ridge. A large colony is about 12.5 mm across the base. Sand coats the whole surface but is less plentiful on the upper end. The zooids open on the upper end, projecting somewhat, and are indistinctly visible through the test. A few common cloacal openings are present amongst the zooids.

The zooids vary in size, up to about 10 mm in length. A typical zooid has a thorax of 2 mm, and abdomen of 2.5 mm and a post-abdomen of 2.7 mm. The abdomen and post-abdomen are of about equal width and are narrower than the thorax. There are six pointed oral lobes. In uncontracted zooids the atrial opening is unusually large for a species of *Aplidium*, and exposes a considerable part of the branchial sac. The anterior border is produced into a lappet with three, four or five lobes. Longitudinal muscles on the thorax are indistinct, except along the margins of the atrial opening, where they are concentrated into thicker bands. There are about 12 rows of branchial stigmata and 11 stout dorsal languets. The oesophagus is long and narrow. Five or six unbroken folds are present on the wall of the stomach. Divisions of the lower gut are indistinct owing to the presence of food but probably comprise the usual post-stomach and intestine. The anus lies opposite the seventh (from the anterior end) row of stigmata. A few zooids have gonads, comprising an ovary near the anterior end of the post-abdomen and a series of male follicles almost immediately behind the ovary.

REMARKS: A few specimens having several features of colony and zooid as in the above description may nevertheless be distinct. The main differences are: in the colony the absence of a projecting rim around the upper face and of swellings over the zooids, and, in the zooid its smaller size, its small atrial opening and its generally more distinct longitudinal muscles. One of these colonies has larvae in the atrial cavities of a few zooids. The trunk is about 0.42 mm long. The differences suggest a separate species, but because there are also considerable similarities they require reinforcement by additional distinctions (e.g., larval characters, at present unknown in *A. pseudoradiatum*) before a separate species is proposed.

A. pseudoradiatum has certain features in common with the Antarctic species *A. radiatum* (Sluiter), notably the sandy short-stalked colony, the large atrial opening, and the number of stomachal folds of the zooid. But it does not have the long narrow radiating arrangement of the zooid systems which is a characteristic of *A. radiatum*. The similarities, notably in the zooid, and the southern distribution of both species, suggest a common ancestry.

Aplidium scabellum (Michaelsen, 1924) Figs 12, 13.

Amaroucium scabellum Michaelsen, 1924: 374–383, fig. 18. Brewin, 1948: 115; 1958b: 455.

Aplidium scabellum. Kott, 1963: 93.

MATERIAL EXAMINED: NZOI Stns C957 (2 specimens), F936 (1 specimen), I3 (9 specimens), I55 (4 specimens), ?J550 (3 specimens), P64 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: Little Barrier Island (Michaelsen 1924): Colville Channel (Michaelsen 1924), Hauraki Gulf (Brewin 1948, 1958b), Chatham Islands (Brewin 1956b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: Michaelsen (1924) described the colonies as consisting of several heads united by a thin basal membrane. In most of the new material the heads usually exist as apparently independent colonies. They

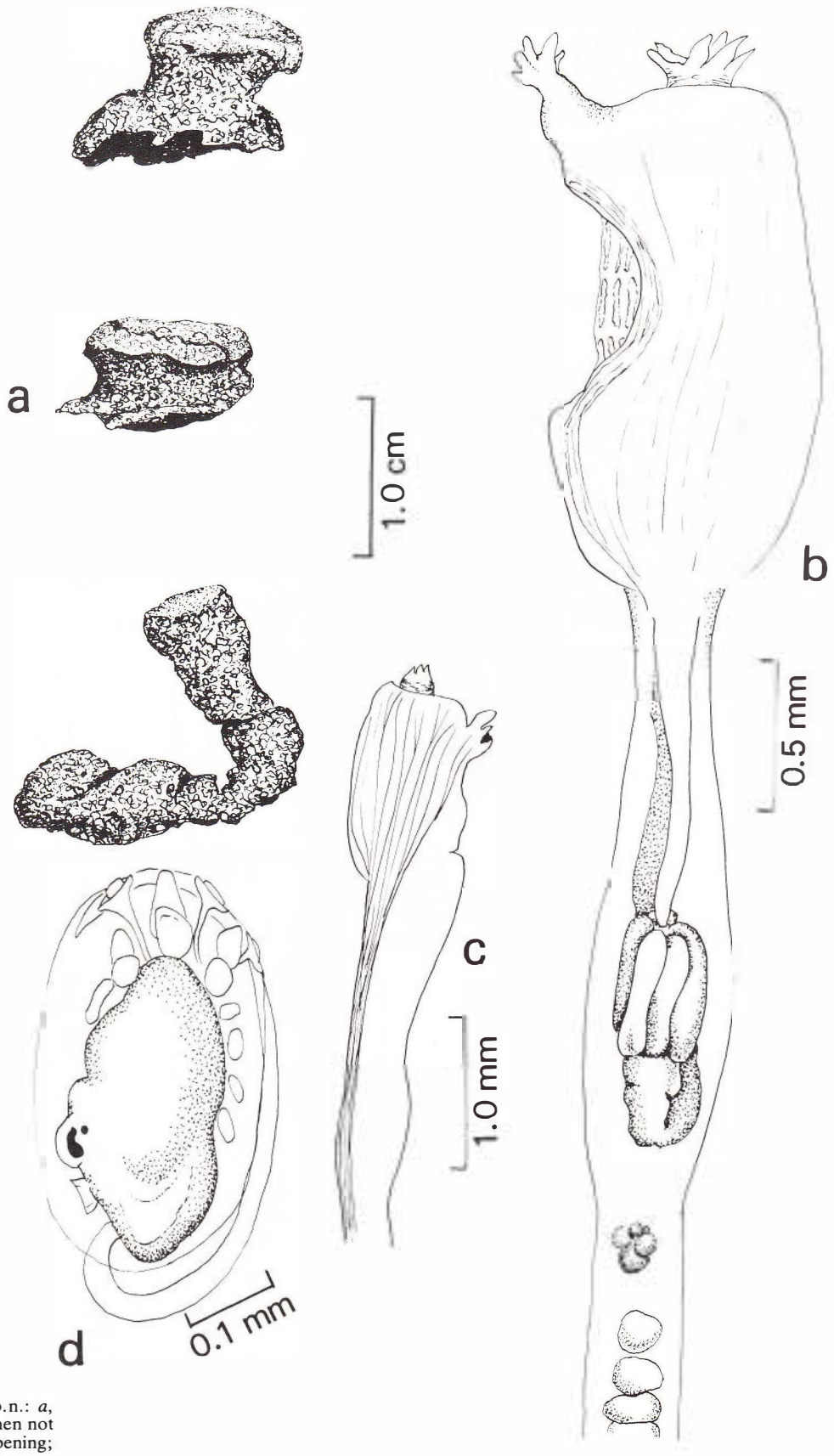

FIG. 11. *Aplidium pseudoradiatum* sp.n.: *a*, colonies; *b*, zooid (part of post-abdomen not shown); *c*, zooid with smaller atrial opening; *d*, larva.

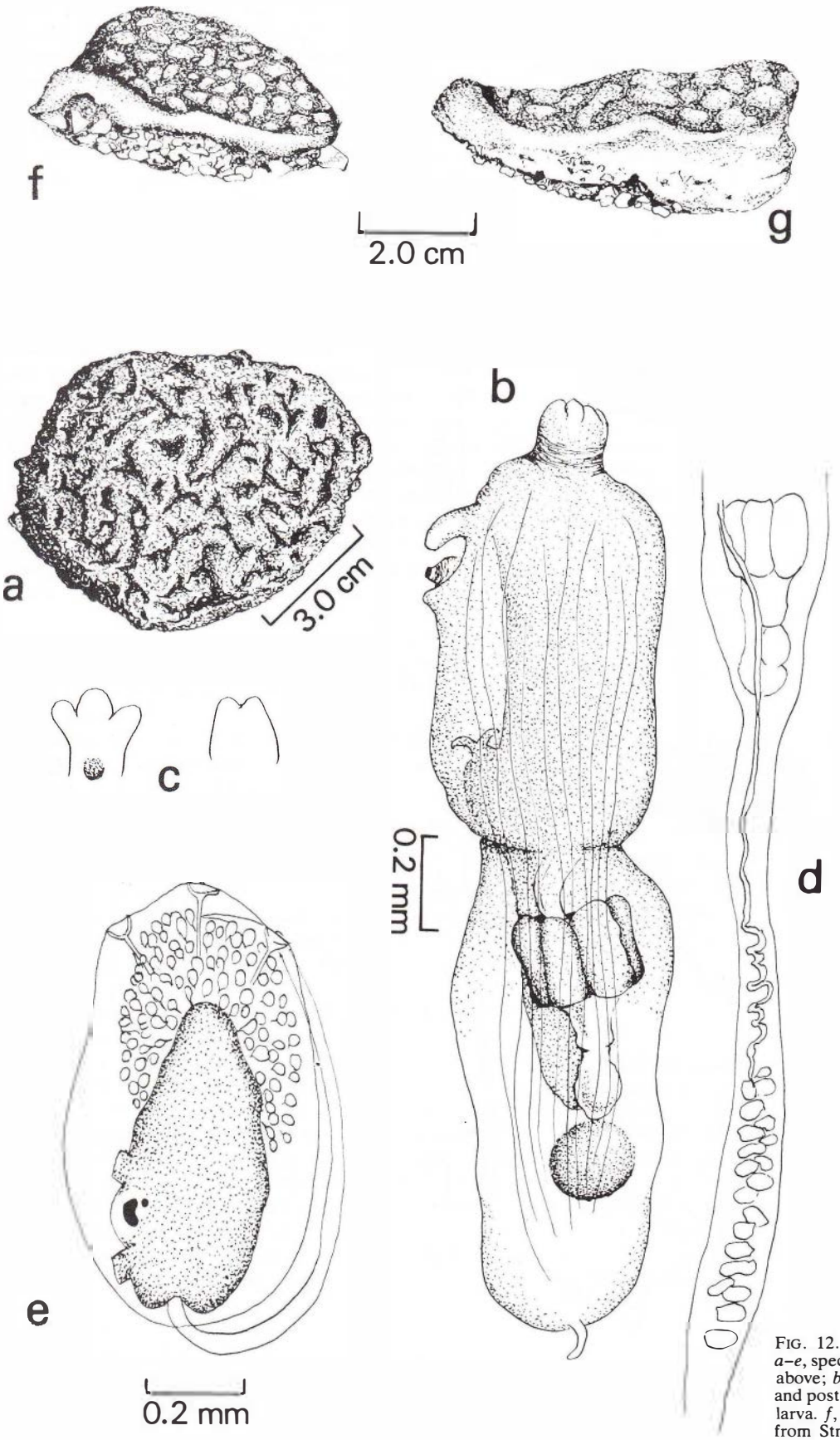

FIG. 12. *Aplidium scabellum* (Michaelsen), *a–e*, specimen from Stn F936: *a*, colony from above; *b*, zooid; *c*, atrial lappet; *d*, abdomen and post-abdomen (ovary not developed); *e*, larva. *f*, specimen from Stn I55. *g*, specimen from Stn I3.

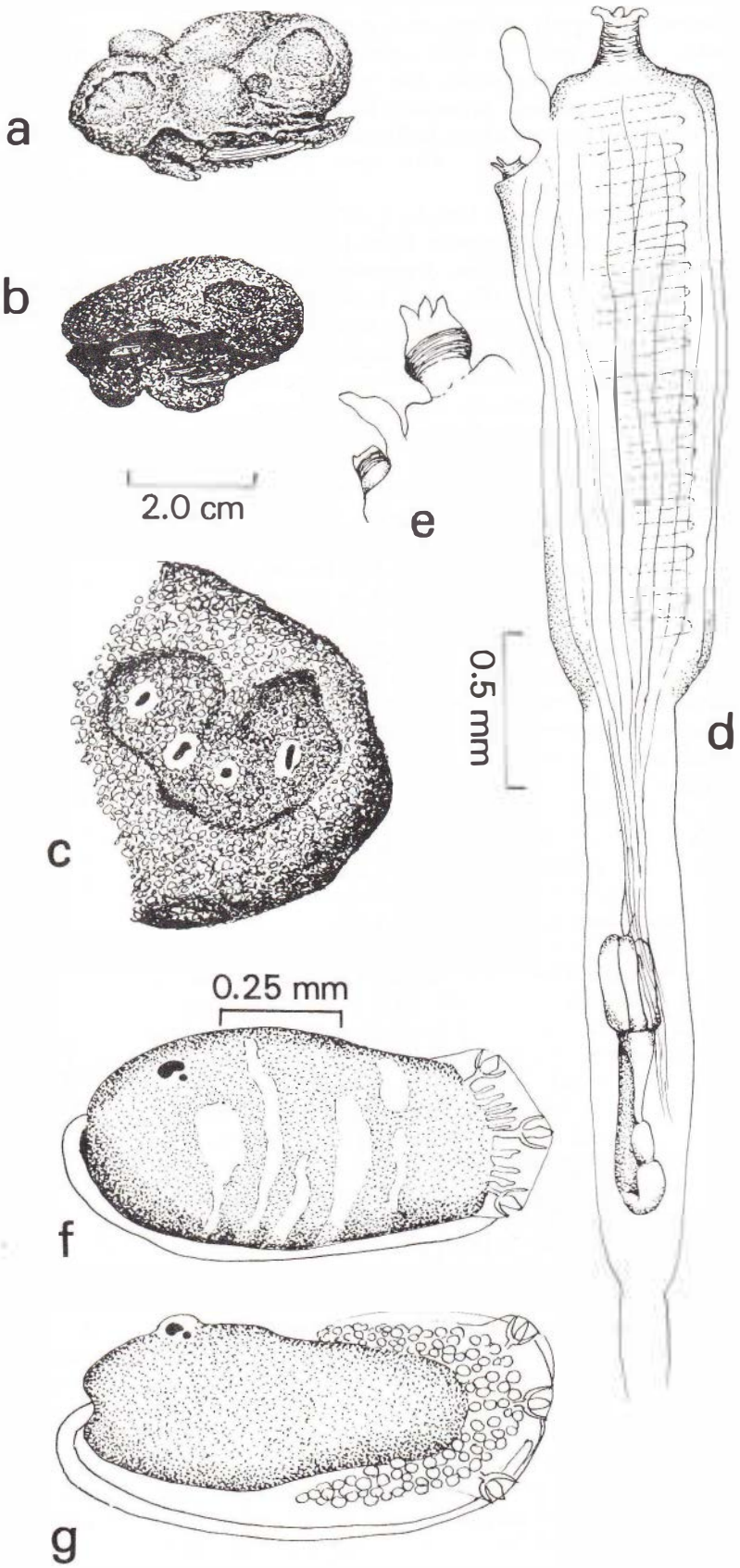

FIG. 13. *Aplidium scabellum* (Michaelsen), specimens from Stn C957: *a*, *b*, colonies; *c*, part of a colony, from above; *d*, zooid; *e*, anterior end of thorax; *f*, developing larva; *g*, fully developed larva.

may reach 7 cm in diameter, and have a convex or almost flat upper surface and more or less straight sides, which may be very short giving a squat or pancake-like appearance. The upper surface has a number of swellings separated by furrows united to form a network, and a low, indistinct ridge encircles the whole upper surface. The test is coated and impregnated with sand.

Two colonies from Station C957 differ somewhat from those described above. Each is a low sandy mass with a few wide shallow depressions on the convex upper side; in one the mass is divided into a few rounded and very incompletely separated lobes. The form of these two colonies is considered to be a simple variation from the commoner shape, since they all have similar and characteristic zooids and larvae.

The systems of zooids are indistinct externally, but horizontal sections of the colony show oval or sometimes elongate systems separated by a network of common cloacal canals lying below the furrows of the surface. Several common cloacal openings exist.

The zooids are pale orange to dark brown. They vary in length, the thorax usually being up to 2 mm long and the abdomen of equal or greater length. The oral siphon has six lobes and the atrial siphon is short and tubular (not noted by Brewin), occasionally with a few teeth on the margin. Both siphons have circular muscles, sometimes forming conspicuous bands. The atrial lappet is blunt and has an undivided, bifid or occasionally trifid end. Longitudinal muscles pass along the thorax and are concentrated into one band along each side of the abdomen and post-abdomen. Michaelsen (1924) remarked on the development of these bands, and Brewin (1956) also noted them but described them as present on the thorax as well as the abdomen and post-abdomen – a condition not found in the new material or in Michaelsen's account. There are 20–22 branchial rows, each with at least 10 stigmata (20–22 stigmata in Brewin's account). The oesophagus is narrow, and the stomach has five or six unbroken folds. The usual divisions of the *Aplidium* gut are visible and the two-lipped anus lies opposite the fifth row of stigmata from the posterior end. The testis is a long series of small follicles and the ovary (not seen in the new material) is anterior to the testis.

Breeding zooids in the present material have two embryos or larvae in the atrial cavity; Michaelsen (1924) noted one. The larva is large, having a trunk (from the tip of the papillae to the base of the tail) 0.9–1.1 mm long. The anterior, narrow part of the trunk is surrounded by a mass of small epidermal vesicles. The three papillae have long slender stalks. Both otolith and ocellus are present. Developing larvae in the colony from Station C957 have irregular whitish bands across the trunk and numerous narrow anterior processes which presumably give rise to the epidermal vesicles of fully developed larvae.

REMARKS: *A. scabellum* is characterised by the sandy colony with sculptured upper surface, the presence of a short tubular atrial siphon, 20–22 rows of stigmata, five or six stomachal folds, and large larvae with many epidermal vesicles.

Aplidium unicornum sp.n. Fig. 14

MATERIAL EXAMINED: NZOI Stn F924 (2 specimens).

HOLOTYPE: A colony 1. 2 cm in maximum diameter and 1.2 cm high, in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H–266.

PARATYPE: NZOI, type number P–525, a colony 1.3 cm across and 1.7 cm high, from same sample as holotype.

TYPE-LOCALITY: NZOI Stn F924, continental slope east of Three Kings Islands, 34°07.5′S, 172°47′E, 315–439 m.

DESCRIPTION: The specimens are attached to the same dead shell. They are somewhat narrowed at the base and the upper end is wide and slightly concave, bordered by a low rounded rim. A few oval common cloacal openings are situated on the upper end, and the zooids are faintly visible through the test. The test is rather soft, semi-transparent, and devoid of encrusting or embedded sand.

A typical zooid has a thorax 2.3 mm, an abdomen 2.3 mm, and a post-abdomen of variable and sometimes considerably greater length. The siphons are characteristic. The oral siphon has six pointed lobes, those on the ventral side being somewhat separated from the dorsal lobes and bent into a hooked shape. The atrial siphon is a distinct short tube with more than six teeth or small lobes on the margin. Between the siphons a variable projection is usually present and may be an atrial lappet. Numerous narrow longitudinal muscles on the thorax pass back along the abdomen without being gathered together into a thick band. There are about 20 rows of branchial stigmata. In expanded zooids the oesophagus is long. The stomach has five unbroken folds and the usual post-stomach and intestine are present. The anus is opposite the fifth stigmatic row from the posterior end. No gonads or larvae were present in any zooid examined.

REMARKS: The characteristics of the species are the form of the colony, the shape of the oral and atrial siphons, and the number of stigmatic rows and stomachal folds.

Aplidium glaphyrum sp.n. Fig. 15

MATERIAL EXAMINED: NZOI Stn F922 (1 specimen).

HOLOTYPE: A colony, in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H-262.

TYPE-LOCALITY: NZOI Stn F922, continental shelf near Three Kings Islands, 33°59′S, 172°16′E, 84–70 m.

DESCRIPTION: The only specimen (the holotype) is a colony about 2.5 cm long, 2.5 cm high and 1.3 cm wide. It is a somewhat laterally flattened column, the upper border of which is a swollen rounded ridge enclosing the low dome-shaped area on which the

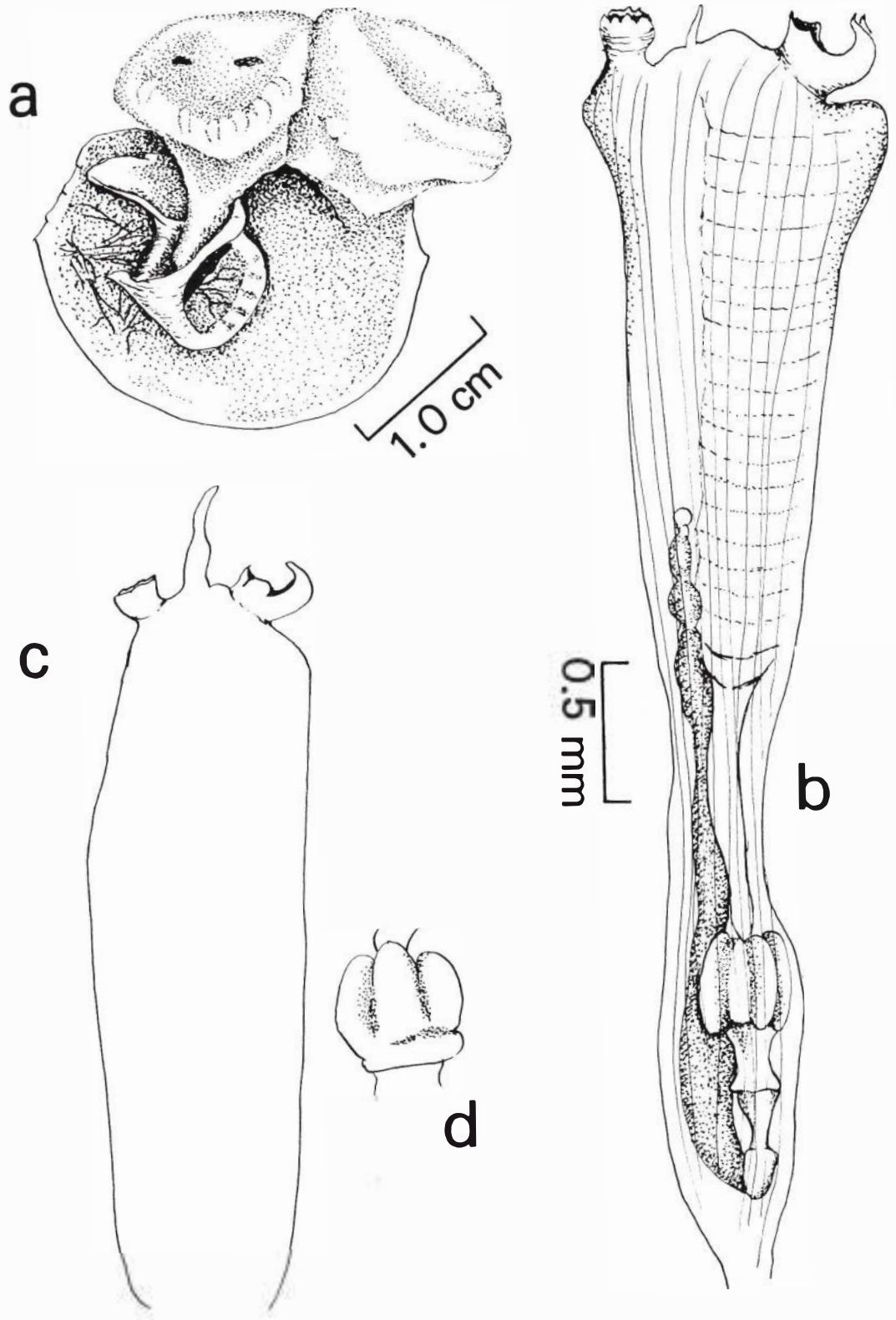

FIG. 14. *Aplidium unicornum* sp.n.: *a*, colonies; *b*, zooid; *c*, thorax of another zooid; *d*, stomach.

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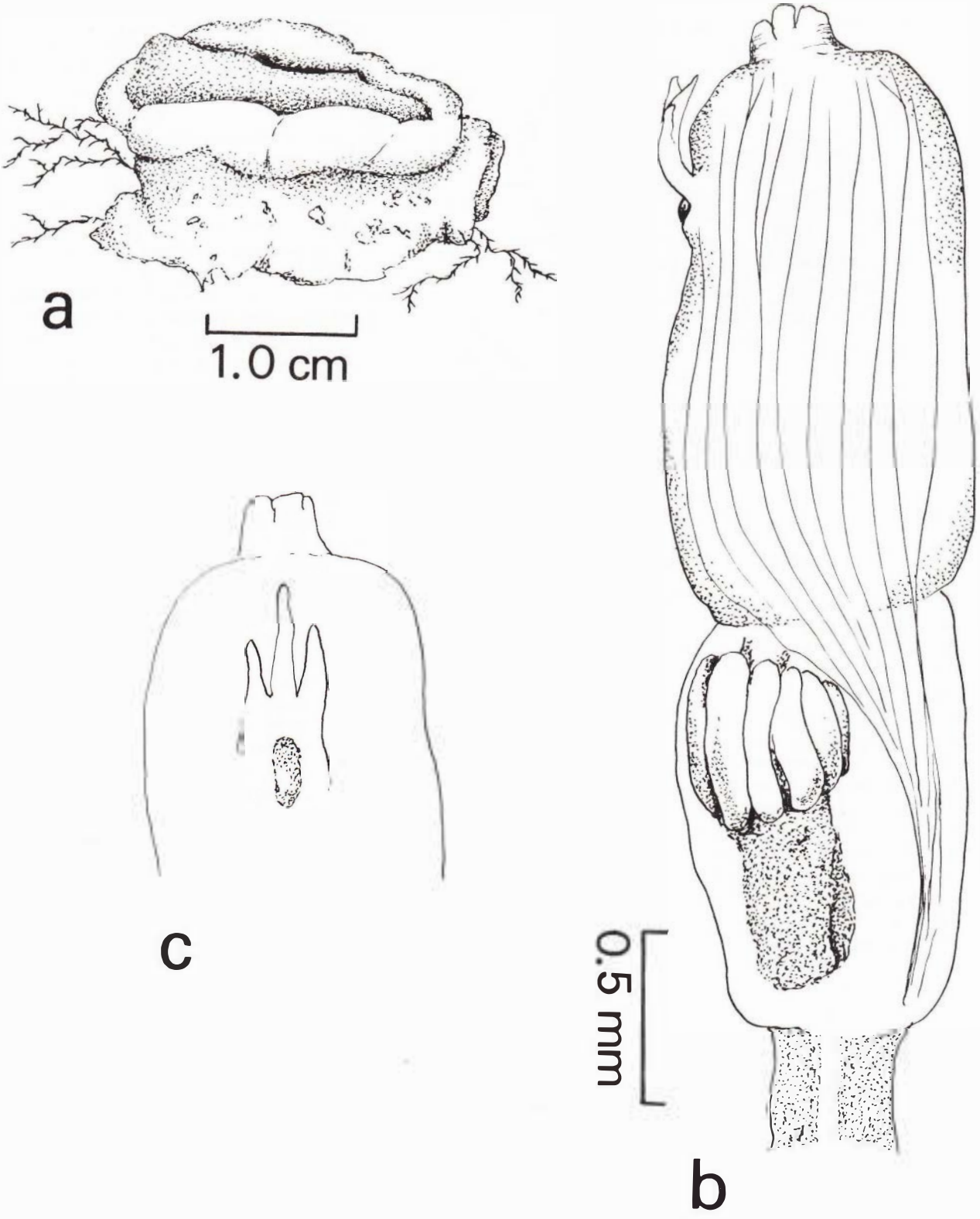

FIG. 15. *Aplidium glaphyrum* sp.n.: *a*, colony; *b*, zooid (thorax and abdomen); *c*, atrial lappet from dorsal side.

zooids open. Between this area and the marginal ridge is a narrow groove containing about eight funnel-shaped common cloacal openings. The oral openings were not distinguished. The colony has very little encrusting matter and no embedded sand. It is pale, translucent, grey and cartilaginous, but not hard in texture.

In a typical zooid the thorax is 1.7 mm and the abdomen 1.5 mm long. The post-abdomen varies in length. The body wall is opaque, with about ten narrow longitudinal muscles on each side of the thorax, concentrated into a single stouter band on each side of the abdomen. The oral siphon has six lobes and the atrial opening is sessile and surmounted by a three-lobed lappet. Fourteen or 15 rows of stigmata are present. The oesophagus is short and the stomach has seven or eight unbroken folds. The remaining divisions of the gut are obscure owing to the presence of food. No gonads were found in any zooid.

REMARKS: The species is characterised, on the basis of the single specimen, by the form of the colony, the arrangement of the common cloacal openings, and the number of stigmatic rows and stomachal folds.

Aplidium amphibolum sp.n. Fig. 16

MATERIAL EXAMINED: NZOI Stn E114 (2 specimens).

HOLOTYPE: A colony 1.1 cm long, in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H-260.

PARATYPE: NZOI, type number P-519, a specimen from same sample as holotype.

TYPE-LOCALITY: NZOI Stn E114, Chatham Rise east of South Island, 43°35′S, 176°15′W, 135 m.

DESCRIPTION: The holotype is 1.1 cm long and 0.6 cm in height, and is a short column with a flat and somewhat expanded upper end with low swellings on its margin. The second specimen has a lobe 0.9 cm long of similar shape to the holotype, and a low rounded divided lobe, which may be a thick basal stolon. It is attached to a dead bivalve shell. The base and sides of both colonies are coated with sand and the upper flat face is almost bare. The consistency of the colonies is soft, and the common test nearly transparent, with only scattered embedded sand grains. Common cloacal openings were not seen and the arrangement of zooids is not clear.

In a typical zooid the thorax measures 2.8 mm, the abdomen 1.2 mm and the post-abdomen 4.5 mm in length. The oral siphon has six narrow pointed lobes and the atrial opening is either sessile or on a very short siphon. It is surmounted by a narrow lappet which is blunt or provided with two or three short terminal lobes. The longitudinal body wall muscles, numbering about seven, are fine and indistinct. There are about 14 rows of stigmata with apparently about 12 stigmata in each. The stomach shows ten folds which have a tendency to break into shorter lengths. The usual divisions of the lower gut into post-stomach and intestine are visible in some zooids, and the anus is opposite the seventh row of stigmata. The long narrow post-abdomen contains only a few male follicles near its lower end and an ovary immediately anterior to the testis. The greater part of the post-abdomen is devoid of gonad, which may be in a spent and reduced state in this material. About six larvae are present in the atrial cavity of some zooids. They have a trunk of 0.38–0.40 mm in length, an ocellus and otolith, the usual three anterior papillae, four pairs of antero-lateral ampullae, and two median ampullae between the papillae.

REMARKS: Two species described from New Zealand waters are somewhat similar to the new species. *A. siphonum* (Brewin, 1956), first taken in 27 m off Chatham Islands, has 15 or 16 rows of stigmata and 11 or 12 stomachal folds. It is distinguished by the presence of a distinct atrial siphon the upper border of which is produced as a lappet, the absence of sand in the test, and the obvious arrangement of the zooids in circular systems. *A maritimum* (Brewin, 1958), also with a distinct atrial siphon distinguishing it from the new species, has 12 rows of stigmata, 6–8 stomachal folds, and a sandy test. It is known from the Otago coast and Foveaux Strait. *A. siphonum* and *A. maritimum* are quite similar to each other; the atrial siphon in particular is the same and is much longer and wider than the small tube sometimes present in the new species.

Aplidium chthamalum sp.n. Fig. 17

MATERIAL EXAMINED: NZOI Stns F100 (9 specimens), F102 (5 specimens); Portobello Stn MU71–266 (8 specimens).

HOLOTYPE: A colony about 2.0 cm high and 2.6 cm wide at the base, in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H–261.

PARATYPES: NZOI, type numbers P–520, eight specimens from same sample as holotype; P–521, five specimens, from NZOI Stn F102. NMNZ, type number ASC 14, eight specimens from Portobello Stn MU71–266.

TYPE-LOCALITY: NZOI Stn F100, south of South Island, 49°02′S, 168°53.5′E, 733–746 m.

DESCRIPTION: The colony has a wide base which is plate-like or somewhat thicker, tapering upwards, and arising from the base a single dome-shaped to conical head or occasionally two heads. Small colonies are 2 cm across the base and 1 cm in total height. A large colony is 3 cm by 1.9 cm. Pale grey sand coats and impregnates the whole colony, most densely on the base which is harder than the head. The base of some colonies is extended into lobes. Zooids are indistinctly visible through the test but no arrangement into systems is apparent, nor are the common cloacal openings apparent. The total length of a zooid varies according to the development of the post-abdomen. The thorax, abdomen and post-abdomen each may be about 1.0–

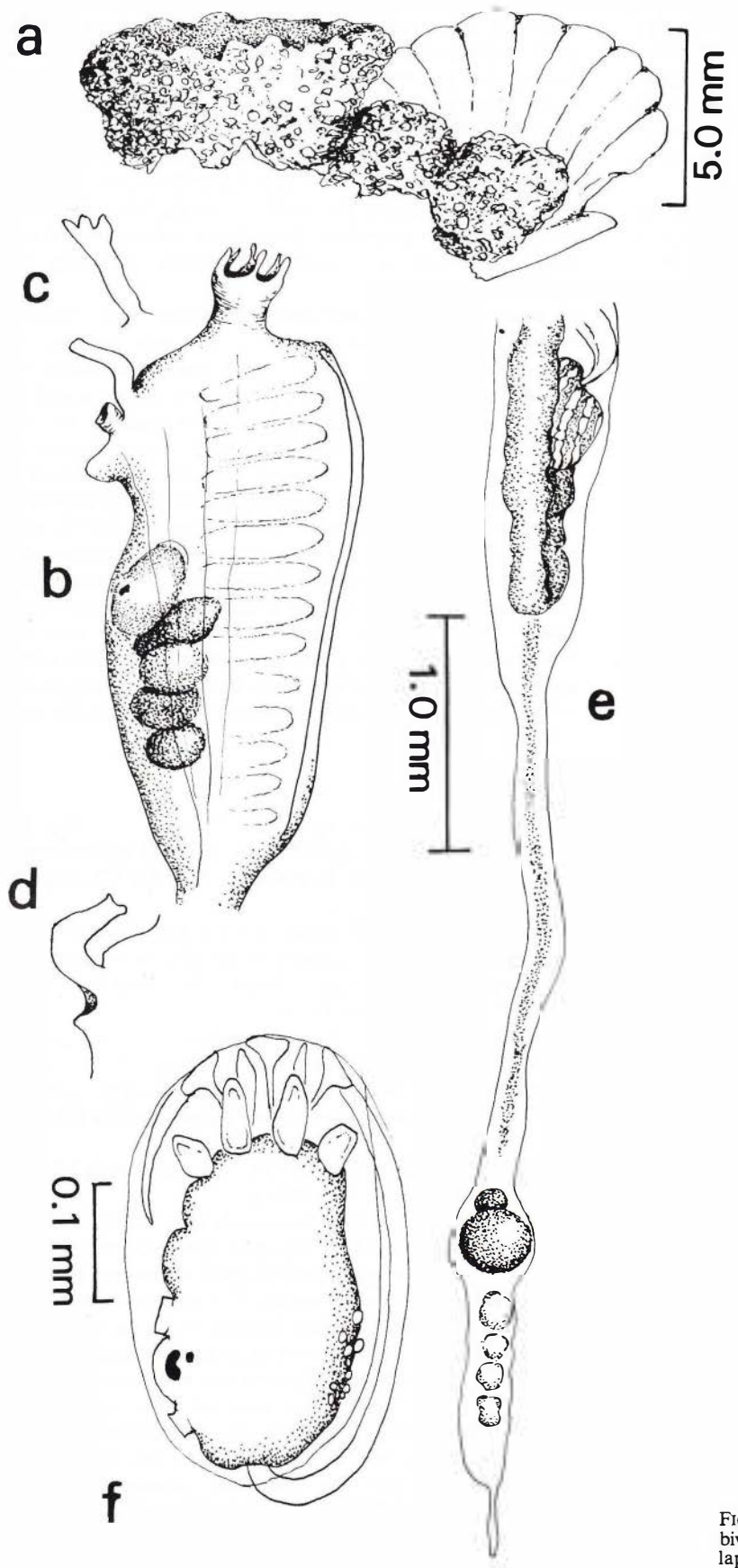

FIG. 16. *Aplidium amphibolum* sp.n.: *a*, colony attached to bivalve shell; *b*, thorax of zooid; *c*, *d*, forms of atrial lappet; *e*, abdomen and post-abdomen; *f*, larva.

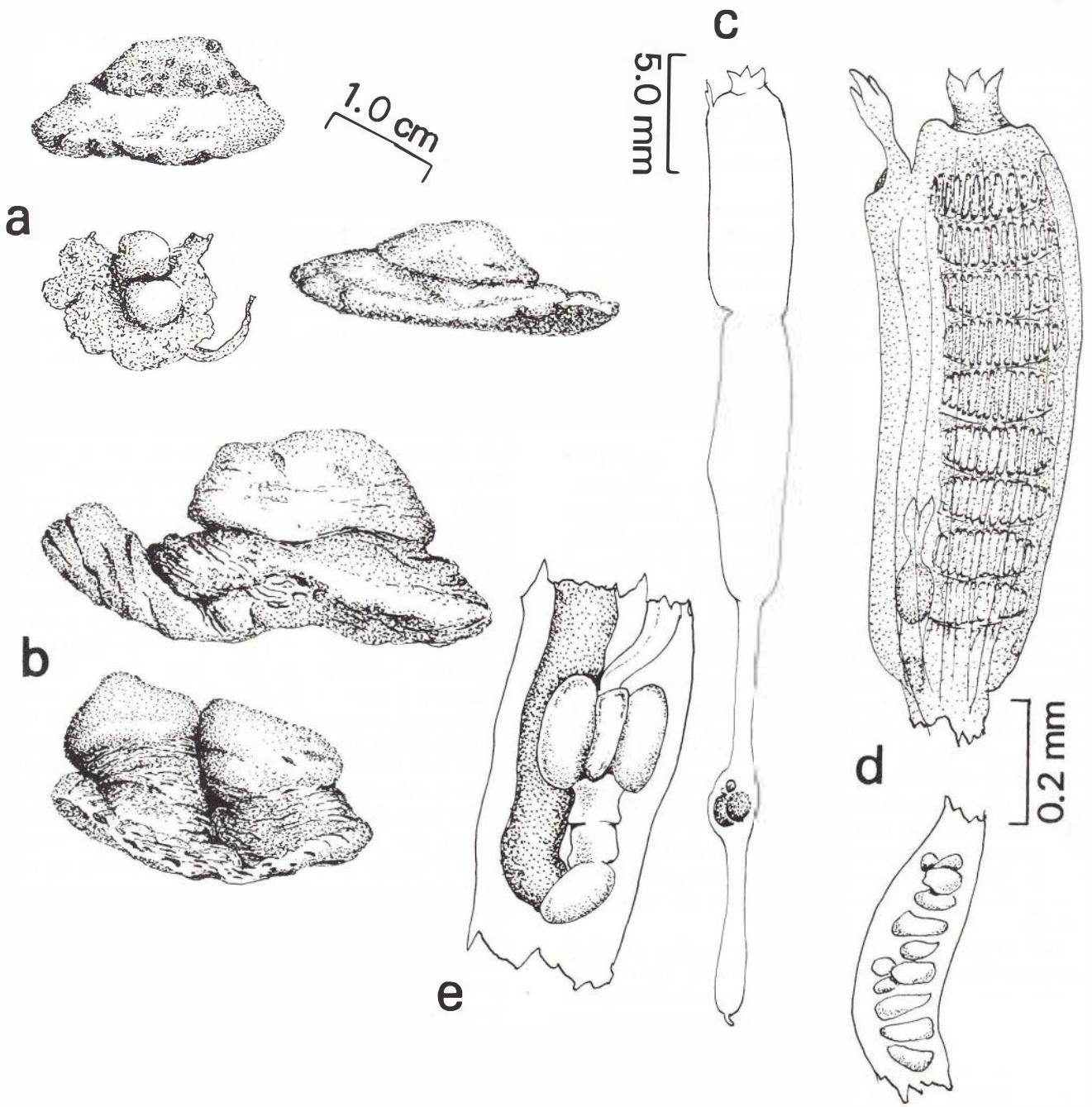

FIG. 17. *Aplidium chthamalum* sp.n.: *a*, three colonies from Stn F102; *b*, two colonies from Stn F100; *c*, zooid; *d*, thorax and part of post-abdomen; *e*, abdomen.

1.2 mm long, but in some zooids the post-abdomen is much longer than the combined length of the thorax and abdomen. There are six pointed oral lobes, and an atrial lappet with its apex usually divided into three pointed lobes, the central lobe being the longest. The atrial opening is sessile. Body wall muscles are thin, and sometimes not clearly seen, partly because of the dull orange colour of the tissues. In many zooids the rows of stigmata could not be counted accurately, but a few were seen to have nine or ten rows. The oesophagus, of moderate length, leads to a stomach with five unbroken folds. Post-stomach, intestine and rectum are demarcated as is usual in the genus. The anus has two lips and lies opposite the third and fourth

row of stigmata from the posterior end. Few zooids have well-developed gonads; in some there is a short series of male follicles and in others a small group of oocytes.

REMARKS: The species is distinguished mainly by the shape of the colony, together with the stomach, the atrial lappet, the colour of the zooids, and possibly the depth of occurrence.

A. powelli (Brewin, 1958), known from Hauraki Gulf, resembles the new species in the number of stigmatic rows and stomachal folds of the zooid. Small colonies of *A. powelli* have a similar shape to colonies of *A. chthamalum*, but appear to differ in the arrangement of zooids, and the larger specimens of *A. powelli* are quite unlike any colonies of the new species.

Aplidium orthium sp.n. Fig. 18

MATERIAL EXAMINED: NZOI Stn F898 (2 specimens).

HOLOTYPE: A specimen 5.2 cm in length, in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H–263.

PARATYPE: NZOI, type number P–522, a specimen from same sample as holotype.

TYPE-LOCALITY: NZOI Stn F898, continental shelf east of northern North Island, 36°13′S, 176°10′E, 63–260 m.

DESCRIPTION: Each specimen is an elongate ovoid upright mass joined by a slight constriction to a sand-encrusted base by which the colony had been attached to the substratum. The colony is dark brown and marked by double rows of paler spots representing the systems of zooids. It is smooth, fleshy, and moderately soft except for the sandy base, which is hard.

The systems are long narrow vertical double rows of zooids. The only common cloacal openings seen were two or three quite large openings near the top of the colony.

The zooids are 12 mm or more in length, of which the post-abdomen occupies about 10 mm. The relative widths of the thorax and abdomen depend on the state of contraction, but the post-abodmen was always found to be very slender. The tissues are brown. There are six oral lobes, a small atrial opening, and an atrial lappet usually having two or three apical teeth. Numerous longitudinal body wall muscles pass along the thorax and down the sides of the abdomen. Fifteen to seventeen rows of stigmata were counted. The oseophagus is of moderate length and the stomach has five or six undivided folds. Divisions of the intestine were obscured by the gut contents. The gonads lie far back in the post-abdomen, the anterior part of which is little more than a narrow stalk. The ovary is small in this material and the testis is a long series of small rounded follicles.

REMARKS: The species is characterised particularly by the colour and shape of the colony, the size and shape of the post-abdomen and the absence of gonads in its anterior part.

Aplidium gilvum sp.n. Fig. 19

MATERIAL EXAMINED: Portobello Stn MU67–12 (2 specimens).

HOLOTYPE: A specimen 3.5 cm high, in collection of the National Museum of New Zealand, Wellington, New Zealand, type number ASC 15.

PARATYPE: NMNZ, type number ASC 16, one specimen from same sample as holotype.

TYPE-LOCALITY: Portobello Stn MU67–12, continental shelf east of Otago, South Island, 46°29′S, 169°53′E – 46°29.5′S, 169°34′E, 60–73 m.

DESCRIPTION: One specimen (the holotype) is 3.5 cm high, 2.8 cm wide and 2.5 cm thick; the other is 3.0 cm by 2.0 cm by 1.8 cm. Each has a short narrow sand-coated stalk and a much longer and wider, very approximately spherical sand-free head. The head is nearly transparent with a faint yellow tint (translucent faint apricot in life, according to the collector's note). The zooids show through the test and are arranged in numerous small round systems, each generally of 8–11 zooids surrounding a small oval common cloacal opening. The zooids are slender and often reach 18 mm in length, of which 14 mm may be occupied by the post-abdomen. The oral siphon has six pointed lobes and the atrial opening is surmounted by a lappet usually divided into three narrow lobes. There are eight or nine slender longitudinal muscles on each side of the thorax which gradually converge as they pass back along the abdomen. Eleven or 12 rows of stigmata were counted in all zooids examined, but the number in each row – possibly about 12 – was uncertain. The oesophagus is short, the stomach has five undivided folds, and the lower gut shows the usual divisions. At the anterior end of the post-abdomen is the ovary and, some distance behind, the testis consists of a long single series of about 19 male follicles. Larvae, numbering up to 28, are present in the atrial cavity of many zooids. The larval trunk is about 0.4 mm long and has three anterior papillae, four pairs of rounded lateral ampullae, narrower median ampullae, and ocellus and an otolith.

REMARKS: The zooid of this species bears some resemblance to that of *A. oamaruensis* (Brewin, 1950), but the latter has 16–18 rows of stigmata, and an atrial opening either with no lappet or an undivided one. The shape of the colony, too, differs.

Aplidium foliaceum (Sluiter, 1900)

Psammaplidium foliaceum Sluiter, 1900: 11–12.
Psammaplidium ambiguum Sluiter, 1900: 12–13.
Amaroucium foliaceum. Brewin, 1958a: 442–443, fig. 1.
Aplidium foliaceum. Kott, 1963: 92.

PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands (Sluiter 1900), Cook Strait (Sluiter 1900), Stewart Island (Brewin 1958a), Otago coast (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Sluiter 1900 and Brewin 1958a): Colony a small flat sandy mat; test impregnated with

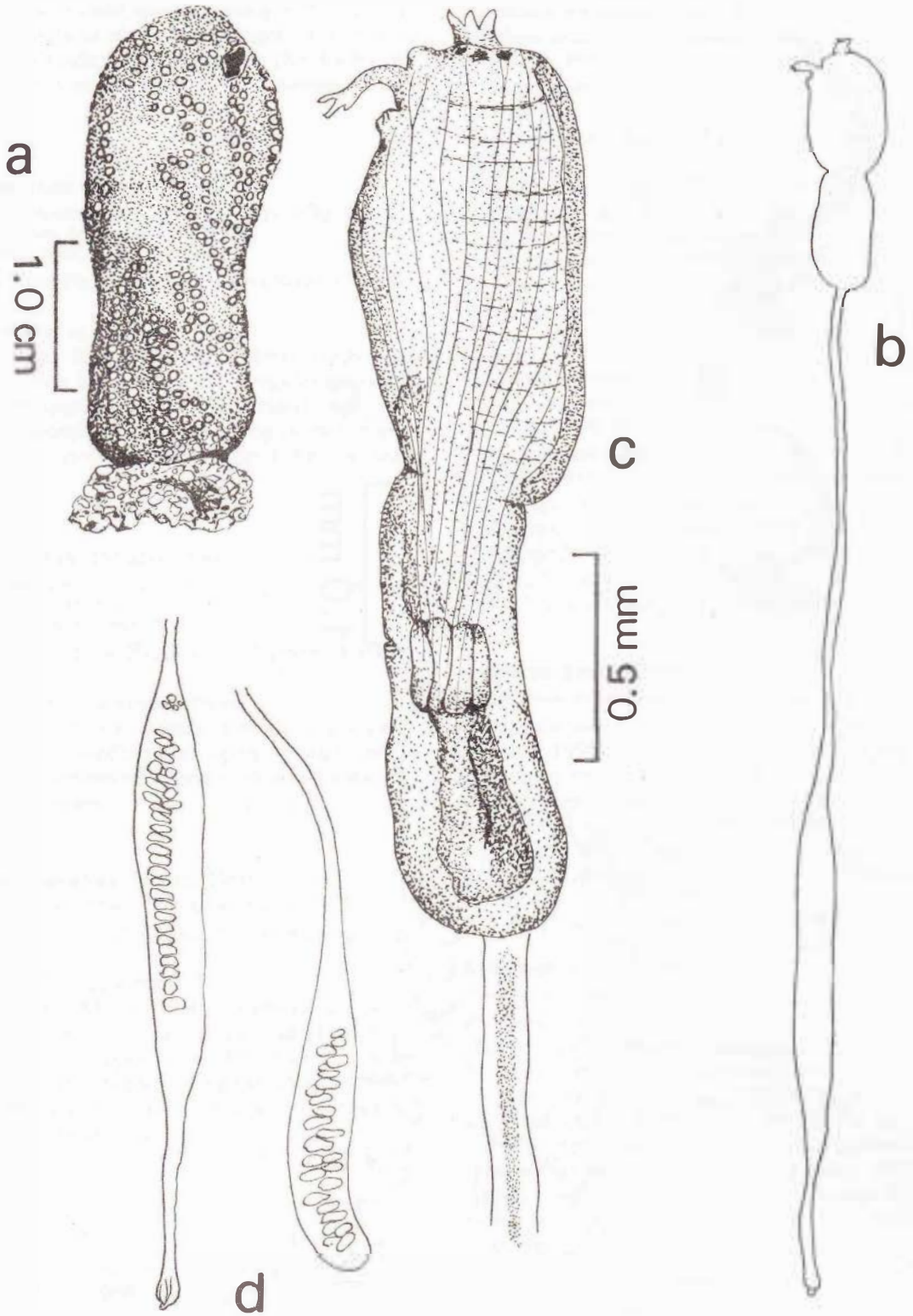

FIG. 18. *Aplidium orthium* sp.n.: *a*, colony; *b*, zooid; *c*, thorax, abdomen and post-abdomen (part); *d*, post-abdomen with testis developed.

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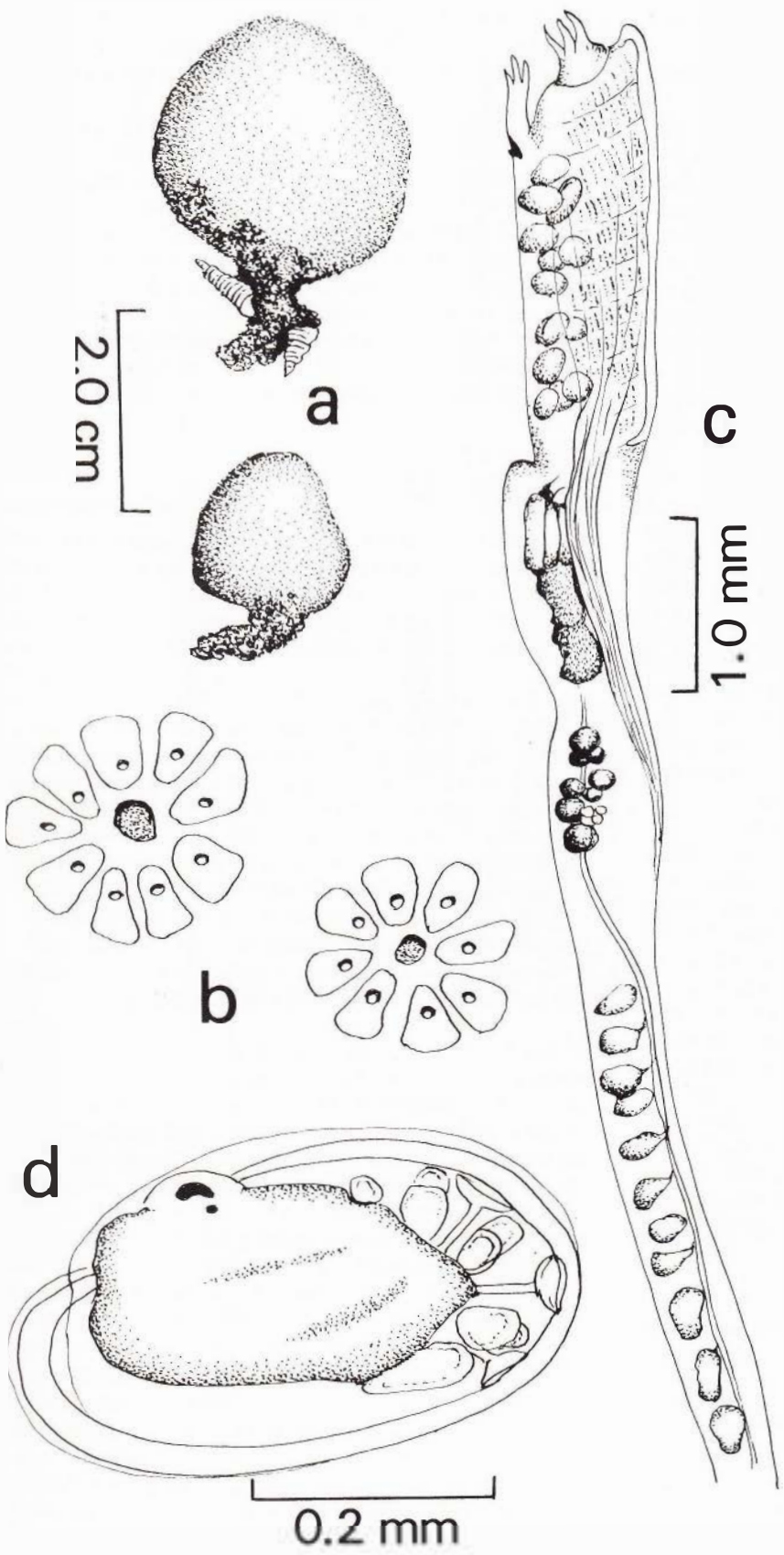

FIG. 19. *Aplidium gilvum* sp.n.: *a*, two colonies (holotype upper); *b*, systems of zooids; *c*, zooid; *d*, larva.

sand except around zooids; atrial opening with one long tapering lappet; eight or nine rows of stigmata; stomach with eight or nine folds; testis with up to 18 follicles, in posterior five-sixths of the short post-abdomen; ovary anterior to testis.

Aplidium stelliferum (Sluiter, 1900)

Psammaplidium stelliferum Sluiter, 1900: 13–14, pl. 2 fig. 10.
Amaroucium stelliferum. Michaelsen, 1924: 388.
Aplidium stelliferum. Kott, 1963: 92.

PUBLISHED RECORDS, NEW ZEALAND: Cook Strait (Sluiter 1900).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Sluiter 1900): Colony (only the single type specimen known) a small irregular rounded mass; test transparent, with embedded but no encrusting sand; atrial opening with long lappet; eight rows of stigmata; stomach with eight folds; gonads unknown.

Aplidium constrictum (Sluiter, 1900)

Amaroucium constrictum Sluiter, 1900: 16–17, pl. 1 fig. 8a. Michaelsen, 1924: 388. Brewin, 1956b: 122.
Aplidium constrictum. Kott, 1963: 95.

PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands (Sluiter 1900).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Sluiter 1900): Colony a rounded mass; test without sand; atrial opening with trifid lappet; eight or nine rows of stigmata; stomach with ten folds; gonads unknown.

Aplidium quadrisulcatum Millar, 1960

Aplidium quadrisulcatum Millar, 1960: 43–44, fig. 6D, E.

PUBLISHED RECORDS, NEW ZEALAND: North of Dargaville (Millar 1960)

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Millar 1960): Colony cushion-shaped to lobed, sand-encrusted and sand-impregnated; atrial opening opposite third or fourth row of stigmata, with pointed lappet having two short pointed basal lobes; ten rows of stigmata; stomach with four or five folds; gonads unknown.

Aplidium seeligeri Millar, 1960

Aplidium seeligeri Millar, 1960: 44–45, fig. 4C, D, E.

PUBLISHED RECORDS, NEW ZEALAND: North Cape and Kapiti Island (Millar 1960).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Millar 1960): Colony with expanded or round head and short basal stalk; not sandy; atrial opening on very short siphon, with triangular lappet having two short basal lobes; 13–16 rows of stigmata; stomach with 19–22 folds; testis a long series of follicles; ovary unknown.

Aplidium novaezealandiae Brewin, 1952

Aplidium novaezealandiae Brewin, 1952b: 189, fig. 1A, B. Kott, 1963: 93. Monniot, 1970: 328–329.

PUBLISHED RECORDS, NEW ZEALAND: Tauranga (Brewin 1952b).

PUBLISHED RECORDS, ELSEWHERE: Kerguelen (Monniot 1970).

DESCRIPTION (from Brewin 1952b): Colony a group of flat-topped, narrow-based lobes each with several circular systems of zooids; test impregnated with sand except on systems; atrial lappet with three lobes; 14 or 15 rows of stigmata; stomach with four or five folds; ovary anterior to the series of testicular follicles.

Aplidium cottrelli (Brewin, 1957)

Amaroucium cottrelli Brewin, 1957: 578, figs 1a, 1b; 1958b: 455.
Aplidium cottrelli. Kott, 1963: 93.

PUBLISHED RECORDS, NEW ZEALAND: North Auckland (Brewin 1957), Hauraki Gulf (Brewin 1958b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1957): Colony a group of flat-topped sandy lobes; atrial opening with a stout lappet; 12 or 13 rows of stigmata; stomach with five folds; ovary anterior to the series of testicular follicles.

Aplidium knoxi (Brewin, 1956)

Amaroucium knoxi Brewin, 1956b: 125–127, fig. $2D_1$, D_2.

PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands (Brewin 1956b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1956b): Colony thin and encrusting; test transparent, not sandy; atrial lappet with three long lobes; 14 rows of stigmata; stomach with 20–22 folds; testis a long series of follicles; ovary anterior to testis.

Aplidium notti (Brewin, 1951)

Amaroucium notti Brewin, 1951: 105–106, fig. 1; 1957: 577.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1951), North Auckland (Brewin 1957).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1951): Colony flat, encrusting; test white or cream (dark brown in formalin), leathery, not sandy; zooids red (colour partially retained in formalin); atrial opening with a stout lappet; 14–16 rows of stigmata; stomach with four or five folds; testis a long series of follicles; ovary immediately anterior to testis.

Aplidium maritimum (Brewin, 1958)

Amaroucium maritimum Brewin, 1958a: 433, fig. $1B_1$, B_2, B_3.

PUBLISHED RECORDS, NEW ZEALAND: Otago (Brewin 1958a), Foveaux Strait (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1958a): Colony irregular rounded masses encrusted and impregnated with sand;

atrial opening on a siphon with wide lappet; 12 rows of stigmata; stomach with 6–8 folds; testis a long irregular double row of follicles.

Aplidium siphonum (Brewin, 1956)

Amaroucium siphonum Brewin, 1956b: 125, fig. $2C_1$, C_2, C_3.

PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands (Brewin 1956b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1956b): Colony round and flat-topped; test transparent, not sandy; atrial opening on a siphon with wide irregularly-edged lappet; 14 or 15 rows of stigmata; stomach with 11 or 12 folds; testis a long series of follicles; ovary among anterior testis follicles.

Aplidium benhami (Brewin, 1946)

Aplidium (Amaroucium) benhami Brewin, 1946: 95–97, fig. 4, pl. 2 figs 1, 4, pl. 3 fig. 3, pl. 5 fig. 1.

Amaroucium benhami. Brewin, 1956b: 122; 1958a: 439; 1960: 119.

PUBLISHED RECORDS, NEW ZEALAND: Portobello Peninsula (Brewin 1946), Stewart Island (Brewin 1958a), Cook Strait (Brewin 1960), Chatham Islands (Brewin 1956b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1946): Colony small; test transparent, without sand; systems stellate; atrial opening with three long lappets, the central one the largest; 10 or 11 rows of stigmata; stomach with 22–26 folds; testis a long series of follicles in posterior two-thirds of post-abdomen; ovary immediately anterior to testis.

Aplidium oamaruensis (Brewin, 1950)

Amaroucium oamaruensis Brewin, 1950a: 55, fig. 1; 1952a: 452; 1958a: 439.

PUBLISHED RECORDS, NEW ZEALAND: Otago Peninsula (Brewin 1950a, 1952a), Stewart Island (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1950a): Colony small, flat-topped, irregular; test transparent but with sand in outer layer; atrial opening usually without lappet but sometimes a single lappet present; 16–18 rows of stigmata; stomach with four folds; testis of 12–18 large follicles, in posterior half of post-abdomen; ovary just anterior to testis.

Aplidium powelli (Brewin, 1958)

Amaroucium powelli Brewin, 1958b: 455–457, fig. $1A_1$, A_2, A_3, A_4.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1958b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1958b): Colony deep brown, club-shaped when small, lobed when large; test leathery; systems irregular double rows of zooids; atrial opening with a stout lappet; 12 rows of stigmata; stomach with four folds; testis a long double row of follicles in posterior half to two-thirds of post-abdomen; ovary immediately anterior to testis.

Aplidium thomasi Brewin, 1948

Aplidium (Amaroucium) thomasi Brewin, 1948: 117–118, fig. 1, pl. 9 fig. 7.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1948).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1948): Colony a thin irregular mass; test not sandy except basally; atrial opening with a long wide lappet; nine or ten rows of stigmata; stomach with 10–12 folds; testis a double row of follicles; ovary anterior to testis.

Aplidium thomsoni Brewin, 1946

Aplidium thomsoni Brewin, 1946: 90–92, fig. 1, pl. 3 fig. 2; 1950b: 344; 1950c: 354; 1952b: 187; 1957: 577; 1958a: 439; 1958b: 455.

PUBLISHED RECORDS, NEW ZEALAND: Portobello Peninsula (Brewin 1946), Christchurch (Brewin 1950b), East Cape (Brewin 1952b), Great Barrier Island (Brewin 1950c), Hauraki Gulf (Brewin 1958b), Stewart Island (Brewin 1958a), Cook Strait (Brewin 1960); North Auckland (Brewin 1957).

PUBLISHED RECORDS, ELSEWHERE: Western Australia (Kott 1963).

DESCRIPTION (from Brewin 1946): Colony small and rounded; systems stellate; test transparent, not sandy; atrial opening with lappet of one central and two short lateral processes; five row of stigmata; longitudinal muscles tend to concentrate on ventral side of post-abdomen; stomach with five or six folds; testis a long irregular double row of follicles; ovary amongst testicular follicles about one third from anterior end of testis.

Aplidium adamsi Brewin, 1946

Aplidium (Amaroucium) adamsi Brewin, 1946: 94–95.

Amaroucium adamsi. Brewin, 1958a: 439.

PUBLISHED RECORDS, NEW ZEALAND: Portobello Peninsula (Brewin 1946), Stewart Island (Brewin 1958).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1946): Colony a large fleshy mass; test semi-transparent, not sandy; systems branching; atrial opening with one or two long wide lappets; 12 or 13 rows of stigmata; stomach with 22–24 folds; testis a long double row of follicles in the posterior three-quarters of post-abdomen; ovary slightly anterior to testis.

Aplidium circumvolutum (Sluiter, 1900)

Psammaplidium circumvolutum Sluiter, 1900: 14–15, pl. 1 fig. 7, pl. 3 fig. 1.

Amaroucium circumvolutum. Michaelsen, 1924: 383–388.

Aplidium circumvolutum. Millar, 1960: 25–28. Kott, 1969a: 57–58 (for additional synonymy).

PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands (Sluiter 1900), North Cape (Michaelsen 1924), Colville Island (Michaelsen 1924).

PUBLISHED RECORDS, ELSEWHERE: Antarctic (*see* Kott 1969a); Subantarctic (*see* Kott 1969a), including west of Macquarie Island.

DESCRIPTION (from published records): Colony thin to quite thick, encrusted and impregnated with sand; surface furrowed; atrial opening with trifid lappet; strong longitudinal muscles concentrated on ventral side of abdomen and post-abdomen; about 14 rows of stigmata; testis a compact bunch of follicles; ovary possibly anterior to, or partially embedded in, testis.

Uncertain records

Amongst uncertain records of *Aplidium* species are *A. irregulare* (Herdman) at Macquarie Island (Kott 1954) and Chatham Island (Kott 1969a) and *A. globosum* (Herdman) at Macquarie Island (Kott 1954, recorded as *A. scabellum* according to Kott 1969a). The synonymies are, however, very confused.

Aplidiopsis Lahille, 1890

Aplidiopsis discoveryi Millar, 1960

Aplidiopsis discoveryi Millar, 1960: 51, fig. 8C. Kott, 1969a: 74, figs 87, 88.

PUBLISHED RECORDS, NEW ZEALAND: Kapiti Island (Millar 1960).

PUBLISHED RECORDS, ELSEWHERE: Patagonian Shelf (Kott 1969a).

DESCRIPTION (from Millar 1960): Colony an irregular, undivided mass; test without sand, semi-transparent; post-abdomen attached to abdomen by short narrow pedicel; atrial lappet wide and simple or toothed; longitudinal thoracic muscles of left and right unite into one band on right of abdomen, continuing into post-abdomen; 14 or 15 rows of stigmata; stomach smooth; testis of bunched follicles; ovary embedded in testis.

Polyclinum Savigny, 1816

Polyclinum sluiteri Brewin, 1956 Figs 20, 21

Polyclinum sluiteri Brewin, 1956b: 124, fig. $2A_1$, A_2, A_3.

MATERIAL EXAMINED: NZOI Stns C957 (2 specimens), D184 (5 specimens), Portobello Stn MU67–124 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands, off Petre Bay (Brewin 1956b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: The colonies are pale brown, generally pear-shaped to spherical, sometimes laterally flattened, and are up to 3.5 cm in height. At the narrow, lower end is a very short, pointed attachment stalk thickly coated with sand. The surface of the rest of the colony has a light coating of sand, which may be very sparse. In consistency the colony is usually firm, never hard, and may be rather soft. Common cloacal openings usually number 1–6. The common test within the colony is translucent and contains scattered sand grains. In the type material (Brewin 1956b) the colony was more broadly based, lacked the short sandy stalk and was attached to a dead shell.

The arrangement of zooids into systems is usually not obvious, but in the Otago specimen many round to oval systems are present. Zooids have a thorax reaching 3.6 mm in length, an abdomen to 1.6 mm and a post-abdomen varying considerably according to its state of sexual development, but sometimes attaining a length of over 4 mm. The body wall is delicate and transparent, with no prominent muscles visible in the present material (except in the Otago specimen) although Brewin (1956b) noted nine longitudinal thoracic and 14 transverse muscles. The oral siphon is short, with narrow pointed lobes; the atrial opening small and round, and the atrial lappet large. About 40 slender oral tentacles were counted, a few of them quite long. Fifteen–eighteen rows of stigmata are present, with 18–20 stigmata in each. Small papillae on the transverse bars are fewer in number than the adjacent stigmata. Brewin (1956b) noted 15 rows of stigmata. The gut is of the usual *Polyclinum* type and is described by Brewin. The proximal part of the post-abdomen is a long slender stalk and the gonads are confined to the swollen ovoid distal part. Numerous rounded to pear-shaped male follicles are crowded together and, in all mature zooids examined, hide the ovary if this is developed.

Larvae were found in the zooids of one sample (Station D184). The trunk measures 0.46–0.54 mm in length and is of the usual *Polyclinum* type.

REMARKS: Brewin (1956b), in her account of *P. sluiteri*, has pointed out the difficulties in characterising species in the genus *Polyclinum*, where zooid structure tends to be rather uniform, and greater reliance has to be put on colony structure. Despite some differences in shape of the colony, the new material is considered sufficiently like the type of *P. sluiteri* to be included in that species.

A further problem of identification arises with a single specimen from Station D121 (43°16.5′S 177°10.5′E, 210 m). This is a soft sand-coated colony 1.8 by 1.7 by 0.4 cm in diameter. The zooids differ from those described above in having: a more muscular thorax, 13 or 14 rows of stigmata with 28–30 stigmata per row, a post-abdomen which is usually short and globular with a very short stalk region (but in a few zooids the post-abdomen is fusiform with a longer stalk), and a smaller larva (trunk about 0.39 mm long). The most significant differences are perhaps the smaller number of rows of stigmata and the greater number of stigmata per row. These features are not found in the other species of *Polyclinum* recorded from the New Zealand area (*P. michaelseni* Brewin, 1956; *P. novaezelandiae* Brewin, 1958; *P. cerebrale* Michaelsen, 1924), but I am unwilling to create another new species based on a single colony.

One specimen, from Station F100 (49°02′S 168°53.5′E, 733–746 m), is a soft, brown, broadly based, approximately conical colony with a basal mass

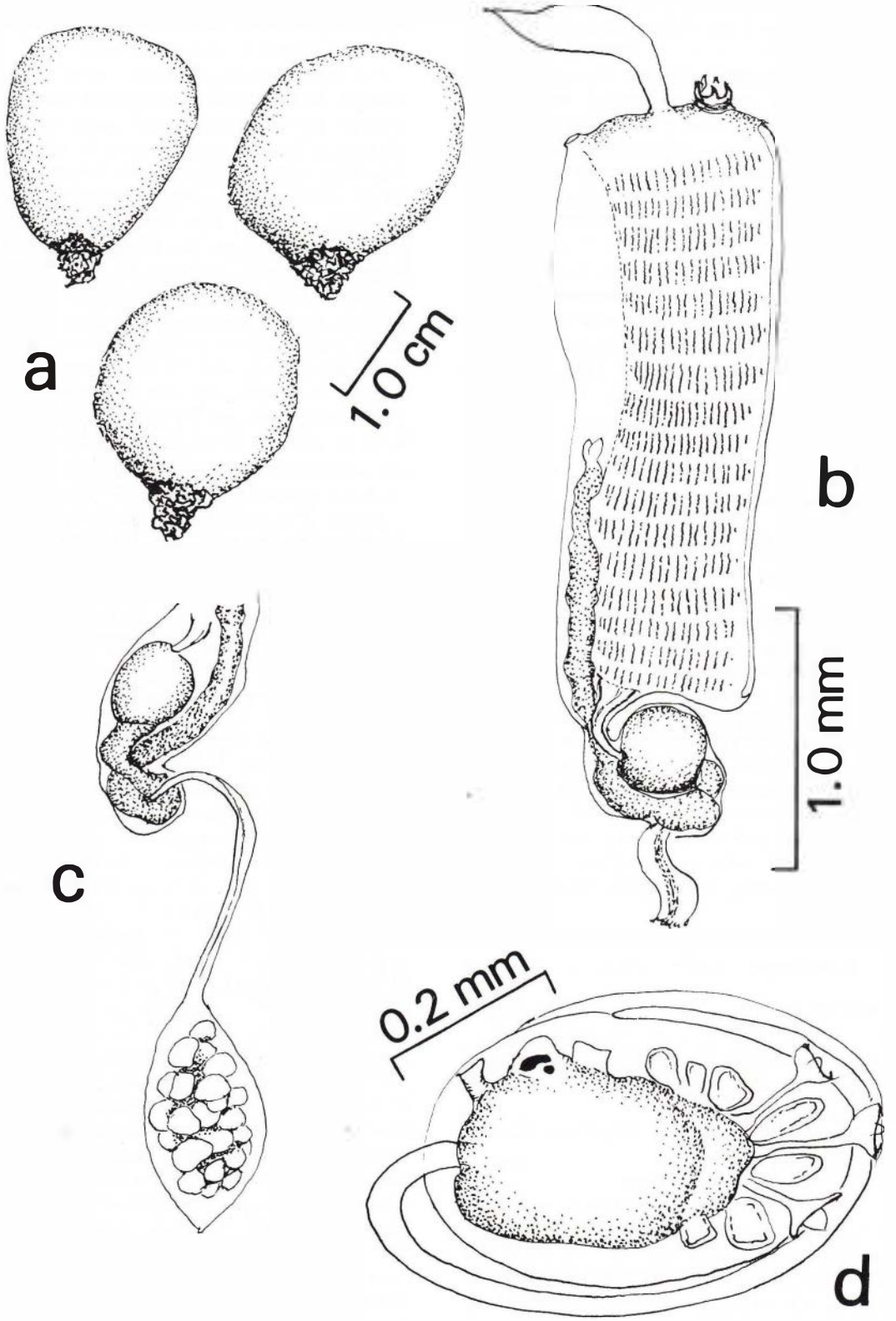

FIG. 20. *Polyclinum sluiteri* Brewin: *a*, colonies from Stn D184; *b*, zooid (post-abdomen omitted); *c*, abdomen and post-abdomen; *d*, larva.

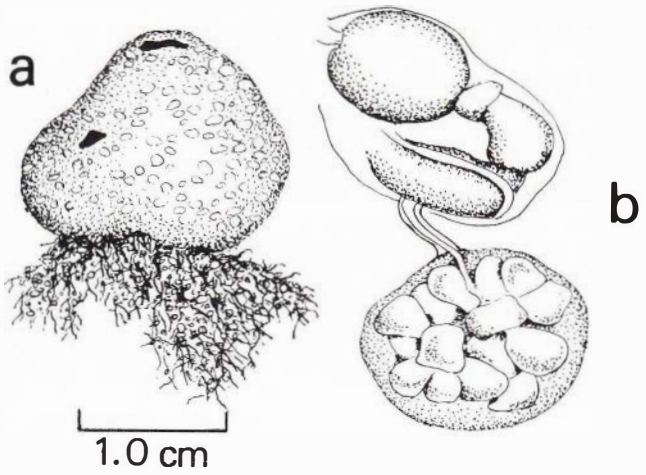

FIG. 21. ?*Polyclinum sluiteri* Brewin, specimen from Stn F100: *a*, colony; *b*, abdomen and post-abdomen of zooid.

of branched test fibrils coated with sand. Some sand adheres to the surface of the colony, between zooids, and a few common cloacal openings are present. The zooids have up to 20 rows of stigmata, and a short-stalked globular post-abdomen. If additional specimens are found, showing the same features of colony structure, a new species may be required.

Single specimens from Stations A910 (43°04′S 178°39′W, 549 m) and F122 (48°06′S 179°57′W, 252 m) also cannot be identified further than the genus *Polyclinum*.

Polyclinum novaezelandiae Brewin, 1958

Polyclinum novaezelandiae Brewin, 1958a: 442.

PUBLISHED RECORDS, NEW ZEALAND: Foveaux Strait (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1958a): Colony a large ovoid mass; test translucent, impregnated with sand only in superficial layer; several common cloacal openings; long wide atrial lappet; 19 rows of stigmata; post-abdomen pyriform with long thin pedicel; testis with 30 or more follicles, in posterior part of post-abdomen; ovary anterior to testis.

Polyclinum michaelseni Brewin, 1956

Polyclinum michaelseni Brewin, 1956b: 132, fig. $4B_1$, B_2.

PUBLISHED RECORDS, NEW ZEALAND: Chatham Rise (Brewin 1956b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1956b): Colony spherical, attached by narrow base; test translucent, with sand in peripheral region; only one common cloacal opening (central); oral lobes very small; wide atrial lappet, undivided; 16 rows of stigmata; post-abdomen pyriform with narrow pedicel; testis a group of up to 30 follicles; ovary anterior to testis.

Polyclinum cerebrale Michaelsen, 1924

Polyclinum cerebrale Michaelsen, 1924: 422–427, figs 29, 30.

MATERIAL EXAMINED: NZOI Stn D873 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: New Plymouth (Michaelsen 1924), Stewart Island (Michaelsen 1924).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: The single specimen is a pancake-like colony 7.5 by 6.0 cm in diameter and 1.0 cm thick. The upper surface is thrown into a network of conspicuous sinuous ridges and is heavily incrusted with sand. Michaelsen's specimens were cushion- or mushroom-shaped, but otherwise similar to the new specimen. The zooid is typical of *Polyclinum*: the atrial opening is on a short siphon; there are 16–18 rows of stigmata; the post-abdomen is long, joined to the abdomen by a slender pedicel. Michaelsen counted about 30 male follicles in the post-abdomen.

The larval trunk is 0.46–0.52 mm long and with the usual ocellus, otolith, three slender-stalked anterior papillae, four pairs of antero-lateral ampullae, and a number of small epidermal vesicles.

REMARKS: The most distinguishing features of the species are the shape and surface sculpturing of the colony.

Protopolyclinum Millar, 1960

Protopolyclinum pedunculatum Millar, 1960

Protopolyclinum pedunculatum Millar, 1960: 52–54, fig. 9, pl. 1 fig. 10.

PUBLISHED RECORDS, NEW ZEALAND: North Cape (Millar 1960).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Millar 1960): An ovoid head on a long, slender stalk, possibly a number of such stalked heads constituting a complex colony; atrial siphon opening directly on surface of colony; longitudinal muscles continue along thorax, abdomen and post-abdomen; about 13 rows of stigmata; small papillae on transverse branchial bars; stomach smooth with indistinct areolations; post-abdomen narrowed at junction with abdomen; follicles bunched in anterior part of testis, reduced to a single row in posterior part; ovary amongst anterior follicles.

Dumus Brewin, 1952

Dumus areniferus Brewin, 1952

Dumus arenifer us Brewin, 1952a: 453, fig. 1; 1958a: 439. Kott, 1976: 58–60, figs 4, 5, 6.

PUBLISHED RECORDS, NEW ZEALAND: Otago Peninsula (Brewin 1952a), Stewart Island (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: Victoria, Australia (Kott 1976).

DESCRIPTION (from Brewin 1952a): Colony sandy, of a thin basal sheet uniting many closely packed slender zooids each with its own covering of test; oral and atrial siphons both six-lobed and both opening directly on the

surface; short thorax and abdomen, long narrow post-abdomen; four rows of stigmata; stomach smooth-walled; testis with up to 17 follicles; ovary anterior to testis.

Homoeodistoma Redikorzev, 1927

Homoeodistoma arenosum (Brewin, 1950)

Sigillinaria arenosa Brewin, 1950c: 357–358, fig 3; 1958b: 455.

PUBLISHED RECORDS, NEW ZEALAND: Great Barrier Island (Brewin 1950c), Hauraki Gulf (Brewin 1958b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1950c): Colony small, sandy, of short flat-topped lobes tapering down to thin common basal sheet; test transparent but with sand in superficial layer; oral and atrial siphons each with six long triangular lobes; nine or ten rows of stigmata with parastigmatic transverse bars; oesophagus short; stomach smooth; testis of up to 17 follicles in irregular double row in posterior half of post-abdomen; ovary anterior to testis.

REMARKS: The genus is uncertain. The species agrees with *Ritterella* Harant, 1931 except in its smooth stomach and branchial parastigmatic bars. It also agrees with *Homoeodistoma* Redikorzev, 1927 except in the anterior position of the ovary, *Homoeodistoma* having an elongate ovary extending along the length of the testis. But the differences are less with *Homoeodistoma* and the species is provisionally placed in that genus.

Croxall (1972) included the species in *Placentela* Redikorzev, 1913, which may be a synonym of *Ritterella* according to Monniot and Monniot (1972).

Pseudodistoma Michaelsen, 1924

Pseudodistoma novaezelandiae (Brewin, 1950)

Sigillinaria novaezelandiae Brewin, 1950c: 356–357, fig. 2; 1951: 104; 1958b: 455.

Brewin (1950c) used the spelling *novae-zealandiae* on p. 354, but *novae-zelandiae* in the definitive description on p. 356. The spelling *novaezelandiae* should be adopted, as probably representing her intention, although the other spelling has page-priority.

PUBLISHED RECORDS, NEW ZEALAND: Great Barrier Island (Brewin 1950c), Hauraki Gulf (Brewin 1951, 1958b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1950c): Colony a thin basal membrane from which arise lobes with an ovoid head and distinct, narrower stalk; test clear, without sand; oral and atrial siphons both opening directly on surface, and both with six rounded lobes; thorax short, abdomen long, post-abdomen up to three-fifths total body length; three rows of stigmata; oseophagus long; stomach smooth-walled; testis with up to 35 follicles, in central half of post-abdomen; ovary anterior to testis.

REMARKS: *See* notes under *P. cereum.*

Pseudodistoma opacum (Brewin, 1950)

Sigillinaria opaca Brewin, 1950c: 358; 1957: 577.

PUBLISHED RECORDS, NEW ZEALAND: Great Barrier Island (Brewin 1950c), North Auckland (Brewin 1957).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1950c): Colony a sandy basal membrane from which arise small flat-topped lobes; test semi-transparent; oral and atrial siphons each with six blunt lobes and opening directly on surface; thorax short; abdomen and post-abdomen about equally long; three rows of stigmata; oesophagus long; stomach with four folds; testis of 12–18 follicles; ovary anterior to testis and immediately behind intestinal loop.

Pseudodistoma cereum Michaelsen, 1924

Pseudodistoma cereum Michaelsen 1924: 364–374, fig. 17. Brewin 1958a: 444–445, fig. $1C_1$, C_2, C_3, C_4. Kott, 1963: 77; 1972a: 12–13; 1972b: 173.

MATERIAL EXAMINED: Portobello Stns ? MU71–266 (3 specimens), ? MU74–92 (3 specimens).

PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Michaelsen 1924, Brewin 1958a), Otago coast (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: Southern Australia.

DESCRIPTION (from Michaelsen 1924 and Brewin 1958a): Colony a basal membrane and upright, stalked, ovoid to globular heads; not sandy; thorax and abdomen short, post-abdomen up to five-sixths of total body length; oral and atrial siphons both six-lobed and opening directly on surface; three rows of stigmata; oesophagus long; stomach with four folds; testis of up to 30 follicles in irregular double row; ovary immediately anterior to testis, but considerably behind intestinal loop; eggs develop progressively to larvae in post-abdominal, abdominal and thoracic parts of oviduct.

REMARKS: Kott (1963) considered this species to include *Pseudodistoma novaezelandiae* (Brewin) which Brewin (1950c) described as a *Sigillinaria.* Brewin's material has a smooth stomach, however, and Michaelsen's account of the type, confirmed by Brewin (1958b) on re-examination of the type, describes four folds on the stomach. Despite Kott's view that "the folds are clearly artefacts and not structural", it is unlikely that both Michaelsen and Brewin were mistaken. It seems probable that two species are involved: *P. cereum* from the southern waters of New Zealand, and *P. novaezelandiae* from the northern part of the North Island and also Victoria, Australia, where it is recorded by Kott (1963) as *P. cereum.*

I have provisionally included in *P. cereum* specimens of a *Pseudodistoma* from Taiaroa and Papanui Canyons. These colonies differ from published accounts in sometimes having a considerable amount of sand on the base and spreading to part of the head, and in the heads being less obviously club-shaped. The zooids, however, agree with those of *P. cereum.* Some

of them (MU74–92) have incompletely developed larvae in the atrial cavity. The trunk is 0.55–0.80 mm long, and has an otolith and ocellus.

Pseudodistoma aureum (Brewin, 1957)

Sigillinaria aurea Brewin, 1957: 580, pl. 1 figs $2a_1$, $2a_2$, 2b, 2c.

PUBLISHED RECORDS, NEW ZEALAND: North Auckland (Brewin 1957).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1957): Colony an irregular fleshy mat; not sandy; test transparent; oral and atrial siphons six-lobed and opening directly on surface; thorax short; abdomen long; post-abdomen one half total zooid length; three rows of stigmata; oesophagus long; stomach with three or four folds; testis of up to 24 follicles in posterior half of post-abdomen; ovary immediately anterior to testis and far behind intestinal loop.

Pharyngodictyon Herdman, 1886

Pharyngodictyon elongatum sp.n. Fig. 22

MATERIAL EXAMINED: NZOI Stns D136 (1 specimen), D138 (1 specimen); Portobello Stn MU71–250 (2 specimens).

HOLOTYPE: a colony 8.1 cm in length, in collection of the National Museum of New Zealand, Wellington, New Zealand, type number ASC 09.

PARATYPES: NMNZ, type number ASC 07, one specimen from same sample as holotype. NZOI, type numbers P-529, one specimen from NZOI Stn D136; P-530, one specimen from NZOI Stn D138.

TYPE-LOCALITY: Portobello Stn MU71–250, continental slope east of Otago, South Island, 45°55′S, 171°00.4′E, 500 m.

DESCRIPTION: A long, slender, sand-coated stalk bears a terminal soft head, which is either bare or lightly coated with sand over part of its surface. In complete specimens the lower end of the stalk is provided with a bunch of branched test fibrils which presumably served to anchor the colony to a loose substratum. The largest specimen has a stalk 7.5 cm long and a head 1.1 cm wide and 0.6 cm long. The head is ovoid, top-shaped or dome-shaped, and is smooth or (only in the largest specimen) with a loose frayed surface. No common cloacal openings exist. Zooids open only on the head, but some are found entirely within the upper part of the stalk, presumably having been retracted from the head on collection. The zooids are dull yellow and visible through the translucent test of the head. They are divided into a thorax, a slightly shorter abdomen, and a post-abdomen of variable length. The thorax and abdomen together measure 1.8–2.5 mm and the post-abdomen may reach 7 mm in length. The thorax of many zooids lies at an angle (sometimes a right angle) to the abdomen, but some zooids are straight. The oral siphon is a short smooth-edged tube and the atrial siphon, which is situated near the base of the thorax, is cleft into an upper and a lower lip. Fine muscles encircle the siphons, which also receive the divided ends of some of the thoracic muscles. Most of the thoracic muscles are transverse or oblique and partially encircle the thorax. They branch at both their dorsal and ventral ends. Narrow longitudinal muscles pass along the sides of the abdomen and post-abdomen. The oral tentacles number about ten, and are short, thick and alternating in size. The branchial sac is of peculiar and characteristic structure. It lacks the walls perforated by rows of stigmata found in most ascidians, and instead has three stout hoop-like transverse bars attached to the ventral and lateral parts of the thoracic body wall but free of attachment dorsally. Each has a short dorsal languet. A fourth (anterior) bar of similar appearance seems to represent the peripharyngeal band and at its mid-dorsal point bears the small dorsal tubercle with a simple round or oval opening. The endostyle is thick. Usually a thick longitudinal bar connects two of the adjacent transverse bars. The oesophagus is short and the stomach wide and provided with seven undivided folds. The divisions of the post-stomach are often obscure and the ascending intestine and rectum without distinct divisions. The anus is indistinctly two-lipped and lies near the base of the atrial siphon. All sexually mature zooids examined were either male or female. Moreover, no colony had both male and female zooids. The testis, which occupies most of the post-abdomen in some zooids but only the anterior half in others, consists of very many small rounded follicles. The common sperm duct becomes thick and convoluted in the abdomen. The ovary is a group of oocytes situated in the post-abdomen some distance below the gut loop. The larger oocytes are brown. No larvae were found, but large embryos were present in the thorax of a few zooids. The heart was not found.

REMARKS: Two species have been described in the genus *Pharyngodictyon*. *P. mirabile* Herdman was originally taken at a depth of 2928 m between Kerguelen and the Cape of Good Hope, and Kott 1969a attributed an additional specimen, from 1226 m on the Scotia Ridge, to the same species. The complex branching of Kott's specimen seems too far removed from the unbranched colonies of the type material to be certainly identified as *P. mirabile*. Kott stated that "Herdman's specimen was a small fragment", but in fact Herdman examined six specimens, only one of which was said to be "considerably damaged". The intact specimens had a simple stalk expanded at the upper end into a single wide flat-topped head. If there is doubt about the identity of the specimens from Scotia Ridge, the additional characters described by Kott for *P. mirabile* have to be discounted in that species. Even Herdman's account alone, however, indicates a species with a very much shorter stalk and more complex branchial sac than the New Zealand material. By courtesy of the British Museum (Natural History) I

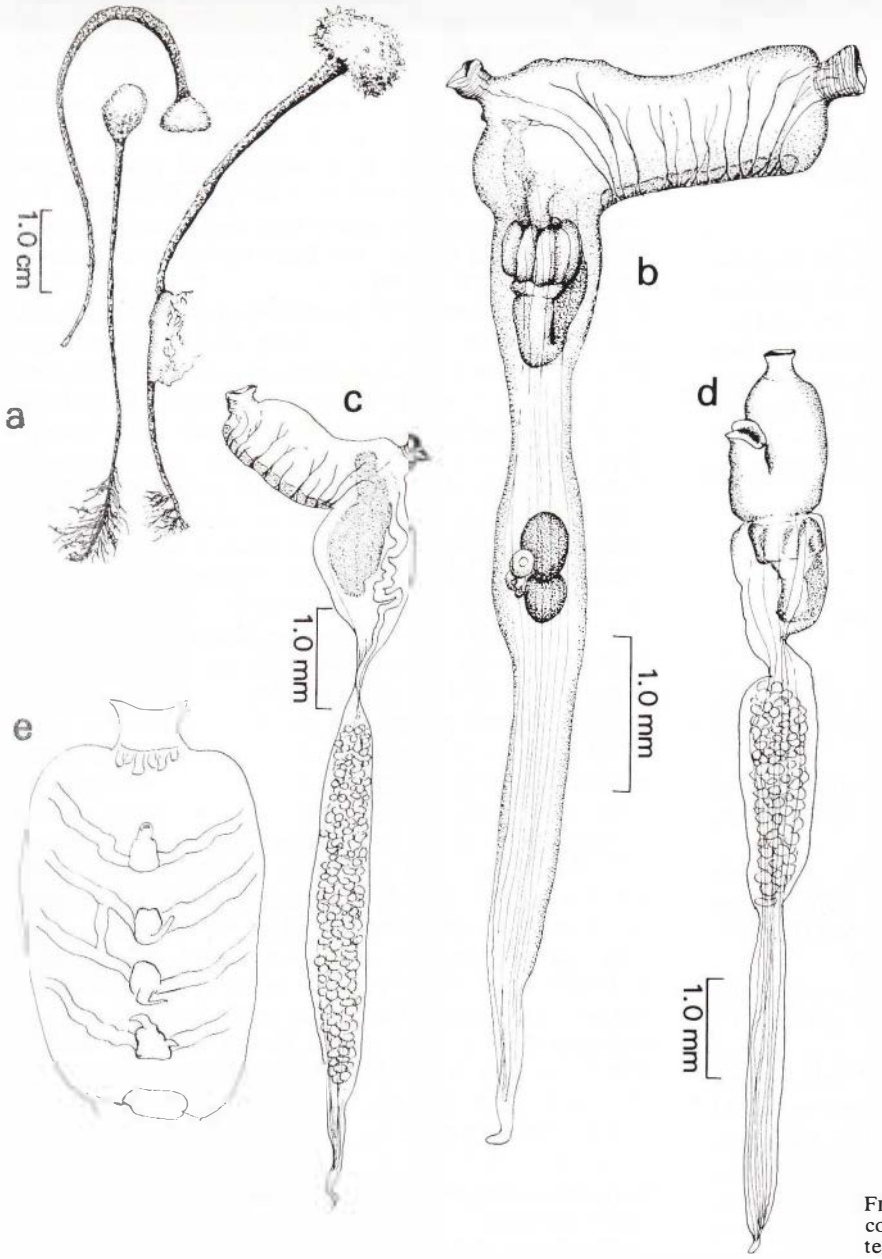

FIG. 22. *Pharyngodictyon elongatum* sp.n.: *a*, colonies; *b*, zooid with ovary; *c*, *d*, zooids with testis; *e*, thorax from dorsal side.

have examined Herdman's type specimens of *P. mirabile* and find that there are five transverse branchial bars, joined by one or two narrower longitudinal connections. Both siphons are short and tubular, the oral being bordered by about six indistinct lobes and the atrial by more numerous distinct narrow lobes. The species is clearly different from the New Zealand specimens. The complex colony of Kott's material also distinguishes it from the new material. The second species described, *P. reductum* Sluiter, has no stalk to the colony and has six or seven transverse branchial bars. It differs greatly from the New Zealand specimens.

The new species has certain puzzling similarities to the polycitorid genus *Protoholozoa,* especially in branchial structure and position of the atrial siphon. But both known species (*P. pedunculata* Kott and *P. pigra* (Monniot)) have abdominal gonads and no post-abdomen. It is difficult to know what relationship, if any, exists between *Pharyngodictyon elongatum* and *Protoholozoa,* and whether *Pharyngodictyon* is better placed in the Polyclinidae or the Clavelinidae.

Ritterella Harant, 1931

Ritterella vestita Millar, 1960

Ritterella vestita Millar, 1960: 54–56, fig. 10.

PUBLISHED RECORDS, NEW ZEALAND: North Cape (Millar 1960).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Millar 1960): Known only from holotype, consisting of a stalk bearing a triangular head, both coated with broken shell; thorax long, abdomen shorter, post-abdomen very long; oral and atrial siphons six-lobed and opening directly on surface; 27–34 rows of stigmata; oesophagus short; stomach with 8–10 folds; testis a long series of follicles in post-abdomen; ovary unknown.

Ritterella sigillinoides (Brewin, 1958) Fig 23

Pseudodistoma sigillinoides Brewin, 1958a: 455, fig. 2 A_1, A_2, A_3, A_4.

MATERIAL EXAMINED: NZOI Stn A852 (3 specimens, or pieces of a broken colony).

PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: The colonies are branched, unlike those described by Brewin (1958a), and the most complex specimen shows two orders of branching. Generally the stalks are more long and slender than in the type material and are much closer in form to branched specimens of *Sycozoa sigillinoides.* The stalks are firm and coated with fine sand, but the heads are bare and soft.

It is the structure of the zooid, closely similar to that described by Brewin, which determines the identification of the new material.

A number of zooids contain up to eight larvae in the atrial cavity. The larval trunk is about 0.54 mm long. It has otolith and ocellus, and four pairs of lateral ampullae surrounding the three adhesive papillae. The papillae have a rather indistinct cup and a long central rod which may be secretory material.

REMARKS: This is a case where it is uncertain whether we are dealing with a known species or a related species differing in only one obvious character (colony form), a character which, moreover, can vary considerably within a species in compound ascidians of branched habit.

The type material was from coastal rocks and the present specimens from a depth of 135 m. The difference in habitat could account for the difference in colony form, but the latter might equally result from seasonal changes involving regeneration and branching as in *Sycozoa sigillinoides* (*see* Millar 1960).

Family DIDEMNIDAE Verrill, 1871

Didemnum Savigny, 1816

Didemnum is probably the most difficult of all ascidian genera from a taxonomic point of view.

Croxall (1972) lists eight species from New Zealand waters. Of these, only *D. studeri* and *D. lambitum* are identified in the present collections with any confidence. The remaining six species are commented on individually, but many doubts remain regarding the number and identity of species.

Didemnum studeri Hartmeyer, 1911 Fig. 24

Didemnum studeri Hartmeyer, 1911: 538–540; 1912: 322. Kott, 1969a: 75–77, figs 92, 93, 94 (for further references).

MATERIAL EXAMINED: NZOI Stn A696 (about 40 specimens).

PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands (Sluiter 1900), Auckland Island (Michaelsen 1924), Stewart Island (Michaelsen 1924), Macquarie Island (Kott 1957b).

PUBLISHED RECORDS, ELSEWHERE: Widely distributed in Subantarctic and Antarctic; Tasmania (Kott 1954).

DESCRIPTION: The largest of the specimens is about 2.5 cm in diameter. All are of a chalky or dirty white colour and are flat and encrusting. They had grown on the test of *Corella eumyota* Traustedt. The spicules, of a stellate form with blunt rays, are present throughout the common test. Hartmeyer (1911) described the type material as having spicules only in the upper part of the colony, but Michaelsen (1919) re-examined the co-type and found spicules at all levels, although most densely near the surface. All the mature zooids of the new material have two male follicles. Three follicles are present according to Hartmeyer (1911) but Michaelsen (1919) found as many zooids with two as with three follicles. Larvae are present in the lower part of the common test of some specimens from Macquarie Island. They appear to be not yet fully developed but are of the usual type found in *Didemnum*, with three anterior papillae, an otolith and ocellus. The trunk measures 0.40–0.46 mm in length, from the end of the papillae to the base of the tail.

Didemnum lambitum (Sluiter, 1900) Fig. 25

Didemnoides lambitum Sluiter, 1900: 18–19, pl. 4 fig. 1.
Didemnum lambitum. Michaelsen, 1924: 352–354. Kott, 1954:164, fig. 54; 1962:317–318.

MATERIAL EXAMINED: NZOI Stns ?B665 (2 specimens), B666 (1 specimen), B686 (45 specimens).

PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands (Sluiter 1900).

PUBLISHED RECORDS, ELSEWHERE: Southern Australia; Tasmania.

DESCRIPTION: The colonies are pink-grey, thick, somewhat fleshy and leathery. Many of them are attached to small stones and broken shells. No common cloacal openings or arrangement of zooids in systems could be seen. Spicules are most numerous in a narrow outer zone of the colony and much more sparse in all other parts. They are regularly stellate and the larger ones attain a diameter of about 50 μm. The zooids are small, a contracted thorax being about 0.3 mm long. There is a slender retractor process. The atrial opening

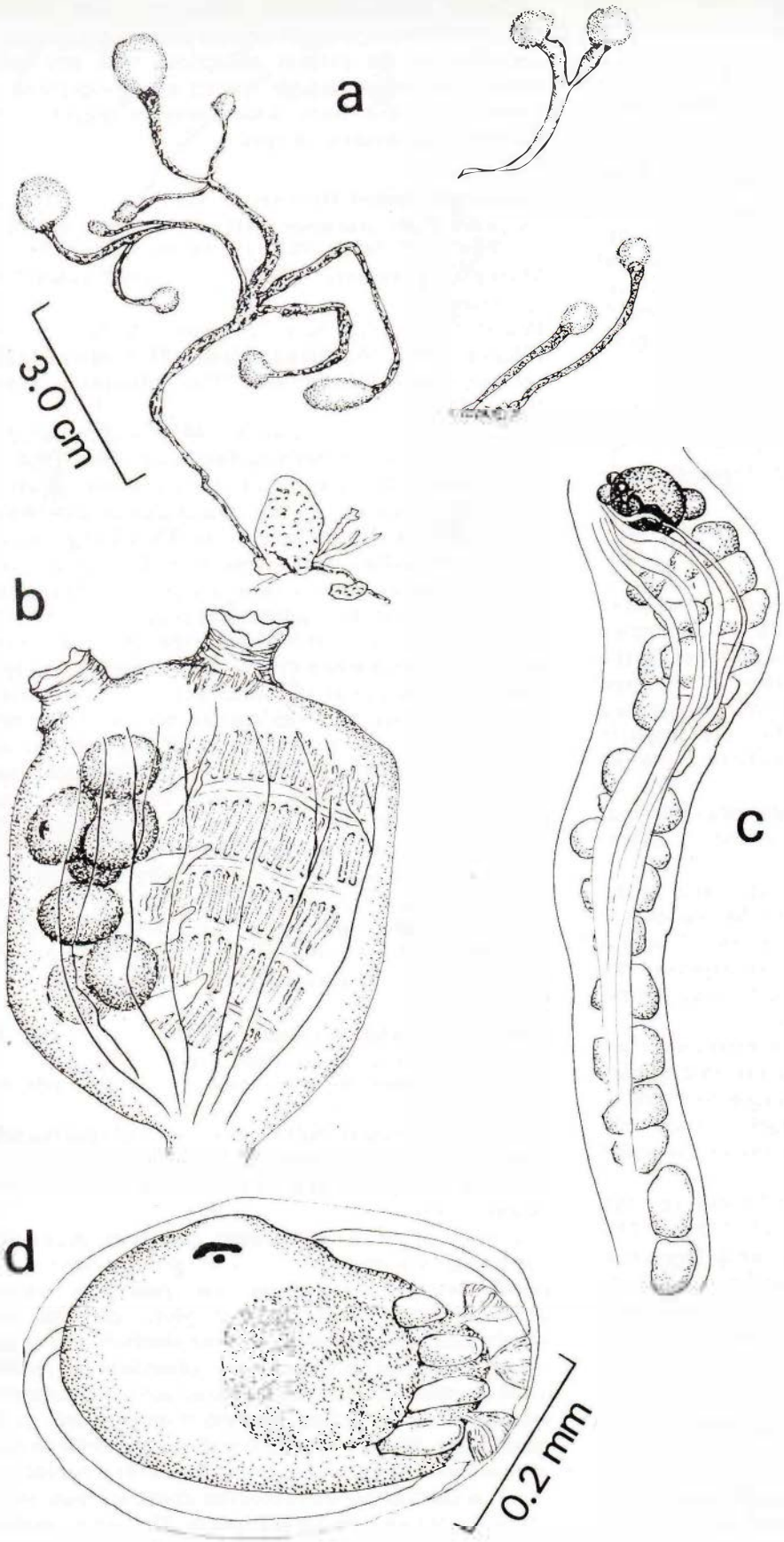

FIG. 23. *Ritterella sigillinoides* (Brewin): *a*, colonies; *b*, thorax of zooid; *c*, post-abdomen, with gonads; *d*, larva.

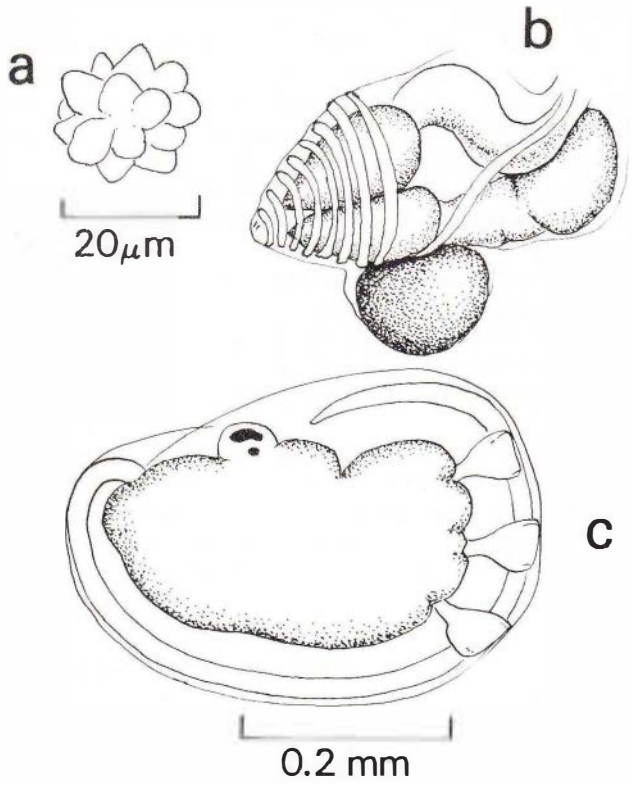

FIG. 24. *Didemnum studeri* Hartmeyer: *a*, spicule; *b*, abdomen; *c*, larva (probably not full developed).

is usually small. The stomach is small and the intestine long and considerably bent. The testis is a single follicle with 7–9 coils in the sperm duct.

REMARKS: The colonies from Station B665 differ from the others in having spicules densely arranged throughout the test, in the wide atrial opening and in the presence of larvae. These larvae are unlike the larvae described by Kott (1954) from Tasmanian material and identified as *D. lambitum*, which were considerably larger and provided with six pairs of lateral ampullae instead of four pairs as at Station B665.

"Didemnum candidum Savigny"

REMARKS: Michaelsen (1924) and Brewin (1946, 1948, 1950a, b, 1951, 1952b, 1956b, 1957, 1958a, b, 1960) recorded the species at several localities from Hauraki Gulf to Stewart Island and from Chatham Islands. It seems unlikely, however, that the species – if indeed a single species is involved – is the one described by Savigny (1816) from the Red Sea. Lafargue (1974) has redefined *D. candidum*, established a neotype, and shown that a number of the records hitherto attributed to the species are in fact of other species. The distribution is probably much more restricted than has been generally accepted, and the New Zealand material should probably be referred to some other species. In support of this view are the following differences in the zooids: 8–12 stigmata per row, a small atrial opening (almost a short tube) and one, two or occasionally three male follicles in the material from Portobello Peninsula (Brewin 1946) compared with 6, 6, 5 and 4 stigmata in the four rows, a very large atrial opening exposing most of the branchial sac, and a single male follicle in *D. candidum* Savigny.

?Didemnum chilense Ärnbäck, 1929

Didemnum chilense Ärnbäck, 1929: 1–27, fig. 5, pl. 2 figs 17, 18. Brewin, 1950c: 359, fig. 5.

PUBLISHED RECORDS: NEW ZEALAND: Great Barrier Island (Brewin 1950c).

PUBLISHED RECORDS, ELSEWHERE: Chile.

REMARKS: The New Zealand specimens attributed by Brewin (1950c) to *D. chilense*, although agreeing well enough with Ärnbäck's species, are in fact more like *D. candidum* than are the specimens which Brewin (1946) assigned to the latter species. This strengthens the doubts regarding identifications of species of *Didemnum*, particularly when *D. chilense* was originally described from as far away as Guaitecas Islands on the Chilean coast.

Didemnum densum (Nott, 1892)

Leptoclinum densum Nott, 1892: 311–314, pl. 25 figs 1–11.
Didemnum albidum Michaelsen, 1924: 354–356, fig. 15. Brewin, 1951: 107, fig. 3.

PUBLISHED RECORDS, NEW ZEALAND: Off Cape Maria van Diemen (Michaelsen 1924), Hauraki Gulf (Michaelsen 1924, Brewin 1951), New Plymouth (Michaelsen 1924), Auckland (Nott 1892), Slipper Island (Michaelsen 1924).

PUBLISHED RECORDS, ELSEWHERE: *See* below.

REMARKS: Croxall (1972) takes the Philippine *Leptoclinum albidum* var. *grande* Herdman, 1886 to be the form also occurring in New Zealand and which Michaelsen (1924) and Brewin (1951) referred to as *Didemnum albidum* (Verrill) and Nott (1892) as *Leptoclinum densum*. There are few indications that this is so, and indeed Van Name's (1918) account of material from the Philippines shows the spicules to differ. The spicules and the testis of the New Zealand specimens are like those of the Arctic and North-Boreal species *Didemnum albidum*, but I think it unlikely that the species extending in New Zealand as far north as the Hauraki Gulf is the same one which commonly occurs in north polar seas. Yet, Michaelsen, probably the most experienced of all ascidian workers, considered this to be a case of bipolar distribution. I prefer to use the name *D. densum* (Nott) for the New Zealand material characterised by spicules with rounded rays and by two male follicles.

Didemnum lithostrotum Brewin, 1956

Didemnum lithostrotum Brewin, 1956b: 127–129, fig. $3A_1$, A_2, A_3; 1958a: 440.

PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands

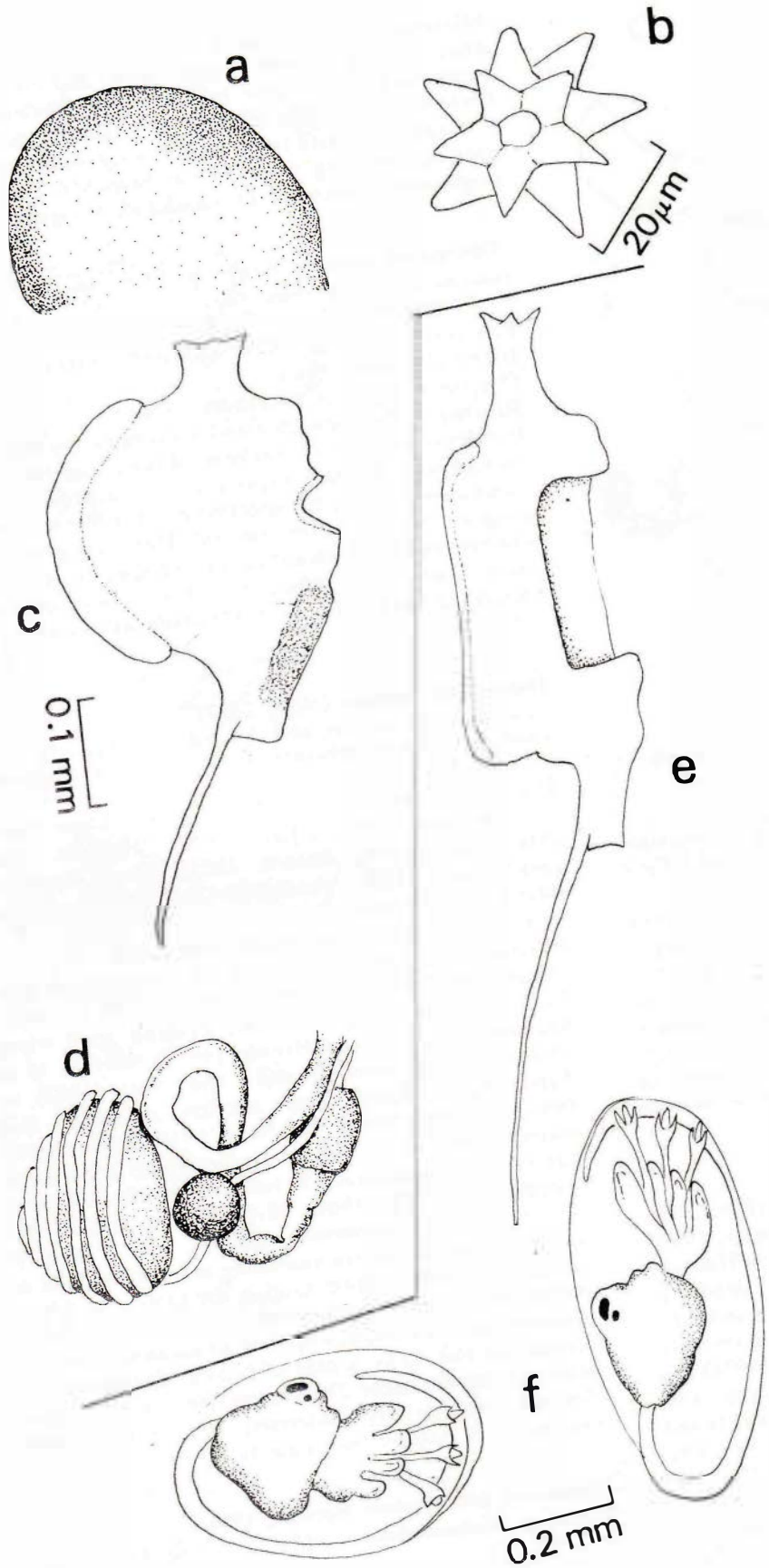

FIG. 25. *Didemnum lambitum* (Sluiter), top and left: *a*, section of colony showing distribution of spicules; *b*, spicule; *c*, thorax (Stn B686); *d*, abdomen (Stn B666). Bottom and right, doubtfully *D. lambitum*: *e*, thorax (Stn B665); *f*, larvae.

(Brewin 1956b), Chatham Rise (Brewin 1956b), Stewart Island (Brewin 1956b, 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1956b): Colony thin, marked out in polygonal areas each with a common cloacal opening and up to 120 zooids; test orange coloured; spicules 10–80 μm in diameter, with round-ended rays; atrial opening with short lappet; testis of two follicles.

REMARKS: The similarities to *D. densum* (Nott) should be noted (pigmented test, spicule shape, testis structure), the main distinction apparently being the superficial division of the test in polygonal areas in *D. lithostrotum*. It is not impossible that the two species are the same.

A single didemnid colony (Station P58, 35°07.2′S 173°05.6′E, 24 m) shows polygonal areas on the surface like those described in *D. lithostrotum*, but the small contracted zooids, with no gonads developed, do not allow an identification to be made.

Didemnum maculatum (Nott, 1892)

Leptoclinum maculatum Nott, 1892: 316–318, pl. 27 figs 1–8.
Didemnum psammatodes var. *maculatum* Michaelsen, 1924: 341–342. Brewin, 1946: 97–98, fig. 5, pl. 3 fig. 5, pl. 4 fig. 11.

PUBLISHED RECORDS, NEW ZEALAND: Bay of Islands (Michaelsen 1924), Auckland (Nott 1892), Christchurch (Brewin 1950b), Portobello Peninsula (Brewin 1946), Stewart Island (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: *See* discussion below.

DESCRIPTION (from Nott 1892): Colony leathery, grey, brown or purple mottled with white; spicules small (7–32 μm); zooids with small thorax, long waist and wide abdomen; no atrial lappet; testis with one follicle.

REMARKS: Michaelsen (1924) considered Nott's species to be the same as *D. psammatodes* (Sluiter) var. *ianthinum* (Sluiter), originally described from Mozambique, but named it var. *maculatum* (Nott) on grounds of priority. *D. psammatodes*, however, is a species differing from Nott's species in a number of respects; notably it has a short waist and an atrial lappet. It seems best to recognise Nott's species as distinct but this is another case of quite uncertain synonymy.

Didemnum tuberatum (Nott, 1892)

Leptoclinum tuberatum Nott, 1892: 314–316, pl. 26 figs 1–8.
Leptoclinum scidula Sluiter, 1900: 19–20.
Didemnum tuberatum. Michaelsen, 1924: 356–358.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Nott 1892, Michaelsen 1924), Stewart Island (Michaelsen 1924), French Pass and D'Urville Island (Sluiter 1900), Auckland Island (Michaelsen 1924).

PUBLISHED RECORDS, ELSEWHERE: None.

REMARKS: The species seems to be distinguished mainly by the sharply pointed spicular rays and the large lateral thoracic organs.

Didemnum mortenseni Michaelsen, 1924 Fig. 26

Didemnum mortenseni Michaelsen, 1924: 360–363, fig. 16. Brewin, 1956b: 127, fig. $2E_1$, E_2, 131. Kott, 1954: 163–164.
Polysyncraton mortenseni. Kott, 1962: 296.

MATERIAL EXAMINED: NZOI Stns A715 (many specimens), E817 (2 specimens), E828 (3 specimens).

PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Michaelsen 1924), Chatham Island (Brewin 1956b), Chatham Rise (Brewin 1956b).

PUBLISHED RECORDS, ELSEWHERE: Tasmania.

DESCRIPTION: The colonies, forming thin grey encrusting sheets, are on dead molluscan shells and small stones. They agree with Michaelsen's (1924) description of the type material, and are characterised by the flat common cloacal cavity dividing the colony into upper and lower layers; the large atrial opening of the zooids; the massive short-rayed spicules (to 75 μm in diameter); the testis with three or sometimes two lobes, and 4–5 coils in the sperm duct.

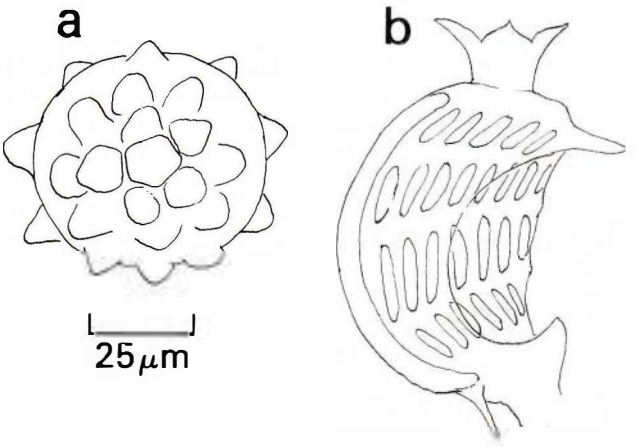

FIG. 26. *Didemnum mortenseni* (Michaelsen): *a*, spicule; *b*, thorax.

Polysyncraton Nott, 1892

Polysyncraton chondrilla (Michaelsen, 1924) Fig. 27

Didemnum chondrilla Michaelsen, 1924: 344–352, fig. 14. Kott, 1954: 165.
Polysyncraton chondrilla. Kott, 1969a: 79–80, figs 97–102 (**not** Kott, 1962: 296–298, according to Kott 1969a).

MATERIAL EXAMINED: NZOI Stn F936 (7 specimens).

PUBLISHED RECORDS, NEW ZEALAND: North Cape, Little Barrier Island, Colville Channel, Stewart Island (Michaelsen 1924).

PUBLISHED RECORDS, ELSEWHERE: Antarctic (Kott 1954, 1969a).

DESCRIPTION: The colonies are soft, fleshy, ochre-coloured upright masses, somewhat narrowed at the base and either undivided or incompletely divided into a few lobes. The longest is about 8 cm high. There are usually one or two oval common cloacal openings at the

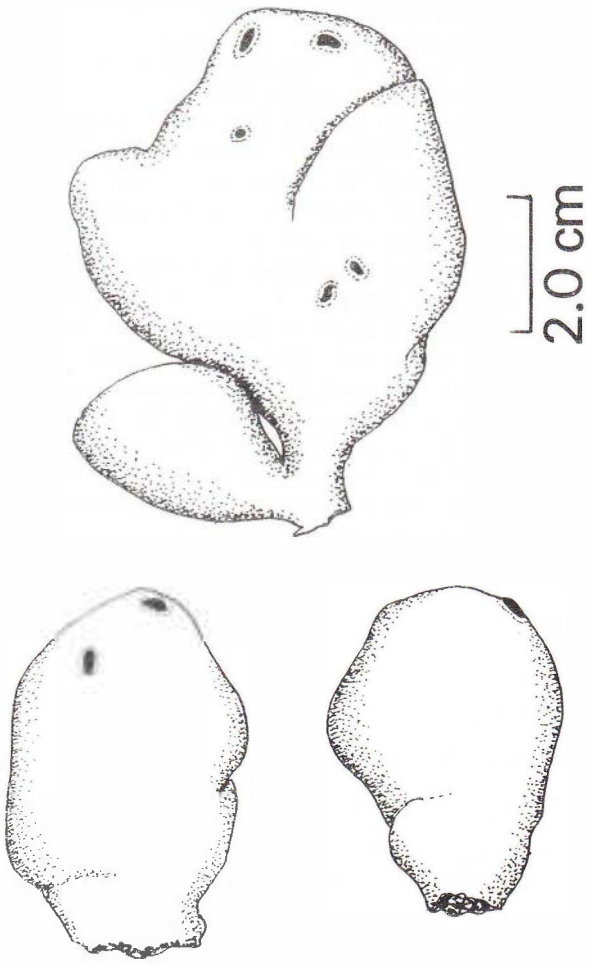

FIG. 27. *Polysyncraton chondrilla* (Michaelsen): three colonies, showing common cloacal openings.

apex and sometimes a few others on the sides of the colony. The spicules are few and confined to a superficial layer. Many of them are about 20 μm in diameter, but some attain 35 μm. The zooids are as described by Michaelsen (1924), but generally have four male lobes and occasionally five, compared with three or four in the type specimens.

Polysyncraton paradoxum Nott, 1892

Polysyncraton paradoxum Nott, 1892: 318–321, pl. 28 figs 1–8.
Polysyncraton fuscum Nott, 1892: 321–323, pl. 29 figs 1–8.
Didemnum paradoxum. Michaelsen, 1924: 344. Brewin, 1957: 580, pl. 1 figs 3a, b, c (**not** Kott, 1954: 163, according to Kott, 1962).

PUBLISHED RECORDS, NEW ZEALAND: Auckland (Nott 1892), North Auckland (Brewin 1957).

PUBLISHED RECORDS, ELSEWHERE: Seychelles (var. *macheinum* Michaelsen, 1920)

DESCRIPTION (from Nott 1892 and Brewin 1957): Colony encrusting, white, brown or black; spicules small (to 18 μm) with many short, blunt rays; atrial opening with simple lappet; testis of 7–10 follicles; sperm duct with 2–4 coils.

Lissoclinum Verrill, 1871

Lissoclinum notti Brewin, 1958

Lissoclinum notti Brewin, 1958b: 457, fig. $1B_1$, B_2, B_3.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1958b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1958b): Colony thin, encrusting; violet or brown; common cloacal cavities within colony large; spicules 10–14 μm, with irregular ridged flat-ended rays; atrial opening wide; testis of one follicle showing indication of division into two; sperm duct not coiled.

Diplosoma Macdonald, 1859

Diplosoma listerianum (Milne Edwards, 1841)

Leptoclinum listerianum Milne Edwards, 1841: 300.
Diplosoma listeri Lahille, 1890: 104, figs 58–60, 62, 65–69.
Diplosoma macdonaldi Herdman, 1886. Brewin, 1946; 1948; 1950b; 1951; 1952b; 1958a; 1960.
For synonymy *see* Rowe 1966.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1948, 1951), Napier (Brewin 1952b), Cook Strait (Brewin 1960), Christchurch (Brewin 1950b), Portobello Peninsula (Brewin 1946), Stewart Island (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: Widely distributed in temperate and warm waters throughout the world.

DESCRIPTION (from numerous published records): Colony sheeting, gelatinous, khaki-coloured; atrial opening wide; testis of two follicles; sperm duct not coiled.

REMARKS: I am following Rowe (1966) who, after studying material from different parts of the world, concluded that many of the species described are conspecific and that *D. listerianum* (Milne Edwards) should be recognised as the correct name. The species has been referred to as *D. macdonaldi* in New Zealand records.

Leptoclinides Bjerkan, 1905

Several species of *Leptoclinides* have been described from New Zealand, in addition to those reported from other parts of the western Pacific. Distinctions are not clear and the discussions by Tokioka (1952), Millar (1960), Kott (1962), Eldredge (1966) and Croxall (1972) have not resolved the difficult taxonomic problems.

Leptoclinides diemenensis Michaelsen, 1924

Leptoclinides diemenensis Michaelsen, 1924: 331–336, fig. 12. Brewin, 1958b: 457.

PUBLISHED RECORDS, NEW ZEALAND: Cape Maria van

Diemen (Michaelsen 1924), Hauraki Gulf (Brewin 1958b).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Michaelsen 1924 and Brewin 1958b): Colony encrusting to cushion-shaped, with several common cloacal openings; spicules to 48 μm, mostly smaller, with 8–10 pointed rays in optical section; lateral thoracic organs in posterior half of thorax; testis a rosette of four or five follicles; sperm duct with 6–7 coils.

Leptoclinides sparsus Michaelsen, 1924
Leptoclinides sparsus Michaelsen, 1924: 336–341, fig. 13.
PUBLISHED RECORDS, NEW ZEALAND: New Plymouth (Michaelsen 1924).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Michaelsen 1924): Known from a single specimen. Colony encrusting but lobed, with several common cloacal openings; large stellate black pigment cells near surface of colony; spicules to 40 or 50 μm, with 8–16 broad, pointed rays; lateral thoracic organs about half-way along thorax; testis a rosette of 5–7 follicles; sperm duct with 7–8 coils.

Leptoclinides marmoreus Brewin, 1956
Leptoclinides marmoreus Brewin, 1956b: 129–130, fig. $3B_1$–B_4.
PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands (Brewin 1956b).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Brewin 1956b): Colony encrusting, marbled yellow and dark grey; common cloacal openings large and generally near margin of colony; spicules 10–45 μm with wide, pointed rays; abdomen small; testis with five follicles; sperm duct with nine coils.

Leptoclinides auranticus Brewin, 1956
Leptoclinides auranticus Brewin, 1956b: 134, fig. $4C_1$–C_4.
PUBLISHED RECORDS, NEW ZEALAND: Chatham Rise (Brewin 1956b).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Brewin 1956b): Colony encrusting, orange coloured; common cloacal openings scattered over surface; spicules 10–60 μm, stellate with wide pointed rays; testis with five or six follicles; sperm duct with seven coils.

Leptoclinides sluiteri Brewin, 1950
Leptoclinides sluiteri Brewin, 1950c: 360, fig. 6.
PUBLISHED RECORDS, NEW ZEALAND: Great Barrier Island (Brewin 1950c).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Brewin 1950c): Colony thin, grey-blue-green, with several cloacal openings; spicules 12–25 μm, stellate with pointed rays; abdomen as long as thorax; lateral thoracic organs, when present, small; testis a rosette of four or five follicles; sperm duct with 9–10 coils.

Leptoclinides novaezelandiae Brewin, 1958
Leptoclinides novaezelandiae Brewin, 1958a: 447, fig. $2C_1$–C_4.
PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Brewin 1958a).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Brewin 1958a): Colony globular or encrusting with several common cloacal openings; spicules 20–45 μm, stellate; testis of three or occasionally four follicles; sperm duct with five coils.

Leptoclinides duminus sp.n. Fig. 28
MATERIAL EXAMINED: Portobello Stns MU67–142 (2 specimens), MU74–95 (3 specimens).
HOLOTYPE: A colony 2.2 cm long, in collection of the National Museum of New Zealand, Wellington, New Zealand, type number ASC 21.
PARATYPES: NMNZ, type numbers ASC 20, one specimen from same sample as holotype; ASC 19, three specimens from Portobello Stn MU74–95.
TYPE LOCALITY: Portobello Stn MU67–142, continental slope east of Otago, South Island, 45°51′S, 171°02′E, 730 m.
DESCRIPTION: The colonies are ovoid to rounded, usually slightly narrowed at the base and having at the centre of the upper end a single conspicuous, oval common cloacal opening. The colour is pale grey, with the numerous oral openings showing as small dark spots. In consistency the colony is firm. The flat common cloacal cavity within the colony is parallel to the surface, and lies immediately below the layer of zooids. It opens by the single apical aperture. Spicules are densely packed in the superficial part of the colony, and more sparsely scattered throughout the deeper layers. They are stellate, up to about 25 μm in diameter, with a solid central ball and rather few conical rays. The zooids are 2–3 mm long. The oral siphon is wide, with six teeth representing the lobes. The atrial siphon, situated at the base of the thorax, is long and directed backwards, and opens on the roof of the common cloacal cavity. Thin longitudinal muscles are present on the sides of the thorax. There are four rows of stigmata but the number per row was not clear. The waist of the zooid is short, and the abdomen is in line with the thorax or only slightly oblique to it. The oesophagus is narrow and the stomach pear-shaped. Post-stomach and mid-intestine are distinct. The testis and ovary are situated beside the intestinal loop, and were always found in separate zooids, which presumably are protandrous. The testis is a group of pear-shaped follicles, usually seven in number, but a few zooids have six, eight, or nine follicles. The sperm duct is spirally coiled, but very fragile and in no zooid dissected from the colony was it undamaged. The

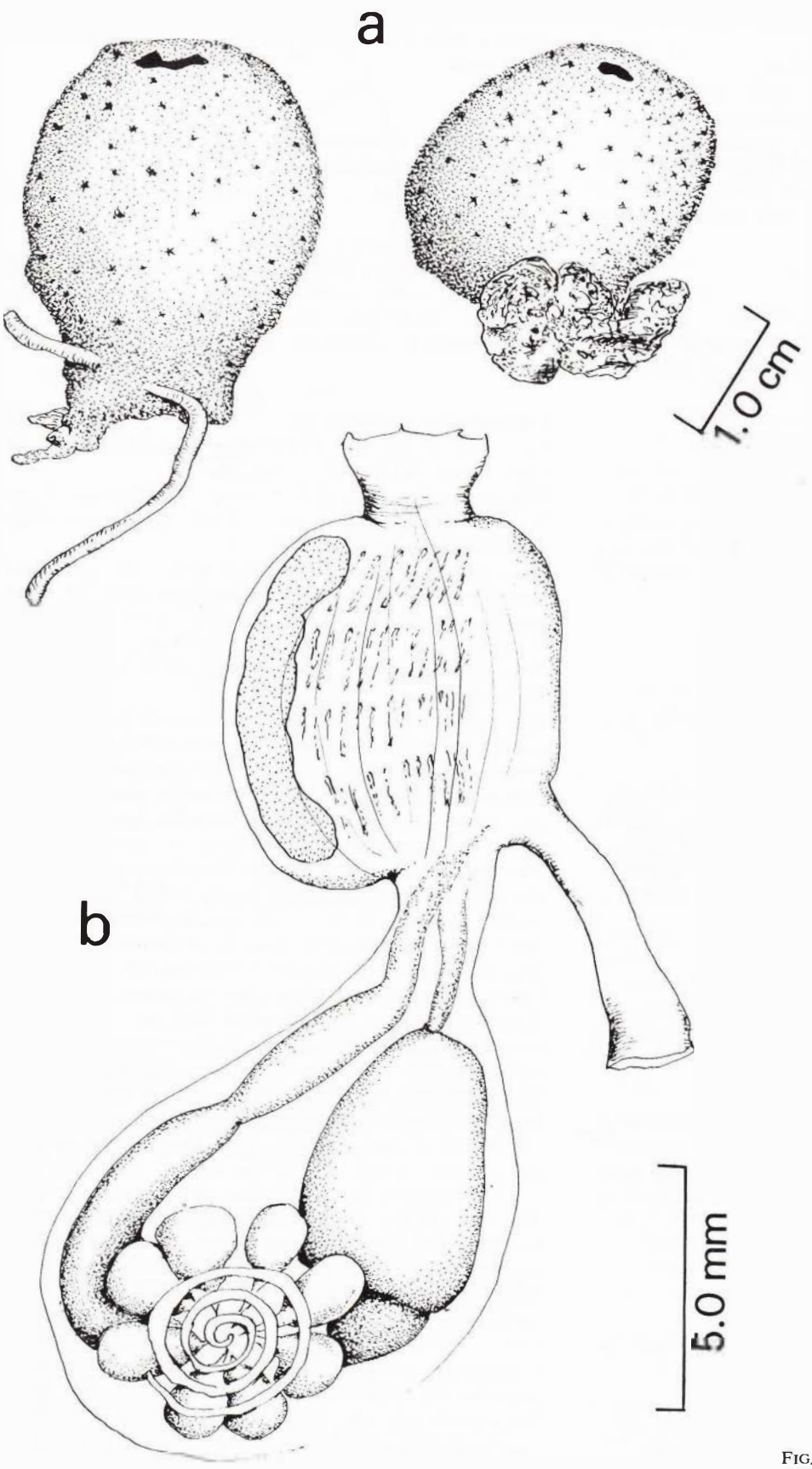

FIG. 28. *Leptoclinides duminus* sp.n.: *a*, colonies; *b*, zooid.

highest number of coils found was four but there were probably more coils in intact zooids. The ovary is not well developed, but has one quite large brown oocyte. No fully formed larvae were found, although embryos were present in the deeper parts of the colony.

REMARKS: The species is distinguished from other species of *Leptoclinides* described from New Zealand by the shape of the colony, the presence of only one common cloacal opening, and the large number of male follicles.

Tridemnum Della Valle, 1881

Tridemnum cerebriforme Hartmeyer, 1913

Tridemnum cerebriforme Hartmeyer, 1913: 139–140, pl. 7 fig. 1, pl. 8 figs 4, 5. Michaelsen, 1919: 37, fig. 2; 1924: 341. Kott, 1962: 275–278; 1972b: 178; 1972c: 47–48; 1973: 247; 1975: 10.

PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Michaelsen 1924).

PUBLISHED RECORDS, ELSEWHERE: Australia; South Africa.

DESCRIPTION (from numerous published records): Colony convoluted and brain-like; spicules stellate, 57–95 μm; variable superficial layer of vesicular cells; up to nine or ten stigmata in each of the three branchial rows; testis of one follicle; sperm duct with about seven coils.

REMARKS: The species was originally described from False Bay, South Africa (Hartmeyer 1913).

Tridemnum sluiteri Brewin, 1958

Tridemnum sluiteri Brewin, 1958a: 445, fig. $2B_1$, B_2.

PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1958a): Colony thin, encrusting; spicules to 50 μm, stellate; vesicular cells "not discernable in the surface layer" (Brewin 1958a); 9 or 10, 9, and 8 or 9 stigmata in the three branchial rows; testis of one follicle; sperm duct with eight coils.

REMARKS: It may be doubted if the distinctions regarding stigmata and vesicular cells made by Brewin (1958a) to separate this species and *T. cerebriforme* are reliable and sufficient. The number of stigmata per row scarcely differs at all and the distribution of vesicular cells within the test evidently varies considerably in *T. cerebriforme*, even within a single colony.

Family ASCIDIIDAE Herdman, 1880

Ascidia Linnaeus, 1767

Ascidia lagena Michaelsen, 1922

Ascidia lagena Michaelsen, 1922: 483–488, fig. 34.

PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Michaelsen 1922).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Michaelsen 1922): Long flask-shaped transparent body with long oral siphon; atrial siphon one sixth of body length from posterior end; body wall muscles confined to right, consisting of strands mainly radiating from atrial siphon; opening of dorsal tubercle U-shaped; primary but no intermediate branchial papillae; anus far behind anterior intestinal loop.

Ascidia stewartensis sp.n. Fig. 29

MATERIAL EXAMINED: NZOI Stns ?B228 (1 specimen), D156 (1 specimen).

HOLOTYPE: A specimen in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H–268.

TYPE-LOCALITY: NZOI Stn D156, near Snares Islands, 48°01.5′S, 166°35.0′E, 81 m.

DESCRIPTION: The holotype is a specimen heavily coated with shell-sand, and measuring about 1.7 cm long. The test is thin and, except for the adhering sand, transparent. Siphons are not externally visible. When removed from the test the body is seen to be laterally compressed, but this condition could be, in some degree, a result of fixation and storage. The oral siphon is short and its margin indented to form very shallow lobes. The atrial siphon is about the middle of the dorsal side and is narrow and very short, with indistinct lobes. The body wall is thin and transparent and, except for some circular strands at the bases of the siphons, has the muscles confined to two strong bands passing ventrally from the dorsal line to one third of the way across the left side and three similar bands on the right side. Each of these five muscles splays out at its dorsal and ventral ends. About 60 slender, almost filiform, oral tentacles are present. The dorsal tubercle, a low elongated pad, has an almost straight and only slightly sinuous narrow slit. The tubercle lies in a narrow triangular papillate area. Papillae also extend over the prebranchial zone of the branchial sac. The dorsal lamina is a low ribbed membrane with inrolled edge. The branchial walls are flat, with no tendency to form plications. There are small branchial papillae but no intermediate papillae. Four or five stigmata lie in the meshes. The gut is of simple form, consisting of a curved oesophagus, pear-shaped stomach, and an open loop comprising the intestine and rectum. The rectum points obliquely back and ends in a plain-edged anus. Renal vesicles with cream-coloured concretions are scattered in the tissues surrounding the gut. The ovary is a rounded, slightly lobed body lying within the gut loop. Although the testis was not distinguished a gonoduct – probably the sperm duct – projects beyond the anus.

One specimen from Station B228 resembles the holotype of *A. stewartensis* in certain features but its distorted and somewhat damaged condition obscures important details. It is about 2.6 cm long. Unlike the holotype it has no coating of sand. The body is

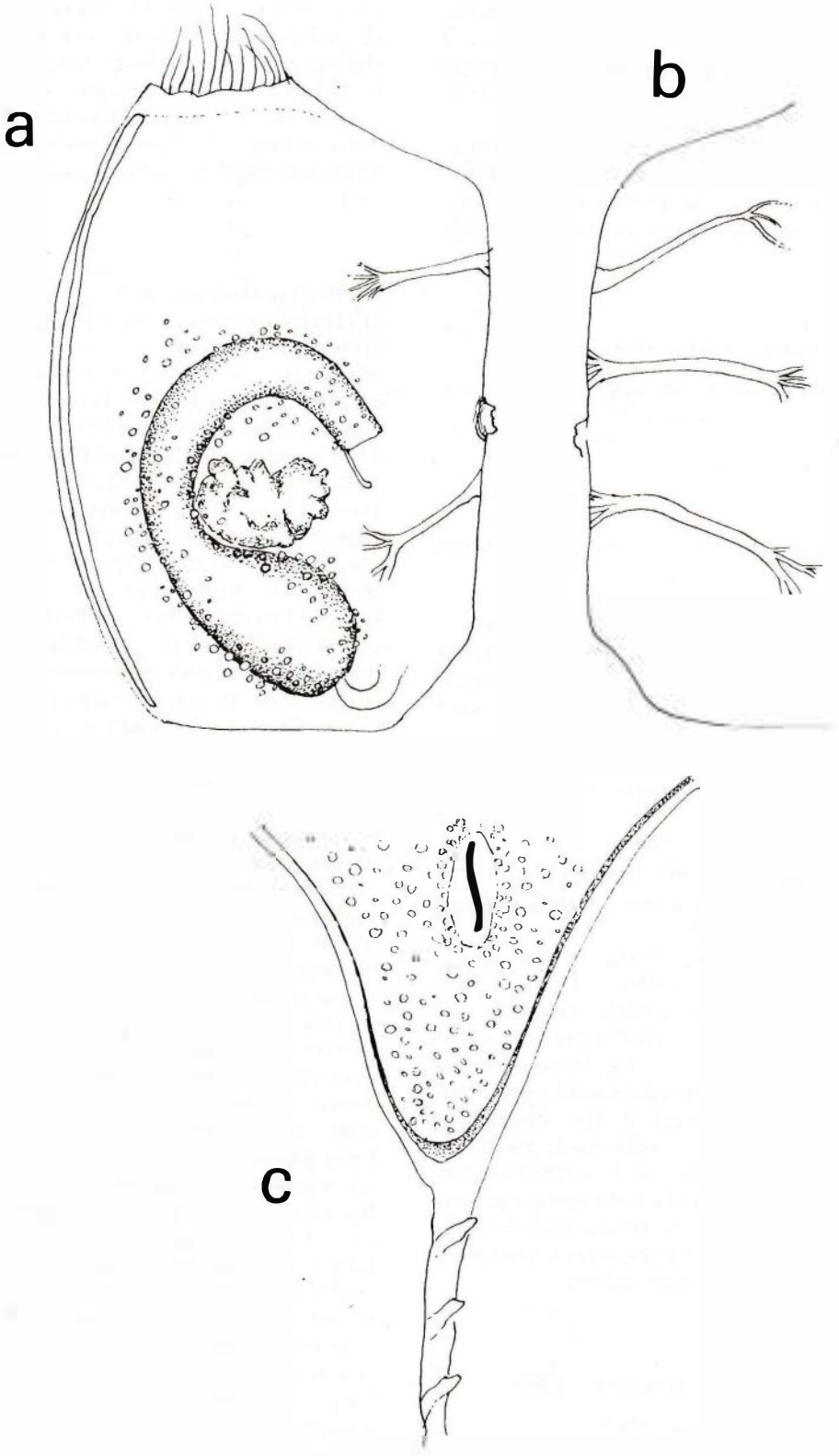

FIG. 29. *Ascidia stewartensis* sp.n.: *a*, holotype, with test removed, from left; *b*, holotype, with test removed, from right, dorsal part of body to show muscles; *c*, dorsal tubercle.

flattened laterally. Each siphon is surrounded by circular muscles. A few strong muscles with splayed-out ends are present but their orientation is difficult to determine. Many filiform oral tentacles are present. The dorsal tubercle was not seen. The branchial wall is flat and no papillae were definitely seen. The gut is compact but its details are indistinct. The features suggesting that this specimen may be *A. stewartensis* are the presence of a few strong body wall muscles, the numerous filiform oral tentacles and the locality (on the shelf south of Stewart Island).

REMARKS: In the family Ascidiidae only *Ascidia lagena* Michaelsen and *Ascidiella aspersa* (Müller) have been recorded from the waters of New Zealand. The diffuse body wall musculature, the absence of branchial papillae, the shape of the dorsal tubercle, and the number of oral tentacles distinguish *Ascidiella aspersa*. *A. lagena* differs from *A. stewartensis* in its musculature and its U-shaped opening of the dorsal tubercle. *Ascidia aclara* Kott, known from Victoria, Queensland, and South Australia, resembles *A. stewartensis* in its sand-coated test, its body wall muscles and numerous oral tentacles, but differs in having a fold in the branchial wall and a more complex dorsal tubercle (Kott 1952, 1972a, 1972b; Millar 1963).

Ascidia macropapilla sp.n. Fig. 30

MATERIAL EXAMINED: NZOI Stn E411 (2 specimens).

HOLOTYPE: A specimen 3.0 cm in length in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H–267.

PARATYPE: NZOI, type number P–526, specimen from same sample as holotype.

TYPE-LOCALITY: NZOI Stn E411, east of southern South Island, 46°38.5′S, 170°59′E, 1275 m.

DESCRIPTION: The two specimens are 3.0 cm (holotype) and 4.0 cm long, and irregularly rectangular in outline. Some debris adheres to the surface. The test is rather thin and is flexible and translucent grey. With the test removed the body is seen to have a short oral siphon. The atrial siphon is far back on the dorsal side, almost at the posterior end of the body, and projects obliquely backwards. Circular muscles surround the siphons and longitudinal strands radiate from their bases for only a short distance. Elsewhere, muscles are almost entirely confined to the right side of the body, where they form a uniform diffuse network. In the larger specimen 97 oral tentacles were counted, of varying sizes. They stand on a somewhat thickened ridge of the body wall. In one specimen the opening of the dorsal tubercle is a narrow U and in the other an almost straight oblique slit. The epibranchial groove extends some distance behind the tubercle. The dorsal lamina is a plain membrane of moderate height. The branchial walls are flat, with slender longitudinal bars which are connected to the branchial wall only where they meet the transverse bars. At these crossing points tall papillae are present but no intermediate papillae were seen. Usually not more than six stigmata occupy the meshes. The gut is confined to the posterior third of the body. The oesophagus is curved, the stomach short and with narrow folds on the surface, and the intestine forms a short narrow loop. The terminal part of the rectum bends dorsally to end in a simple anus lying considerably posterior to the anterior pole of the intestinal loop. No renal vesicles were visible. The ovary is in the intestinal loop and short thick male follicles lie on the surface of the intestine, extending to the ventral face of the stomach.

REMARKS: This species of *Ascidia*, which may prove to be confined to deep water, has no single distinguishing feature. It may be characterised by the position of the atrial siphon, the relatively small gut, simple but variable dorsal tubercle, long epibranchial groove, large primary branchial papillae, and absence of intermediate papillae. No species from southern waters or the deep-sea appears to have this assemblage of characters.

Ascidiella Roule, 1883

Ascidiella aspersa (Müller, 1776)

Ascidia aspersa Müller, 1776: 225. Kott, 1952: 307–308. Brewin, 1946: 106–108, fig. 10; 1950b: 344.

Ascidiella aspersa. Brewin, 1958a: 440. Berrill, 1950: 154–155 for synonymy.

PUBLISHED RECORDS, NEW ZEALAND: Christchurch (Brewin 1950b), Portobello Peninsula (Brewin 1946), Stewart Island (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: Europe; western and southern Australia.

DESCRIPTION (from various published records): Elongate quadrilateral colourless body; body wall muscles weak, confined to right and periphery of left side; oral tentacles 18–34 and fewer than longitudinal branchial bars on either side; opening of dorsal tubercle a broad horizontal C with inrolled horns; no branchial papillae; anus slightly anterior to anterior border of intestinal loop.

REMARKS: The distribution, limited to the south-eastern part of South Island, is curious, the species otherwise being known from European and Mediterranean waters and certain parts of the Australian coast. It may have been introduced to New Zealand during fisheries experiments (Brewin 1946).

Family RHODOSOMATIDAE Hartmeyer, 1908

Corella Alder and Hancock, 1870

Corella eumyota Traustedt, 1882

Corella eumyota Traustedt, 1882: 271, 273, pl. 4 figs 2, 3, pl. 5 figs 13, 14. For synonymy *see* Van Name 1945.

MATERIAL EXAMINED: NZOI Stns A695 (1 specimen), A696 (many specimens), B216 (1 specimen), B218 (1 specimen), B222 (1 specimen), B223 (1 specimen), B231 (2 specimens), B237 (2 specimens); ?B248 (1 specimen), B254 (1 specimen), C730 (many speci-

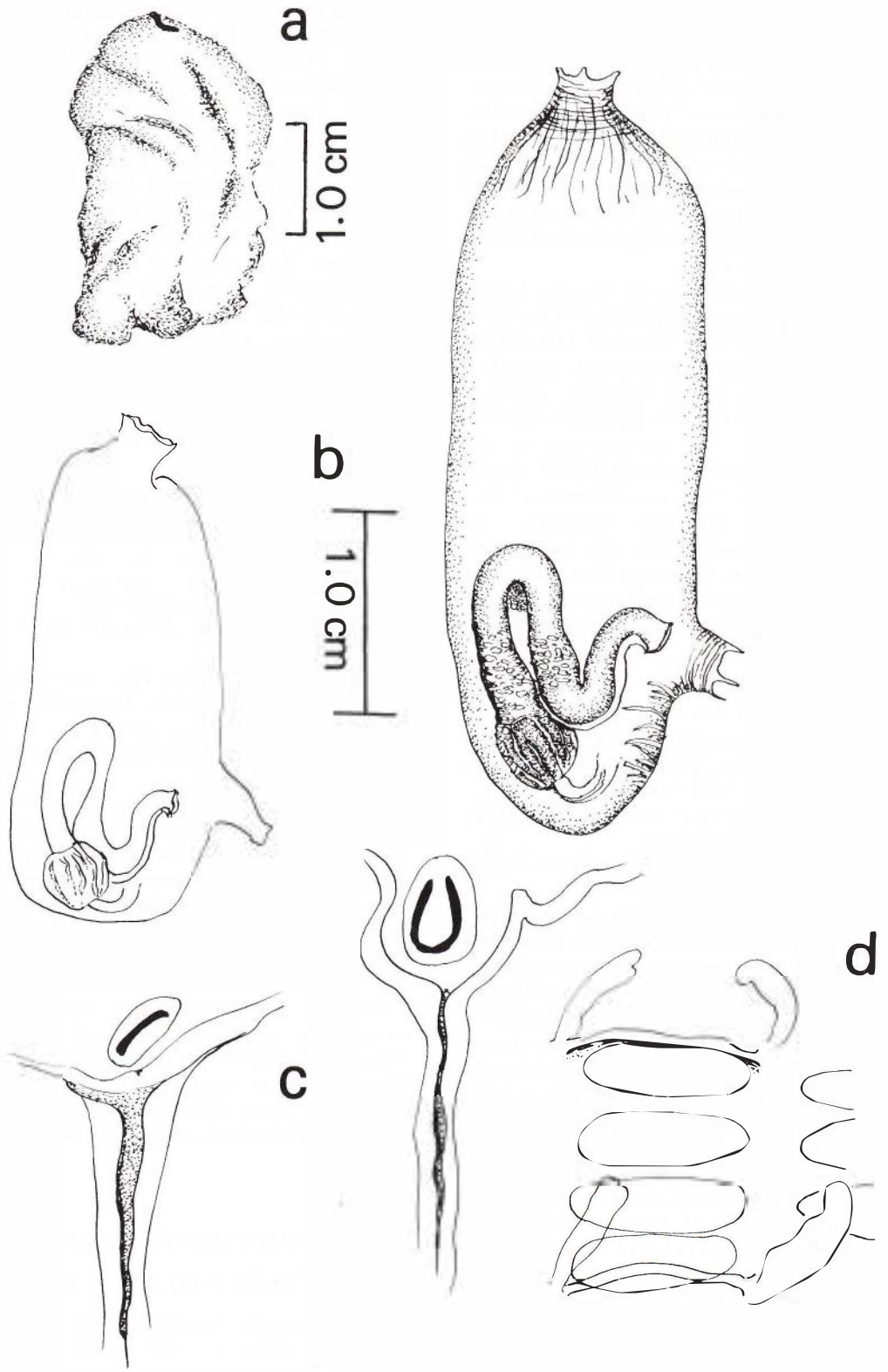

FIG. 30. *Ascidia macropapilla* sp.n.: *a*, intact specimen; *b*, two specimens, with test removed; *c*, dorsal tubercles; *d*, part of branchial wall.

mens), C732 (many specimens), D52 (33 specimens), D65 (3 specimens), D74 (many specimens), D121 (1 specimen), D182 (1 specimen), D873 (1 specimen), E107 (1 specimen), E228 (46 specimens), E234 (4 specimens), E235 (1 specimen), E236 (1 specimen), E237 (>100 specimens), E811 (1 specimen), E812 (1 specimen), E834 (1 specimen), F103 (3 specimens), G660 (1 specimen), G674 (1 specimen), G680 (8 specimens), G685 (12 specimens), G694 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: Kaipara Harbour (Michaelsen 1922), Hauraki Gulf (Michaelsen 1922; Brewin 1948, 1950c, 1951, 1958b), North Auckland (Brewin 1957), Slipper Island (Michaelsen 1922), Tauranga (Hartmeyer 1911), Napier and Cape Kidnappers (Brewin 1952b), Mahia Peninsula (Michaelsen 1922), Wellington (Michaelsen 1922), Cook Strait (Sluiter 1900; Michaelsen 1922; Brewin 1960), Lyttelton (Michaelsen 1918), Christchurch (Brewin 1950b), Otago Harbour (Brewin 1946), Stewart Island (Michaelsen 1922; Brewin 1958a), Chatham Islands (Sluiter 1900; Brewin 1956b), Auckland Islands (Herdman 1910; Bovien 1921; Brewin 1950d), Macquarie Island (Kott 1954).

PUBLISHED RECORDS, ELSEWHERE: Subantarctic, Antarctic, Tasmania, southern and western Australia.

REMARKS: This is a well-known species and is readily distinguished from species of *Ascidia*, which it superficially resembles, by the position of the stomach and intestine on the right of the branchial sac, and by the spiral stigmata.

Family AGNESIIDAE Huntsman, 1912

Adagnesia Kott, 1963

Adagnesia antarctica Kott, 1969 Fig. 31

Adagnesia antarctica Kott, 1969a: 99, figs 133, 134.

MATERIAL EXAMINED: NZOI Stn A907 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: None.

PUBLISHED RECORDS, ELSEWHERE: West of Macquarie Island (Kott 1969a).

DESCRIPTION: The body, measured over the coating of sand, is 2.0 cm long and 1.5 cm wide. Very slender test filaments are thickly spaced over the lower half of the body and are coated with adhering sand grains. No filaments are present on the upper surface, which is devoid of sand. The two siphons lie in a single oval depression bordered by a rounded ridge on the upper side of the body. The test substance is transparent, soft and flexible. Each siphon has seven lobes. The body wall musculature comprises a set of circular strands around each siphon, about 20 longitudinal strands radiating from the oral siphon and about 15 from the atrial siphon, and some approximately transverse strands on the posterior part of the body. Rows of transverse muscles such as are described by Kott (1969a) were not seen. The oral tentacles are arranged as in the type material. The dorsal tubercle is a small oval pad with a simple longitudinal slit. In the types it is extended into a process pointing to the right. The dorsal languets are hooked. The branchial sac has 13 rows of stigmata separated by transverse bars bearing biramous papillae with long slender processes. The oesophagus is quite long, the stomach short and barrel-shaped, the intestine S-shaped and the anus smooth-edged.

REMARKS: This specimen presents some problems, being like the type material in a number of important respects and unlike it in some features. It apparently differs in possessing test fibrils, Kott (1969a) having made no reference to these. In the type specimen the transverse bars with papillae separate double transverse rows of stigmata; in the present specimen transverse bars occur between single rows. These branchial differences may be related to different stages in growth. In *A. opaca* Kott 1969b noted stages in the proliferation of the rows of stigmata which resulted in different arrangements even within a single branchial sac.

Agnesia Michaelsen, 1898

Agnesia glaciata Michaelsen, 1898

Agnesia glaciata Michaelsen, 1898: 370.

For synonymy *see* Kott 1969a: 97–99.

PUBLISHED RECORDS, NEW ZEALAND: North of Dargaville (Millar 1960).

PUBLISHED RECORDS, ELSEWHERE: Subantarctic, Antarctic, South Africa.

DESCRIPTION (from published records): Ovoid sand-coated body; test thin; siphons sessile, close together; four bands of short transverse muscles pass down sides of body; dorsal languets hooked; stigmata square spirals; branchial papillae simple.

REMARKS: The species – if only one is involved – has a very wide distribution, but the records from Japan and California (both accepted by Kott 1969a) may possibly refer to a different species.

Family PEROPHORIDAE Giard, 1872

Perophora Wiegmann, 1872

Perophora annectens Ritter, 1893

Perophora annectens Ritter, 1893: 37–85, pls 1–3, figs 1–39. Brewin, 1951: 108–109, fig. 4 (mis-spelled *P. annectans*).

For American references *see* Van Name 1945: 168–169.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1951).

PUBLISHED RECORDS, ELSEWHERE: West coast U.S.A.

DESCRIPTION (from published records): Colony a mat with zooids completely embedded (New Zealand material, Brewin 1951) or partially free in parts of colony (American material, Van Name 1945); zooids small and rounded; both siphons opening on surface; five (New Zealand material, Brewin 1951) or four

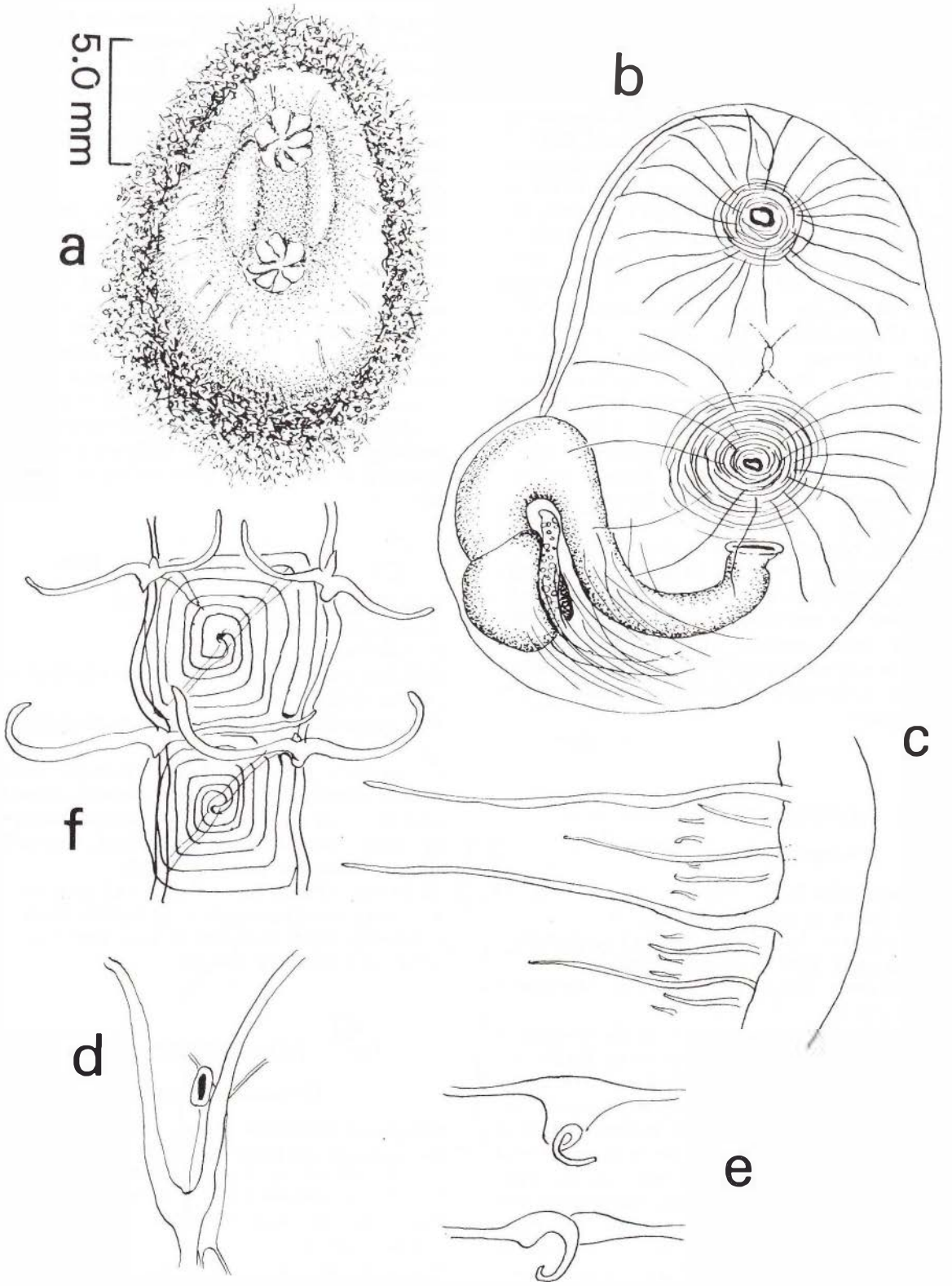

FIG. 31. *Adagnesia antarctica* Kott: *a*, intact specimen, from dorsal side; *b*, specimen with test removed, from dorsal side; *c*, oral tentacles; *d*, dorsal tubercle; *e*, dorsal languets; *f*, part of branchial wall.

(American material, Van Name 1945) rows of stigmata; stomach globular, smooth; intestine a horizontal loop enclosing ovary and 2–7 radiating testicular follicles.
REMARKS: The apparently discontinuous distribution, and the different number of branchial rows (if confirmed) may require recognition of the New Zealand specimens as a new species, but present evidence is insufficient to justify this.

Perophora boltenina Michaelsen, 1922

Perophora boltenina Michaelsen, 1922: 488-493, fig. 35.

PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Michaelsen 1922).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Michaelsen 1922): Colony a branched bare stolon with a regular series of small, rounded, narrow-stalked sandy zooids; five rows of stigmata; stomach elliptical; intestine a horizontal loop enclosing gonad (immature in only known specimens).
REMARKS: Michaelsen (1922) believes this to be a different species from the rather similar *P. hutchisoni* Macdonald of New South Wales.

Family CIONIDAE Lahille, 1887

Ciona Fleming, 1822

Ciona intestinalis (Linnaeus, 1767)

Ascidia intestinalis Linnaeus, 1767: 2, 1087.
For synonymy *see* Kott (1952).

PUBLISHED RECORDS, NEW ZEALAND: Christchurch (Brewin 1950b).
PUBLISHED RECORDS, ELSEWHERE: Widely distributed in temperate, cool and warm waters.
DESCRIPTION (from numerous published records): Cylindrical, soft, flexible, colourless to greenish; both siphons anterior; strong separate longitudinal muscles; branchial sac long, with row of dorsal languets; branchial papillae; gut mainly behind branchial sac; stomach with folds; rectum long; numerous small testicular follicles spread over gut wall; ovary sac-like, beside intestinal loop.

Family STYELIDAE Sluiter, 1895

Botryllus Gaertner *in* Pallas, 1774

Botryllus schlosseri (Pallas, 1766)

Alcyonium schlosseri Pallas, 1766: 355.
Botryllus schlosseri. Savigny, 1816: 47. Brewin, 1946: 112–113; 1948: 121; 1950b: 344; 1958a: 440; 1960: 119.
For synonymy *see* Berrill 1950: 216–217.

PUBLISHED RECORDS, NEW ZEALAND: North Island (locality unknown) (Michaelsen 1922), Hauraki Gulf (Brewin 1948), Cook Strait (Brewin 1960), Christchurch (Brewin 1950b), Portobello Peninsula (Brewin 1946), Stewart Island (Brewin 1958a).
PUBLISHED RECORDS, ELSEWHERE: Europe, eastern and western coasts of North America.
DESCRIPTION (from Brewin 1946): Colony flat; test light yellow, transparent; zooids purple, green or orange; systems circular or elliptical; atrial siphon wide, tapering and with upper lip produced; oral tentacles 8 or 16; nine or ten rows of 16–20 stigmata; stomach wide, oval, with nine or ten folds and long hooked caecum; testis of numerous lobes; ovary anterior and dorsal to testis, with 1--4 large ova.
REMARKS: Specimens from New Zealand are indistinguishable from those of eastern and western Atlantic waters. Berrill (1950) suggests that the species may have been introduced to the American coast by ships from Europe. The same may be true for New Zealand, but if so it has subsequently spread widely in both North and South Islands.

Botryllus stewartensis Brewin, 1958 Fig. 32

Botryllus stewartensis Brewin, 1958a: 444, fig. $3A_1$–A_5.

MATERIAL EXAMINED: NZOI Stns A853 (several colonies or pieces), D873 (1 specimen).
PUBLISHED RECORDS, NEW ZEALAND: Stewart Island and Foveaux Strait (Brewin 1958a).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION: Each colony or fragment of a broken colony consists of a thin flat sandy sheet from which project a few columnar lobes usually not more than 5 mm long. The free end of these lobes is concave and on this area the zooids open, although they are obscured by the coating of sand grains over the whole surface. Brewin (1958a) does not mention a flat sheet, which I assume to be a common basal part of the colony, but she describes the colonies as "lobate up to 3.5 cm in height above the substratum, 1.5 cm in maximum diameter, surface of the lobes not highly domed". The zooids agree with Brewin's description, which can be summarised as follows: zooids up to 2.5 mm long; atrial opening tubular with wide lappet; eight oral tentacles; ten rows each of 14 stigmata; stomach with 10 or 11 folds and a curved caecum; a testis on each side, palmate with backwardly-directed lobes; ovary anterior to testis. No gonads were found in the new material.

?**Botryllus separatus** Sluiter, 1904

Botryllus separatus Sluiter, 1904: 100-101, pl. 15 fig. 22. Millar, 1960: 95–96.

PUBLISHED RECORDS, NEW ZEALAND: Off North Cape (Millar 1960).
PUBLISHED RECORDS, ELSEWHERE: Indonesia.
REMARKS: Only one specimen, without gonads, has been provisionally identified as *B. separatus*. The New Zealand specimen had round to elongate systems of zooids with 12 rows each of about 18 stigmata, and a conical stomach with nine folds and no caecum.

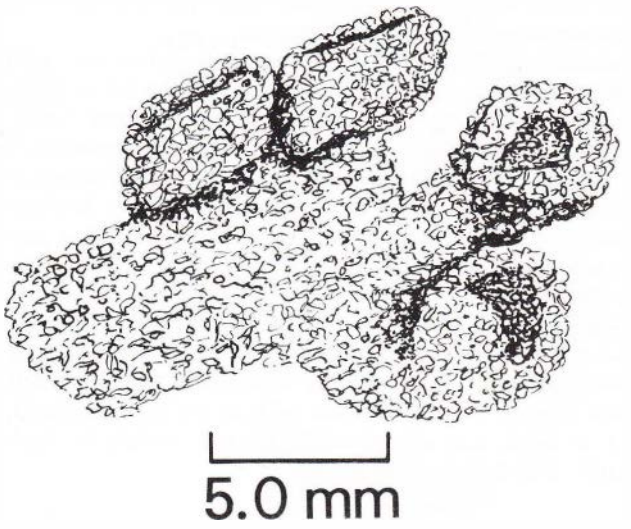

FIG. 32. *Botryllus stewartensis* Brewin: part of a colony.

Botrylloides Milne-Edwards, 1841

?**Botrylloides leachi** (Savigny, 1816)

Botryllus leachii Savigny, 1816: 199–200, pl. 4 fig. 6, pl. 20 fig. 4.
Botryllus leachi. Michaelsen, 1922: 479. Brewin, 1946: 111–112.
For synonymy *see* Berrill, 1950: 224–225; Michaelsen, 1922: 479.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Michaelsen 1922; Brewin 1948, 1951), Tauranga (Michaelsen 1922), Cook Strait (Sluiter 1900; Brewin 1960), Chatham Islands (Brewin 1956b), Christchurch (Brewin 1950b), Portobello Peninsula (Brewin 1946), Stewart Island (Michaelsen 1922; Brewin 1958a), Auckland Island (Bovien 1921).

PUBLISHED RECORDS, ELSEWHERE: Europe.

DESCRIPTION (from Brewin 1946): Colony flat; test grey, semi-transparent; zooids purplish with variable yellow or white marks; systems elongate or circular; 16 oral tentacles; 15 or 16 rows of 19 or 20 stigmata; stomach wide at oesophageal end, with nine folds and short straight erect caecum; testis lobed; ovary just dorsal or anterior to testis, with one or two large ova.

REMARKS: I have some doubt whether this is the same species which is common in European waters. The European *B. leachi* has the ovary posterior to the testis (Ärnbäck 1923; Berrill 1950) not alongside or anterior as in Brewin's (1946) account. Other differences are the generally much more elongate systems of zooids and the smaller number of stigmata (about 12) in the rows in European specimens.

Botrylloides magnicoecum (Hartmeyer, 1912)

Botrylloides nigrum magnicoecum Hartmeyer, 1912: 271–272, pl. 41 fig. 11.
Botryllus magnicoecus. Michaelsen, 1922: 480–481.
For synonymy *see* Kott, 1972a: 302, 480.

PUBLISHED RECORDS, NEW ZEALAND: North Auckland (Brewin 1957), Hauraki Gulf (Brewin 1951), Tauranga (Michaelsen 1922), Stewart Island (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: Eastern, southern and western Australia, China, Japan, Indian Ocean, southern Africa.

DESCRIPTION (from Brewin 1951): Colony flat, saffron yellow with purple or dark brown pigment round anterior ends of zooids (in life), or dull purple (preserved); systems elliptical or irregularly branched; 16 oral tentacles; 10 or 11 rows of 11–13 stigmata; stomach globular with 10 or 11 folds and long hooked pyloric caecum; testis of 10–16 lobes; ovary of one ovum anterior to testis.

REMARKS: The species was originally described from the Cape of Good Hope, South Africa by Hartmeyer (1912) as a new variety of *B. nigrum* Herdman. It was later recorded from several parts of Australia (Kott 1952), African coasts and the Mediterranean. This distribution, together with the difficulties of identifying botryllids, suggest that more than one species may have been confused.

?**Botrylloides** sp. Fig. 33

MATERIAL EXAMINED: NZOI Stn D119 (6 specimens).

DESCRIPTION: The colony is an oval or elongate flat plate, bare above, and on the underside bearing numerous filamentous test processes to which adhere black and grey sand grains. A few quite large common cloacal openings are scattered on the upper side and the systems of zooids are round or oval. The colour of the preserved colonies is dull pale purple-grey. The zooids have about 15 rows of stigmata. The stomach is parallel-sided or truncate conical with a well-developed, curved but not strongly hooked, caecum. No gonads are present, and the species cannot be identified or assigned to a genus but appears to agree best with *Botrylloides.*

REMARKS: The colonies are evidently adapted to life on a loose substratum to which attachment is made by the basal test processes. This is an unusual habit in botryllid ascidians. If specimens with gonads are found and a more complete description can be made, the species could be assigned to a genus and may prove to be a new species.

Polyzoa Lesson, 1830

Polyzoa opuntia Lesson, 1830

Polyzoa opuntia Lesson, 1830: 437. Brewin, 1950d: 6–8, fig. 1.
For synonymy *see* Van Name, 1945: 236. Kott, 1969: 100.

PUBLISHED RECORDS, NEW ZEALAND: Auckland Islands (Brewin 1950d), Campbell Island (Sluiter 1932).

PUBLISHED RECORDS, ELSEWHERE: Subantarctic, Antarctic.

DESCRIPTION (from Brewin 1950d): Colony of small clusters of brown, leathery, flattened, pyriform lobes; zooids embedded; both siphons open on surface; 24–30 oral tentacles; no branchial folds; eight longitudinal bars per side; stomach globular with 16 folds and small curved caecum; intestine and rectum long; 7–9 small

endocarps each side; gonads hermaphrodite, in one row each side of endostyle, 4–7 on left, 11–13 on right (this row curving dorsally at its posterior end).

Polyzoa reticulata (Herdman, 1886) Fig. 34

Chorizocormus reticulatus Herdman, 1886: 346–349, pl. 46 figs 1–8.
Polyzoa falklandica var. repens Michaelsen, 1900: 55.
Polyzoa reticulata. Michaelsen, 1904: 65–68. Van Name, 1945: 237–238. Bovien, 1921: 40–41. Millar, 1960: 97. Kott, 1954: 147; 1969: 102–103.

MATERIAL EXAMINED: NZOI Stns A696 (several colonies), D25 (1 colony), E228 (1 colony).
PUBLISHED RECORDS, NEW ZEALAND: Campbell Island (Bovien 1921), Macquarie Island (Kott 1969).
PUBLISHED RECORDS, ELSEWHERE: Subantarctic, Antarctic.
DESCRIPTION: The characteristic form of the colony is a number of thin sand-coated stolons spreading over a solid substratum – generally broken shell – and small upright sand-coated zooids arising at intervals from the stolons. The zooids are ovoid, with the two short closely-spaced siphons on the upper end, and are usually 2–6 mm in height. From the lower end of the zooid arise the stolon and a short wide test projection, and it is this rather than the stolon which attaches the zooid to the substratum. The internal features are: about 16 oral tentacles; large dorsal tubercle with variable but simple slit; body wall muscles of external circular and internal longitudinal strands; eight longitudinal branchial bars per side; short wide stomach with 15–20 folds and a hooked caecum; two-lipped anus with reflected unlobed margin; a row of hermaphrodite gonads on each side of the endostyle; scattered endocarps. Some of the gonads may appear to be purely male, but high magnification shows the presence of small oocytes; in other cases a large egg is present and both oviduct and sperm duct are developed. Larvae lie in the atrial cavity of some zooids. They have an ovoid trunk 0.66–1.0 mm long and a tail with a broad fin. The black sensory spot is sometimes visible externally and sometimes hidden by overlying tissues.

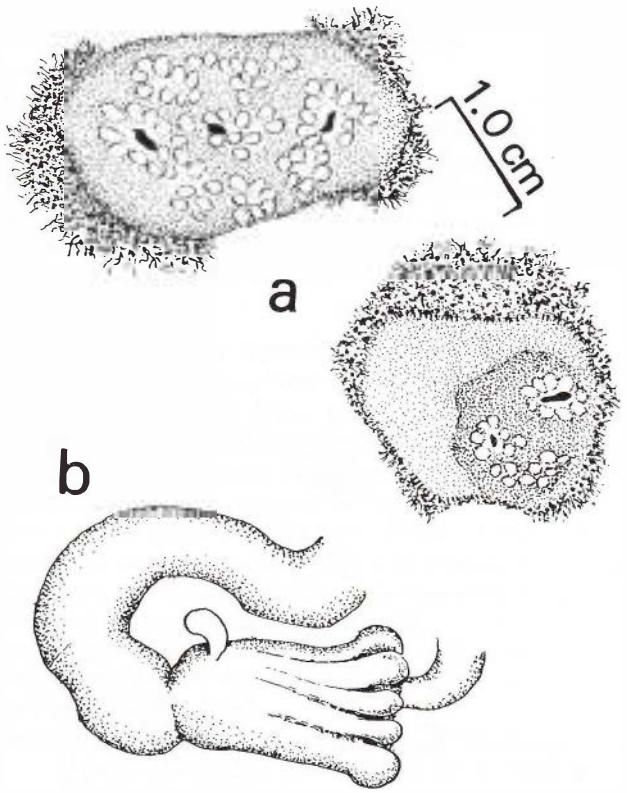

FIG. 33. ?*Botrylloides* sp.: *a*, two colonies; *b*, stomach.

Okamia Brewin, 1948

Okamia thilenii (Michaelsen, 1922)

Metandrocarpa thilenii Michaelsen, 1922: 457–461, fig. 28.
Okamia thilenii. Brewin, 1948: 123–124.

PUBLISHED RECORDS, NEW ZEALAND: North Auckland (Brewin 1957), Hauraki Gulf (Brewin 1948, 1958b), Tauranga (Michaelsen 1922), New Plymouth (Michaelsen 1922).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Michaelsen 1922, Brewin 1948): Colony of closely packed upright zooids joined by a thin basal membrane; oral tentacles 32–48; no branchial folds; ten longitudinal bars per side; stomach longer than wide, with 20–22 folds and a curved pyloric caecum; long intestine and rectum; 10–15 small endocarps on right, 8–10 on left; gonads of one sex, ovaries a curved row on ventral part of left side, testes in two curved rows, one on left anterior to row of ovaries, and one on right.

Metandrocarpa Michaelsen, 1904

Metandrocarpa protostigmatica Michaelsen, 1922

Metandrocarpa protostigmatica Michaelsen, 1922: 461–469, figs. 29–30.
Metandrocarpa protostigmata (sic!). Brewin, 1952b: 191–192.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Michaelsen 1922), Napier (Brewin 1952b).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Michaelsen 1922, Brewin 1952b): Colony of separate, low, dome-shaped zooids united by stolons; both siphons open on surface; oral tentacles 17 (–20?); no branchial folds; 6–8 longitudinal bars per side; posterior quarter to third of left branchial wall has transverse stigmata running from dorsal lamina to endostyle; elsewhere normal longitudinal stigmata arranged in transverse rows; stomach conical with 16–18 folds and short hooked pyloric caecum; intestine and rectum a short S-shaped curve; 8–15 small endocarps, some on each side; gonads – right, 4–6 female, 0–2

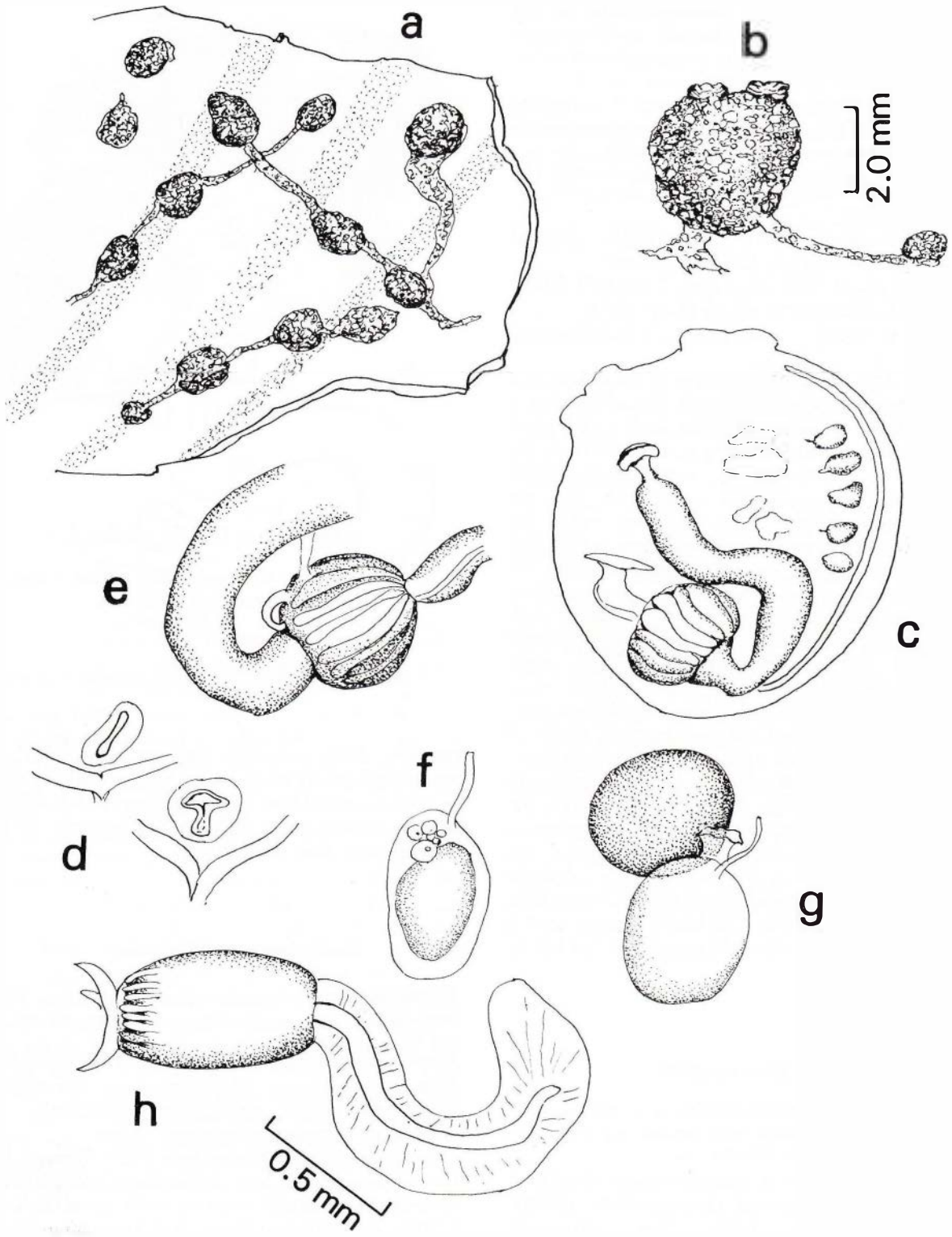

FIG. 34. *Polyzoa reticulata* (Herdman): *a*, colony; *b*, zooid; *c*, gut, gonads of left side and endocarps; *d*, dorsal tubercle; *e*, stomach; *f*, gonad with male follicles and small ovary; *g*, gonad with large ovum; *h*, larva.

male, 0 or 1 hermaphrodite; left, 3–5 female, 2 or 3 male, 1 or 2 hermaphrodite; male gonad with single lobe.

Arnbackia Brewin, 1950

Arnbackia novaezelandiae Brewin, 1950

Arnbackia novaezelandiae Brewin, 1950c: 361–362, fig. 7.

PUBLISHED RECORDS, NEW ZEALAND: Great Barrier Island (Brewin 1950c), Bay of Islands (Brewin 1957).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1950c): Colony a thin basal sheet uniting closely spaced mature zooids; young zooids more widely separated; 16–24 oral tentacles; two branchial folds per side (occasionally one on left); stomach short, wide, with 16–18 folds and hooked pyloric caecum; intestine and rectum long; small scattered endocarps both sides; 25–35 pear–shaped testes on right, not arranged in a row; 5–8 single-egged ovaries in a curved ventral row on left.

REMARKS: Brewin (1950c) spelled the specific name *novae-zealandiae* on p. 354 in her species list, but *novae-zelandiae* on p. 361 in the detailed description, and as this latter spelling was probably her intention, it should be adopted.

Berrillia Brewin, 1952

Berrillia boltenioides Brewin, 1952

Berrillia boltenioides Brewin, 1952a: 455, fig. 3A, B.

PUBLISHED RECORDS, NEW ZEALAND: Otago coastal waters (Brewin 1952a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1952a): Colony a sandy mat consisting of pear-shaped, crowded zooids united by thin basal membrane; 24 oral tentacles; no branchial folds; four longitudinal bars per side; stomach short, tubular, with 12–15 low folds and a curved pyloric caecum; anus level with oesophageal mouth; a few endocarps; gonads on left only; 3–5 ovaries near endostyle; 2–6 large lobed testes each with long thin sperm duct.

Alloeocarpa Michaelsen, 1900

Alloeocarpa affinis Bovien, 1921

Alloeocarpa affinis Bovien, 1921: 40-43, pl. 4 figs 1, 2.

PUBLISHED RECORDS, NEW ZEALAND: Campbell Island (Bovien 1921).

PUBLISHED RECORDS ELSEWHERE: None.

DESCRIPTION (from Bovien 1921): Low, dome-shaped, more or less separated zooids, some united to parent zooids by a stolon, others having lost the connection and become isolated; about 20 oral tentacles; no branchial folds; six longitudinal bars per side; short wide stomach with 16–18 folds and club-shaped pyloric caecum; intestine short, strongly curved into compact loop beside stomach; about six ovaries on right near endostyle; 4–6 testes on left, pear-shaped with slender sperm duct.

REMARKS: Bovien (1921) remarked on the similarity between this species and *A. capensis* Hartmeyer, 1912, a South African species differing mainly in the organisation of the colony. A single colony (K051I) of an *Alloeocarpa* species cannot be identified since it lacks well-developed gonads, but in other respects agrees well with *A. affinis.*

Alloeocarpa minuta Brewin, 1951

Alloeocarpa minuta Brewin, 1951: 110, fig. 6.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1951, 1958b), Chatham Islands (Brewin 1956b), Foveaux Strait (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1951): Low, dome-shaped, separated zooids united only by fine stolons; 16–24 oral tentacles; no branchial folds; six or seven longitudinal bars per side; stomach short with 13–15 folds and curved pyloric caecum; intestine strongly curved; a few endocarps; 2–6 ovaries on right; 1–3 testes on left, with very short sperm duct.

REMARKS: This species resembles *A. affinis* Bovien and *A. capensis* Hartmeyer, but differs from both in its short sperm ducts.

Amphicarpa Michaelsen, 1922

Amphicarpa michaelseni Brewin, 1956 Fig. 35

Amphicarpa michaelseni Brewin, 1956b: 134–135, fig. $4E_1$, E_2, E_3.

MATERIAL EXAMINED: NZOI Stns E107 (2 colonies), E108 (1 zooid).

PUBLISHED RECORDS, NEW ZEALAND: Chatham Rise (Brewin 1956b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: The specimen from Station E108 is a single zooid of length 1.1 cm and completely sand-coated. Two colonies or groups of zooids are present in material from Station E107. The zooids are sand-coated and club-shaped, the lower end being drawn out into a stalk joining a basal mass of common test. Large zooids measure about 1.3 cm exclusive of the basal stalk. The following structural details identify the species: 30–60 oral tentacles; dorsal tubercle with a straight longitudinal slit; dorsal lamina a long plain-edged membrane; two branchial folds on each side with the following typical arrangement of longitudinal bars – dorsal lamina 1 (8) 4 (9) 6 endostyle; stomach short and wide with about 16 undivided folds and a small hooked caecum; intestine and rectum not sharply curved; anus without lobes. The full set of gonads is probably not developed in any of the zooids; in one there were about 40 small pear-shaped testes on the right side and only a few gonads (possibly female or hermaphrodite) on the left. Brewin (1956b) recorded

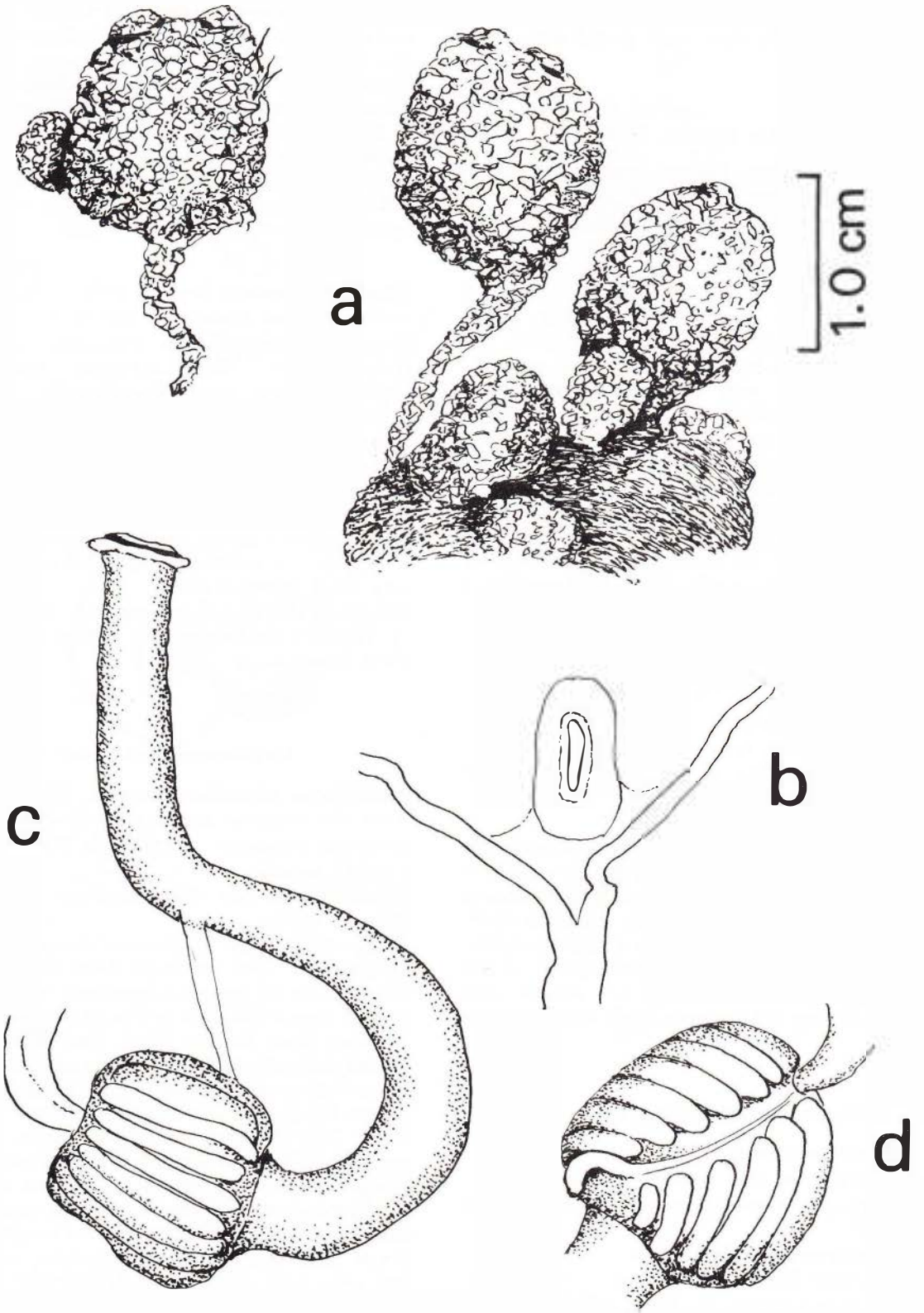

FIG. 35. *Amphicarpa michaelseni* Brewin: *a*, zooids; *b*, dorsal tubercle; *c*, gut; *d*, stomach, to show pyloric caecum.

19 testes and 5 ovaries on the right and 29 testes on the left, in one zooid.
REMARKS: Brewin (1956b) listed the features distinguishing this species from *A. schauinslandi* Michaelsen. In addition, the gut loop appears to be much more sharply bent and compact in the latter species.

Amphicarpa schauinslandi Michaelsen, 1922
Amphicarpa schauinslandi Michaelsen, 1922: 454–457, fig. 27.
PUBLISHED RECORDS, NEW ZEALAND: Chatham Island (Michaelsen 1922).
PUBLISHED RECORDS, ELSEWHERE: None.
REMARKS: According to Brewin (1956b) the species differs from *A. michaelseni* in having four branchial folds per side, about 16 oral tentacles, and more testes on the right than the left.

Theodorella Michaelsen, 1922

Theodorella arenosa Michaelsen, 1922
Theodorella arenosa Michaelsen, 1922: 469–473, fig. 31. Brewin, 1958a: 449.
PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Michaelsen 1922), Bluff (Brewin 1958a).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Michaelsen 1922, Brewin 1958a): Sac-like zooids sandy, united by stolons or thin basal membrane; 18–24 oral tentacles; no branchial folds; seven longitudinal bars per side; stomach globular with 14–17 folds and slightly curved pyloric caecum; intestine and rectum a long open loop; six or more small endocarps per side; 10–16 sac-like testes on left in a row near endostyle; 13–18 gonads on right, mainly hermaphrodite (a few male sometimes), in a row near endostyle.

Theodorella torus Michaelsen, 1922
Theodorella torus Michaelsen, 1922: 473–474.
PUBLISHED RECORDS, NEW ZEALAND: Bay of Islands (Michaelsen 1922), New Plymouth (Michaelsen 1922).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Michaelsen 1922): Colony of closely crowded, sandy zooids united basally to a common membrane; about 32 oral tentacles; no branchial folds; seven longitudinal bars on right, six on left; stomach globular with about 18 folds (pyloric caecum not mentioned by Michaelsen); 14 testes on left in a row near endostyle; eight gonads in a row near endostyle on right (anterior two hermaphrodite and posterior six male).
REMARKS: Michaelsen (1922) recognised the similarity of this species and *T. arenosa*.

Theodorella stewartensis Michaelsen, 1922
Theodorella stewartensis Michaelsen, 1922: 475–479, figs 32, 33. Brewin, 1958a: 449.
PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Michaelsen 1922), Foveaux Strait (Brewin 1958a).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Michaelsen 1922, Brewin 1958a): Sac-like zooids sandy, closely crowded and united basally to each other or to a thin basal membrane; 26–32 oral tentacles; no branchial folds; 14 longitudinal bars per side; stomach tubular with 14 folds and sharply angled pyloric caecum; intestine and rectum in a short narrow loop; 9–13 testes on left in a row near endostyle; 16–18 gonads on right, mainly hermaphrodite (a few male sometimes), in a row near endostyle.

Oligocarpa Hartmeyer, 1911

Oligocarpa megalorchis Hartmeyer, 1911 Fig. 36
Oligocarpa megalorchis Hartmeyer, 1911: 527–531, pl. 47 fig. 6, pl. 55 figs 13–19. Kott, 1954: 147; 1969a: 106. Monniot, 1970: 346–348.
MATERIAL EXAMINED: NZOI Stn A696 (7 specimens).
PUBLISHED RECORDS, NEW ZEALAND: Macquarie Island (Kott 1954, 1969a).
PUBLISHED RECORDS, ELSEWHERE: Kerguelen (Hartmeyer 1911, Monniot 1970).
DESCRIPTION: The new specimens from Macquarie Island have completely separated zooids, as in some of Hartmeyer's type material. The body is dome-shaped to ovoid, 4–9 mm high, and attached by the wide flat under side to a dead molluscan shell or the test of *Corella eumyota*. The colour is pale dirty brown and the surface of the thin test is divided by fine furrows into small rectangular plates. There may be some sand on the surface. A specimen of 7.5 mm has 21 oral tentacles, four of which are large, four medium, and the remainder small or very small. Slender atrial tentacles are numerous. In the most clearly seen dorsal tubercle the slit is a rounded V, but the tubercle is partially covered by a triangular flap arising from the anterior end of the dorsal lamina. There are three branchial folds on each side. The following is a typical arrangement of longitudinal bars:

right, dorsal lamina 1 (10) 3 (9) 2 (5) 2 endostyle
left, dorsal lamina 0 (10) 2 (10) 2 (5) 2 endostyle.

Up to six long stigmata lie in each mesh, crossed by parastigmatic transverse bars. The oesophagus is narrow and strongly curved, and the ovoid to barrel-shaped stomach has about 22 folds and a small hooked caecum. The intestine and rectum make a tight S-shaped loop ending in the anus which has several shallow lobes. Moderately numerous endocarps project from the body wall. The gonads are very characteristic of the species. On the right side, close to the endostyle, are two sausage-shaped ovaries, the posterior one of

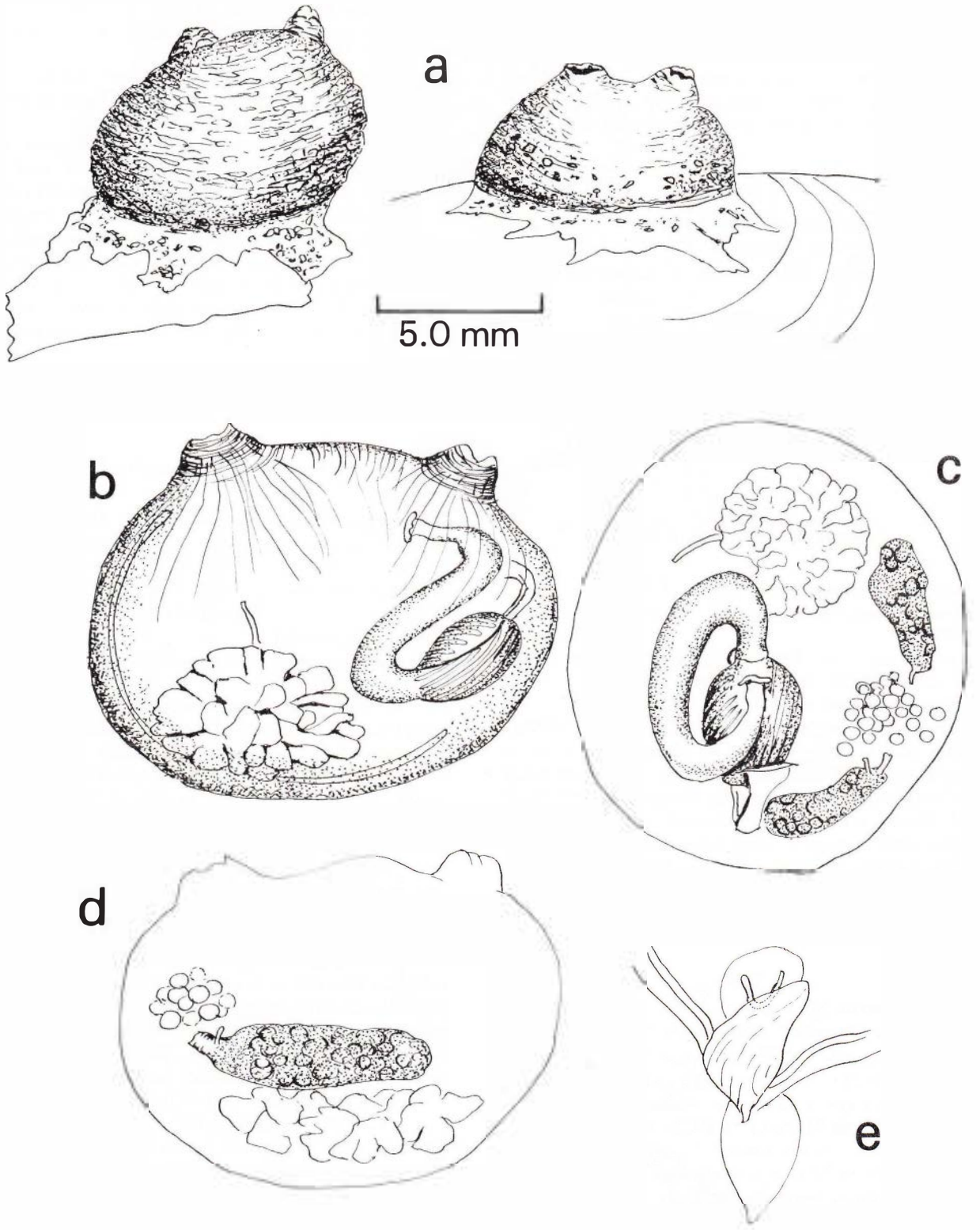

FIG. 36. *Oligocarpa megalorchis* Hartmeyer: *a*, zooids; *b*, zooid, with test removed, from left side; *c*, zooid, with test removed, from ventral side; *d*, zooid, with test removed, from right side; *e*, dorsal tubercle.

which lies somewhat across the body and behind the oesophagus. This ovary appears to have a duct passing along one face and ending close to the opening of the oviduct; it resembles a sperm duct but no connection with any testicular tissue was seen. The more anterior of the two ovaries has its oviduct pointing back towards the oviduct of the posterior ovary. A single large mass of male follicles lies in the ventral part of the left side. A terminal sperm duct, which may show two divisions, projects from the testis. A mass of embryos lies in the peribranchial cavity between the two oviducts, but no fully developed larvae were present. Kott (1969a) deduced from the orientation of the oviducts that the species is viviparous, but at that time without direct evidence.

Cnemidocarpa Huntsman, 1912

Cnemidocarpa stewartensis Michaelsen, 1922 Fig. 37

Cnemidocarpa stewartensis Michaelsen, 1922: 435–440, figs 20, 21. Brewin, 1950a: 56–58; 1956b: 131; 1958a: 440.

MATERIAL EXAMINED: NZOI Stns A887 (6 specimens), B563 (1 specimen), C844 (1 specimen), G674 (1 specimen), G679 (1 specimen); University of Canterbury Stn ?K061V (1 specimen); Portobello Stn MU67–120 (many specimens).

PUBLISHED RECORDS, NEW ZEALAND: Chatham Rise (Brewin 1956b), Otago (Brewin 1950a), Stewart Island and Foveaux Strait (Michaelsen 1922, Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: The present specimens reach 2.5 cm in greatest diameter. They show the following characters, mostly conforming to existing accounts: ovoid somewhat flat-based shape; brown transversely wrinkled test, sometimes with many small glassy papillae or swellings; siphons quite close together; about 16 oral tentacles; numerous thread-like atrial tentacles spread over a wide zone; small scattered and not always numerous endocarps; basically C-shaped opening of dorsal tubercle; four branchial folds each side with 20–26 bars on folds and 3–6 between folds; about 36 unbroken stomachal folds; small hooked pyloric caecum; long convoluted intestine; lobed anus; two or three long sinuous gonads on each side.

Cnemidocarpa bicornuta (Sluiter, 1900) Fig. 38

Styela bicornuta Sluiter, 1900: 22–24, pl. 3 figs 6–8, pl. 4 fig. 2.
Cnemidocarpa bicornuta. Michaelsen, 1922: 440-445. Brewin, 1946: 117–119; 1948: 127; 1950a: 58; 1951: 104; 1952b: 187; 1956b: 122, 131; 1957: 577; 1958b: 455; 1960: 119.

MATERIAL EXAMINED: NZOI Stns B233 (1 specimen), B563 (12 specimens), D873 (1 specimen), G660 (3 specimens), G669 (5 specimens), G685 (2 specimens); Portobello Stn MU68–22 (several specimens).

PUBLISHED RECORDS, NEW ZEALAND: Bay of Islands (Brewin 1957), Hauraki Gulf (Brewin 1948, 1951, 1958b), Napier and Tauranga (Brewin 1952b), Cook Strait (Brewin 1960), French Pass (Sluiter 1900), Queen Charlotte Sound (Michaelsen 1922), Otago (Brewin 1946, 1950a), Christchurch (Brewin 1950b), Chatham Islands (Sluiter 1900, Brewin 1956b), Chatham Rise (Brewin 1956b), Stewart Island (Michaelsen 1922, Brewin 1958a),

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: Large specimens in the collection are about 7.5 cm long and some have an additional basal blade-like extension of the test. Externally the species is recognised by the position of the atrial siphon, far back along the dorsal margin, and by the longitudinal furrows which divide the test into numerous, mainly elongate, rectangular pads. Internally the specimens agree closely with the descriptions by Michaelsen (1922) and Brewin (1946). The right gonads are sometimes sharply bent back at their blind ends.

REMARKS: The name is often incorrectly spelled *bicornuata*.

Cnemidocarpa madagascariensis Hartmeyer var. **regalis** Michaelsen, 1922 Fig. 39

Cnemidocarpa madagascariensis Hartmeyer var. *regalis* Michaelsen, 1922: 430–435, figs 18, 19. Brewin, 1952a: 455–457.

MATERIAL EXAMINED: NZOI Stn B686 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: Three Kings Island (Michaelsen 1922), Otago (Brewin 1952a).

PUBLISHED RECORDS, ELSEWHERE: var. *regalis*, none; f. *typica*, Madagascar.

DESCRIPTION: The specimen is 5 cm long and about 2.8 cm dorso-ventrally. The oral siphon is terminal and the atrial siphon about the middle of the dorsal side. The test is tough and leathery and divided into numerous low swellings. Internally the structure agrees with the descriptions by Michaelsen (1922) and Brewin (1952a). There are about 28 oral tentacles, 12–14 bars between the branchial folds and 19–34 bars on the folds, a C-shaped opening of the dorsal tubercle, at least 30 undivided stomachal folds, no pyloric caecum, a simple S-shaped gut loop, faintly lobed triangular anus, five gonads on the left and nine on the right (one of which has three branches), and numerous small endocarps.

Cnemidocarpa nisiotis (Sluiter, 1900) Fig. 40

Styela nisiotis Sluiter, 1900: 21–22, pl. 3 figs 2–5.
Cnemidocarpa nisiotis. Michaelsen, 1922; 427–430. Brewin, 1950b: 349–350; 1950c: 354; 1951: 104; 1957: 577; 1958a: 440; 1960: 119.

MATERIAL EXAMINED: NZOI Stns B233 (3 specimens), D443 (1 specimen), E909 (2 specimens), ?E108 (2 specimens), ?F698 (1 specimen), Z2034 (5 specimens).

PUBLISHED RECORDS, NEW ZEALAND: Bay of Islands (Brewin 1957), Hauraki Gulf (Brewin 1951), Great Barrier Island (Brewin 1950c), Napier (Brewin 1952b), French Pass (Sluiter 1900), Queen Charlotte Sound (Michaelsen 1922), Cape Campbell, Nelson Harbour, Wellington (Brewin 1960), Christchurch (Brewin 1950b), Stewart Island (Brewin 1958a).

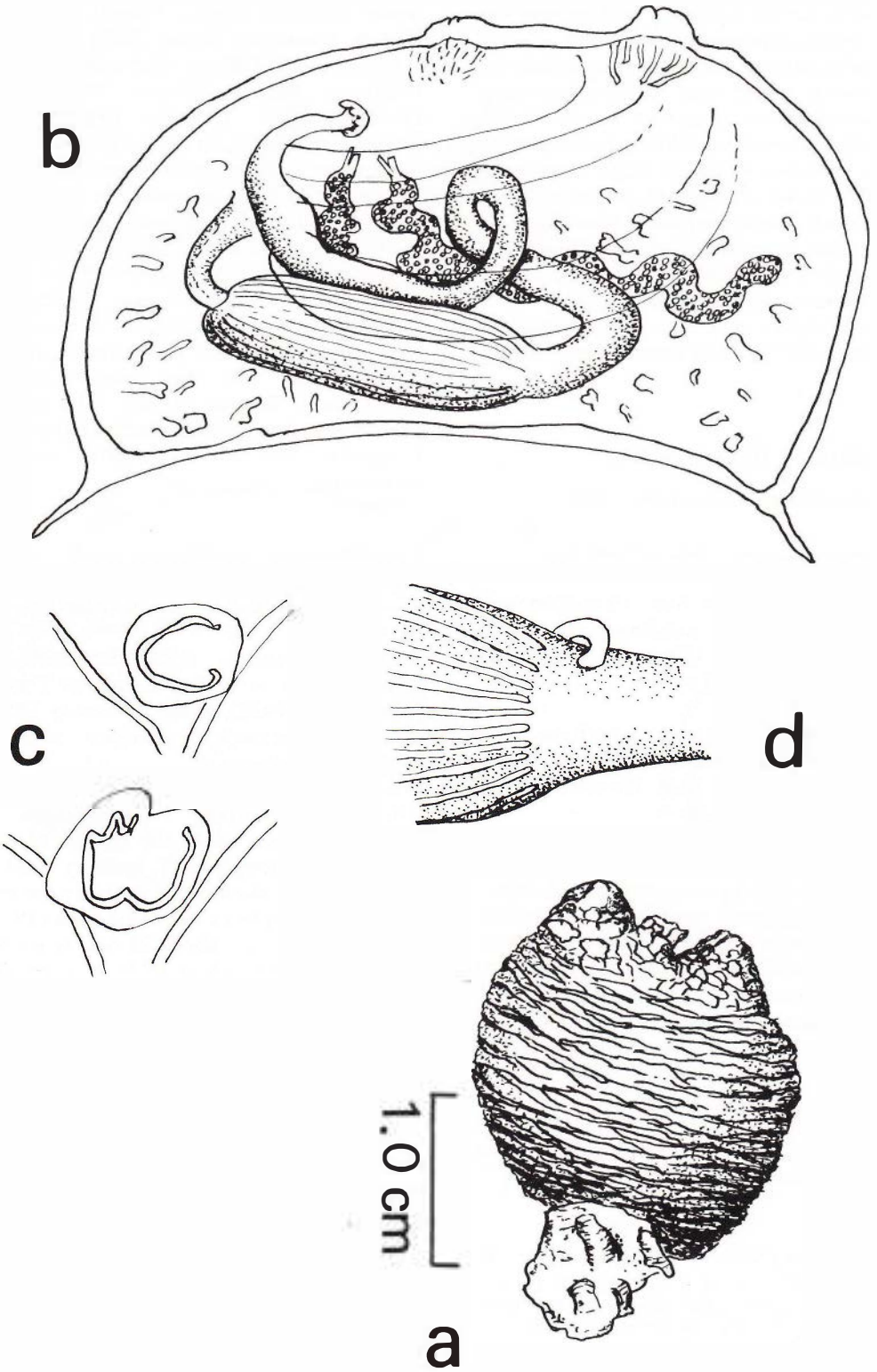

FIG. 37. *Cnemidocarpa stewartensis* Michaelsen: *a*, intact specimen; *b*, left half of body, to show gut, gonads and endocarps; *c*, dorsal tubercle; *d*, pyloric caecum.

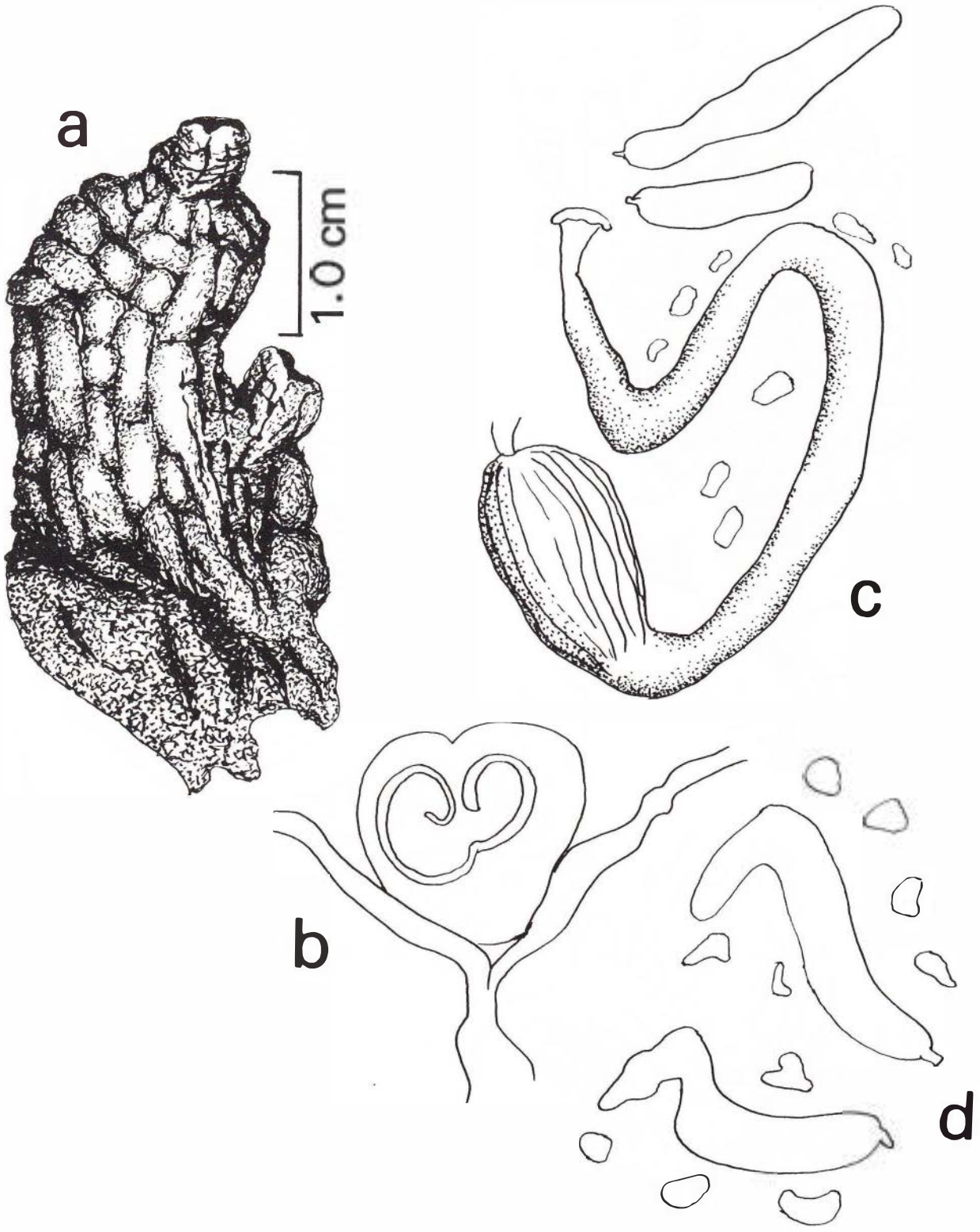

FIG. 38. *Cnemidocarpa bicornuta* (Sluiter): *a*, intact specimen; *b*, dorsal tubercle; *c*, gut, left gonads and endocarps; *d*, right gonads and endocarps.

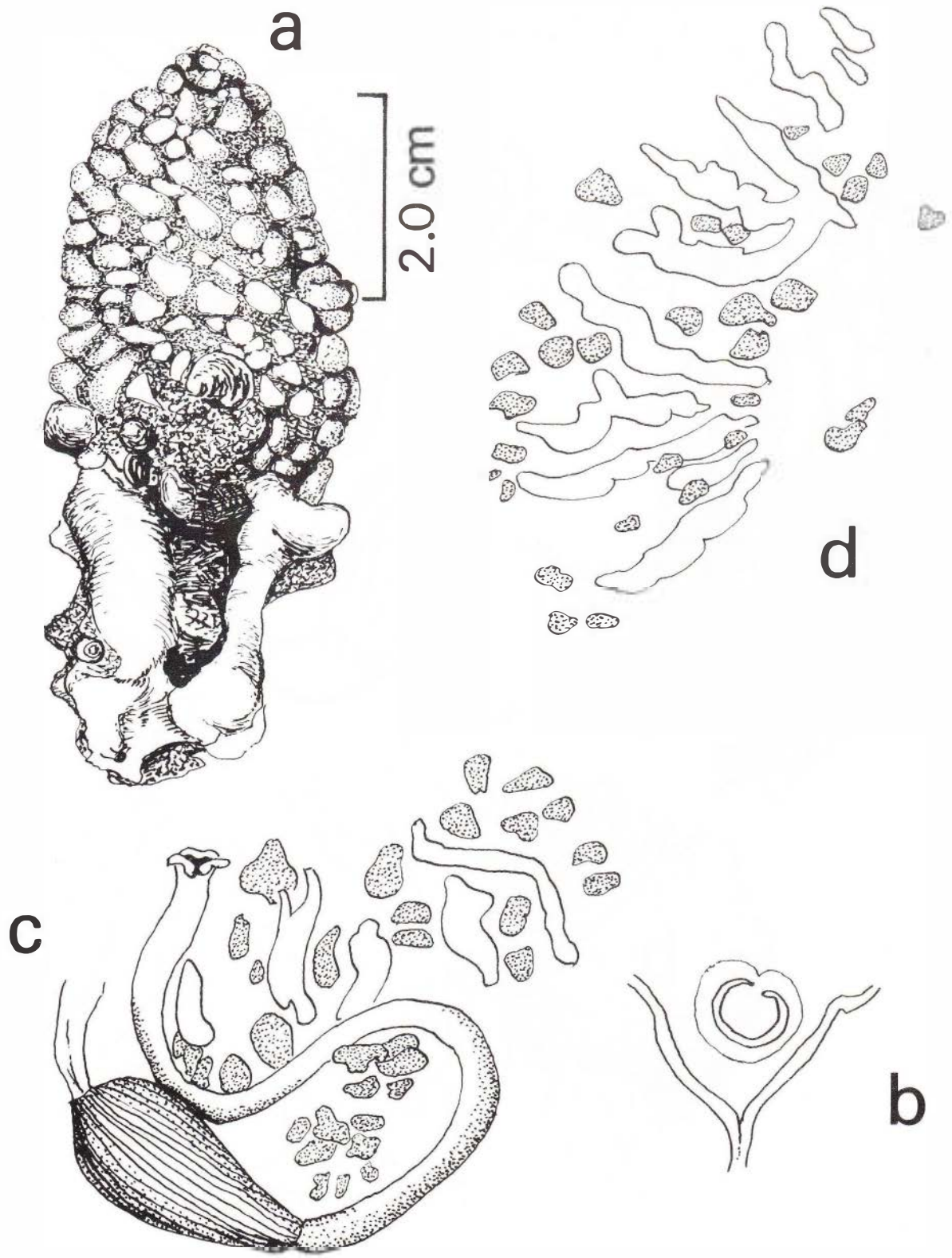

FIG. 39. *Cnemidocarpa madagascariensis* Hartmeyer var. *regalis* Michaelsen: *a*, intact specimen; *b*, dorsal tubercle; *c*, gut, left gonads and endocarps; *d*, right gonads and endocarps.

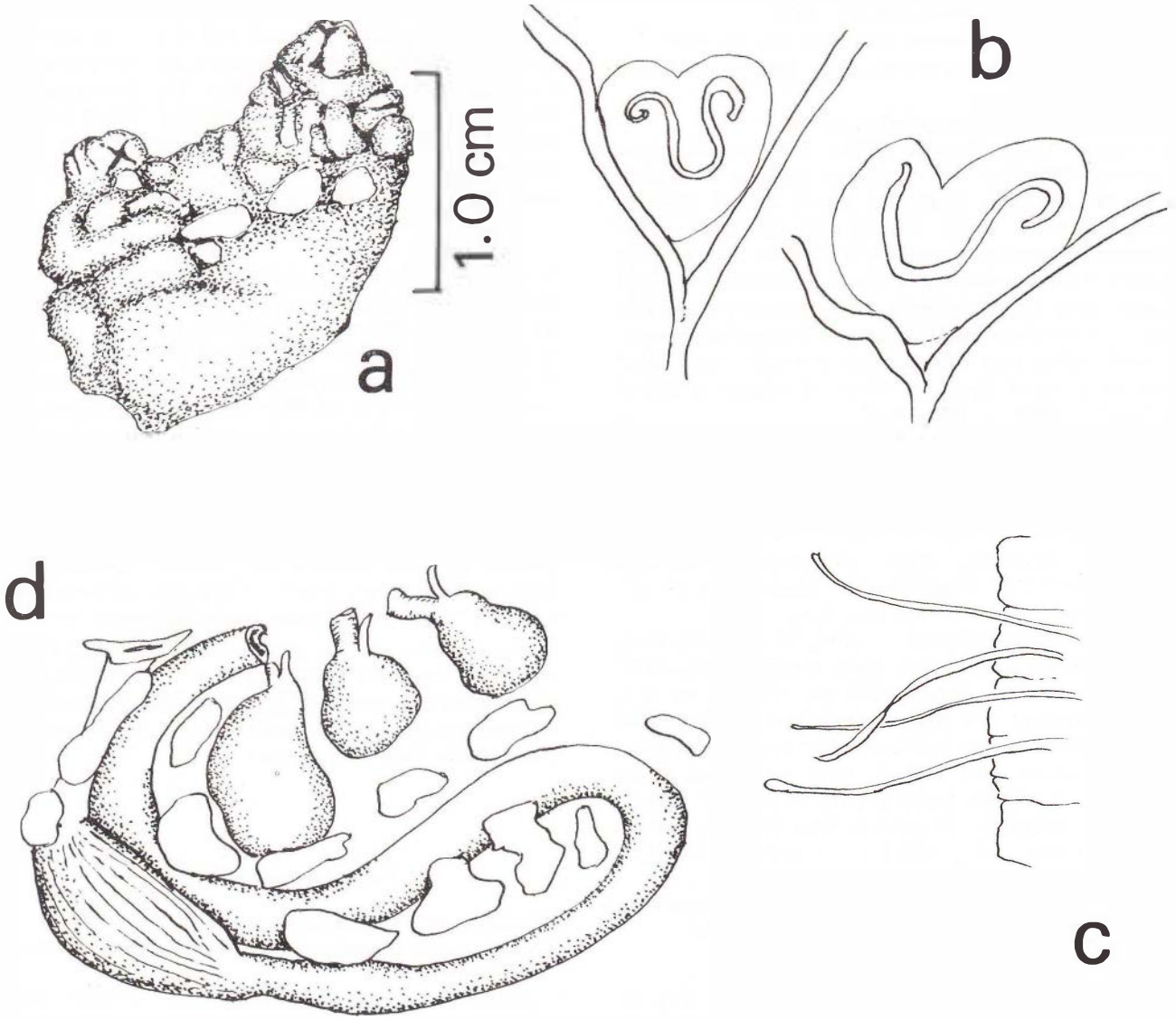

FIG. 40. *Cnemidocarpa nisiotis* (Sluiter): *a*, intact specimen; *b*, dorsal tubercle; *c*, atrial tentacles; *d*, gut, left gonads and endocarps.

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: The largest specimen in the collections is about 6 cm long. In most cases the body is somewhat convex on the lower side and concave on the upper side, with the oral siphon sometimes directed upwards and the atrial siphon situated more than half way back along the dorsal side. The surface of the test is irregularly wrinkled or divided into low swellings. There are generally 20–30 oral tentacles. The atrial tentacles are thread-like and arranged in a single circle at the base of the velum. The slit of the dorsal tubercle has one or both arms turned outwards. In a large specimen the following arrangement of longitudinal branchial bars was seen on one side:

dorsal line 14 (20) 11 (19) 10 (24) 5 (22) 6 endostyle.

The gut loop is narrowly open apically and closed at the level of the stomach. The anus has no lobes. The gonads vary in number, up to three or occasionally four on each side. They are usually rather short and thick flask-shaped bodies but are sometimes sausage-shaped. Characteristically endocarps are present only on the left side, grouped mainly around the gut, but one specimen in addition had a few small endocarps on the right.

REMARKS: The species is distinguished principally by the position of the atrial siphon, shape of the dorsal tubercle slit, smooth-edged anus, absence of endocarps on the right, and the shape of the gonads.

Cnemidocarpa otagoensis Brewin, 1952

Cnemidocarpa otagoensis Brewin, 1952a: 457–458, fig. 5A–D.

PUBLISHED RECORDS, NEW ZEALAND: Otago Peninsula (Brewin 1952a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1952a): Body ovoid, white to brown, wrinkled and leathery; siphons far apart; 28–32 filiform oral tentacles; slit of dorsal tubercle U-shaped with horns turned in or out; 12–23 longitudinal bars on branchial folds and six or seven between folds; oesophagus short; stomach long and narrow with 12–20 folds; narrow primary intestinal loop; rectum short and curved; endocarps numerous, on both sides; two long gonads per side, with short ducts near atrial opening; band of orange-coloured (storage?) tissue on body wall.

Cnemidocarpa novaezelandiae (Michaelsen, 1911)

Pyuropsis novaeselandiae Michaelsen, 1911: 113–118, figs 1, 2.
Cnemidocarpa novaezelandiae. Michaelsen, 1922: 425–427.

PUBLISHED RECORDS, NEW ZEALAND: Tauranga (Michaelsen 1922), Christchurch (Michaelsen 1911).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Michaelsen 1911, 1922): Body oval, smooth, white; siphons half body length apart; about 26 oral tentacles; dorsal tubercle with horse-shoe shaped opening; 3–8 longitudinal bars on branchial folds and three or four between folds; oesophagus long; stomach narrow and curved, with numerous folds; intestine and rectum forming narrow primary and V-shaped secondary loop; gonads flask-shaped, one on left, two (near and parallel to endostyle) on right; endocarps on left side only.

REMARKS: Michaelsen used the spelling *novaeselandiae* in 1911 but changed to *novaezelandiae* in 1922.

Cnemidocarpa rectofissura sp.n. Fig. 41

MATERIAL EXAMINED: NZOI Stn E236 (3 specimens).

HOLOTYPE: A specimen 7.5 mm tall in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H–269.

PARATYPES: NZOI, type number P–527, two specimens from same sample as holotype.

TYPE-LOCALITY: NZOI Stn E236b, near Macquarie Island, 54°59.7′S, 158°36.4′E, 174 m.

DESCRIPTION: The body is dome-shaped, either as tall as it is wide at the base or lower and flatter. The largest specimen has a basal width of 1.5 cm. The base is slightly expanded over the substratum. The siphons are small, only slightly projecting, and separated by a third to a half of the basal body diameter. The test is bare, pale ochre in colour, thin, and slightly roughened by minute ridges passing round the body. The body wall adheres closely to the test and is thin and transparent. Circular muscles are quite well developed on the siphons. Over the rest of the body wall there is a thin sheet of internal longitudinal muscles and one of external circular muscles. Endocarps are small, narrow-based and projecting. There are about 24 oral tentacles, quite widely spaced and of various sizes. The atrial tentacles are very numerous and are spread over a zone at the base of the siphon. The dorsal tubercle has a simple almost straight opening. There are four branchial folds on each side. The arrangement of the longitudinal branchial bars on the left side of one specimen is:

dorsal lamina 3 (20) 5 (15) 7 (24) 6 (12) 5 endostyle.

Slender parastigmatic transverse bars are present. The dorsal lamina is a plain-edged membrane, quite low at the anterior end and becoming taller towards the posterior end. The gut is confined to the posterior half of the body. The oesophagus is sharply curved and the stomach barrel-shaped with about 18 unbroken folds and a small hooked pyloric caecum. The intestine is bent back against the stomach and then forward to the short rectum, ending in a triangular lobed anus. A slight swelling is present in the intestine near its junction wih the stomach. One long sinuous gonad is present on each side, of the typical *Cnemidocarpa* - type, with the ovary and the testis lobes closely bound together. The long slender ducts end near the anus.

REMARKS: This species cannot be identified with any described from the waters of New Zealand, the Sub-antarctic or the Antarctic. It is best characterised by the body shape, the simple dorsal tubercle, the closely bent gut and the two long gonads.

Polycarpa Heller, 1877

Polycarpa pegasis Michaelsen, 1922

Polycarpa pegasis Michaelsen, 1922: 450–453, figs 25, 26. Brewin, 1958a: 450.

PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Michaelsen 1922, Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Michaelsen 1922, Brewin 1958a): Body 11–21 mm in diameter, roughly globular, coated with sand or broken shell; test fibrils may be present on base; 50–60 oral tentacles; slit of dorsal tubercle usually horse-shoe shaped with ends rolled outwards, but variable; four flattened branchial folds per side; total longitudinal bars to about 70 per side; intestinal loop widely open; 17 or 18 stomachal folds and no caecum; no endocarps; gonads in a narrow band of 2–4 rows on each side of endostyle; up to 45 gonads on right and 38 on left.

REMARKS: A record of the species from Tasmania (Kott 1954) is questioned by Brewin (1958a). *P. pegasis* has a number of similarities to the Australian species *P. tinctor* (Quoy and Gaimard), notably the sandy test, arrangement and degree of development of the branchial folds, the simple curvature of the gut, the arrangement of the gonads, and the habit of incubation. *P. tinctor* differs in the suppression of the

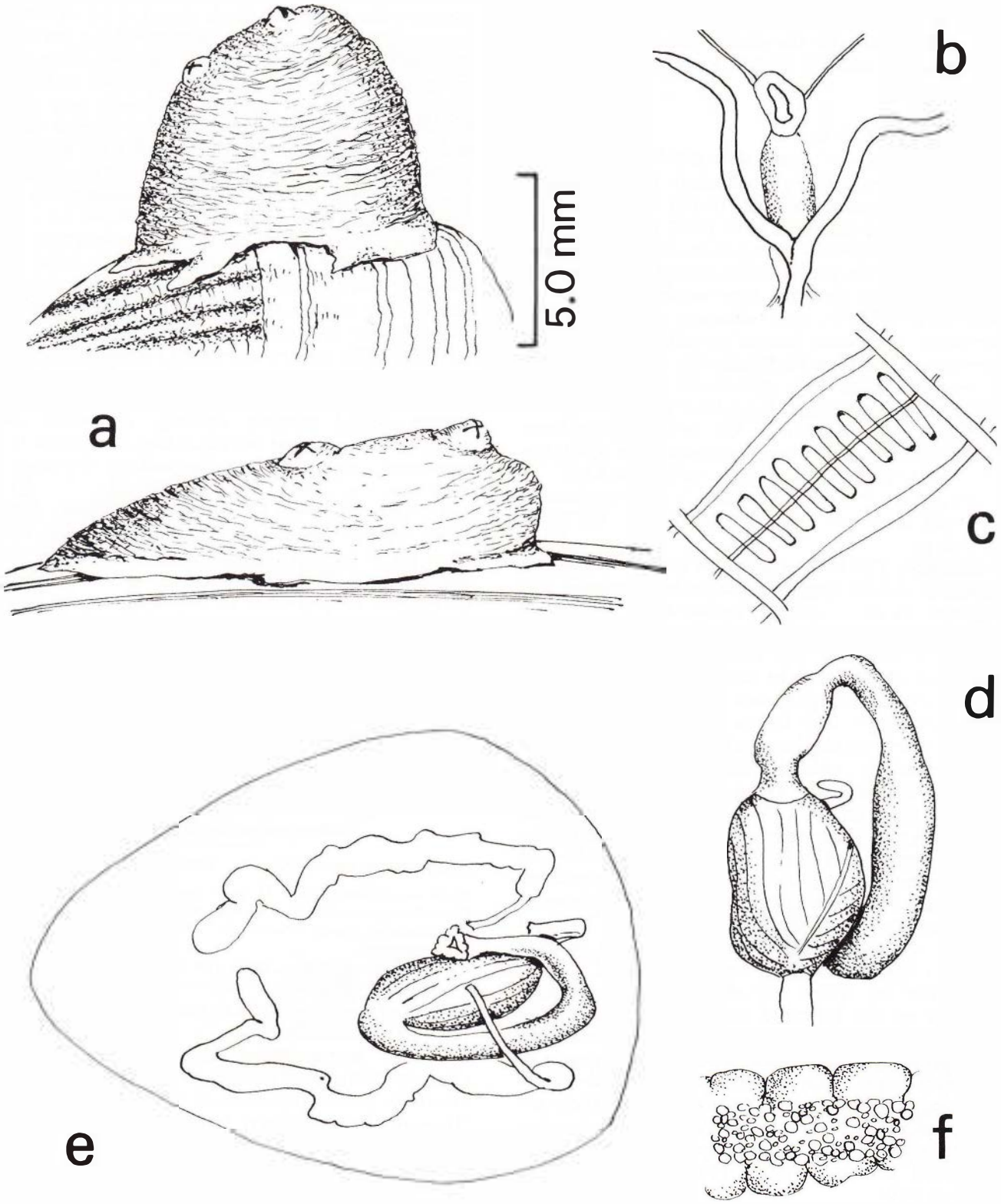

FIG. 41. *Cnemidocarpa rectofissura* sp.n.: *a*, intact specimens; *b*, dorsal tubercle; *c*, part of branchial sac; *d*, stomach and intestine, from below; *e*, gut and gonads, from above; *f*, part of a gonad.

larval phase, having instead direct development of oozooids within the parental atrial cavity.

A comparison with the closely related *P. zeteta* is given with the account of that species.

Polycarpa zeteta sp.n. Fig. 42

MATERIAL EXAMINED: NZOI Stns E134 (1 specimen), F99 (1 specimen), F109 (1 specimen); Portobello Stns MU68–26 (7 specimens), MU71–103 (2 specimens), MU71–266 (4 specimens), MU 74–92 (3 specimens).

HOLOTYPE: A specimen of maximum diameter 1.5 cm, in collection of the National Museum of New Zealand, Wellington, New Zealand, type number ASC 03.

PARATYPES: NMNZ, type numbers ASC 02, three specimens from same sample as holotype; ASC 01, three specimens from Portobello Stn MU74–92; ASC 04, two specimens from Portobello Stn MU71–103; ASC 13, seven specimens from Portobello Stn MU68–26. NZOI, type numbers P–531, one specimen from NZOI Stn E134; P–532, one specimen from NZOI Stn F99; P–533, one specimen from NZOI Stn F109.

TYPE-LOCALITY: Portobello Stn MU71–266, continental slope east of Otago, South Island, 45°45′S, 171°06′E, 620–540 m.

DESCRIPTION: The body is generally ovoid with the axis horizontal and the upper part somewhat narrowed, but some specimens are upright. The small conical siphons are less than one third of the body diameter apart. Most specimens have fine test fibrils developed over the lower part of the body; in some there are, instead, a few stouter root-like processes. Large specimens reach 2.3 cm in length and 1.6 cm in height. The whole surface, except on the siphons, is coated with sand. The body, however, remains flexible. Most specimens appear to have rested on a loose substratum, although a few had been attached to broken shell. The test is rather thin and is impregnated with sand grains. On the delicate transparent body wall circular muscles are more or less confined to the siphons, and numerous thin longitudinal muscles radiate from the siphons to about half-way down the sides of the body. The oral tentacles alternate in size and usually number 24–30; a specimen of 8 mm diameter has 12 and one of 1.75 cm height has 40. There are about 60 filiform atrial tentacles on the indented margin of a velum. The opening of the dorsal tubercle is a variable but relatively simple curved slit. The dorsal lamina is of moderate height. The internal longitudinal branchial bars number 51–107 in specimens examined. There are four branchial folds on each side, and the arrangement of longitudinal bars in a large specimen is:

dorsal lamina 3 (12) 5 (20) 7 (22) 7 (18) 11 endostyle.

About three stigmata are present in each mesh, in the areas between folds. The whole gut makes an unusually simple, widely open loop. The oesophagus is short and slightly curved. The stomach is short and ovoid to barrel-shaped, with 14–19 unbroken folds on the walls, and a very short straight caecum. The intestine and rectum make a gentle S-bend, ending in the anus which has two lips each with a number of small shallow lobes. No endocarps were found on the right side of the body; on the left there are up to 11 small sac-like endocarps, some of which are opposite the lower part of the intestinal loop. Gonads occupy a zone on each side of the endostyle. The numbers counted in a few specimens were: 18 (right), 12 (left); 13, 8; 16, 10; 14, 10; 10, 8; 16, 14; 4, 2; 5, 5; 6, 3. Sometimes one of the left gonads lies within the lower part of the intestinal loop. The gonads are ovoid and of the usual *Polycarpa* type, with a central tubular ovary and lateral slightly lobed male follicles. The follicles number 4–10 on each side of a gonad. The oviduct and sperm duct are terminal and short. Larvae are present in the atrial cavity.

REMARKS: The species resembles *Polycarpa pegasis* in its coating of sand, arrangement of gonads, and shape of the gut. It differs in its less numerous oral tentacles, simpler dorsal tubercle opening, somewhat more numerous longitudinal branchial bars (at least in large specimens), and notably smaller number of gonads on each side.

All specimens were taken from considerably deeper water than *P. pegasis* (99–710 m compared to about 45 m for *P. pegasis*). These shallow and deep water populations, distinguished by a set of structural characters, are regarded as belonging to two species related by a common ancestry. It is possible, however, that more specimens, including some from intermediate depths, would indicate that the populations show merely the extremes of a continuous variation related to depth, in which case a single variable species *P. pegasis* would be indicated.

Asterocarpa Brewin, 1946

Asterocarpa cerea (Sluiter, 1900) Figs 43, 44

Styela cerea Sluiter, 1900: 24, pl. 3 figs 9–11.
Cnemidocarpa aucklandica Bovien, 1921: 38–40.
Cnemidocarpa cerea. Michaelsen, 1922: 417–425 (for further synonymy).
Asterocarpa cerea. Brewin, 1946: 114–117 (for further synonymy); 1948: 124–125. Kott, 1952: 227–228. (for further synonymy).

MATERIAL EXAMINED: NZOI Stns B223 (1 specimen), ?D173 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1948), D'Urville Island (Sluiter 1900), Queen Charlotte Sound (Michaelsen 1922), Otago Harbour (Brewin 1946), Stewart Island (Michaelsen 1922), Auckland Island (Bovien 1921).

PUBLISHED RECORDS, ELSEWHERE: Southern Australia and possibly South Africa and Malayan Archipelago.

DESCRIPTION: The specimen from Station B223, which is definitely identified as *Asterocarpa cerea,* is 1.8 by 1.8 cm in diameter, and of a grey translucent appearance, with a tough but flexible test to which a number of small pebbles adhere. The siphons, both on

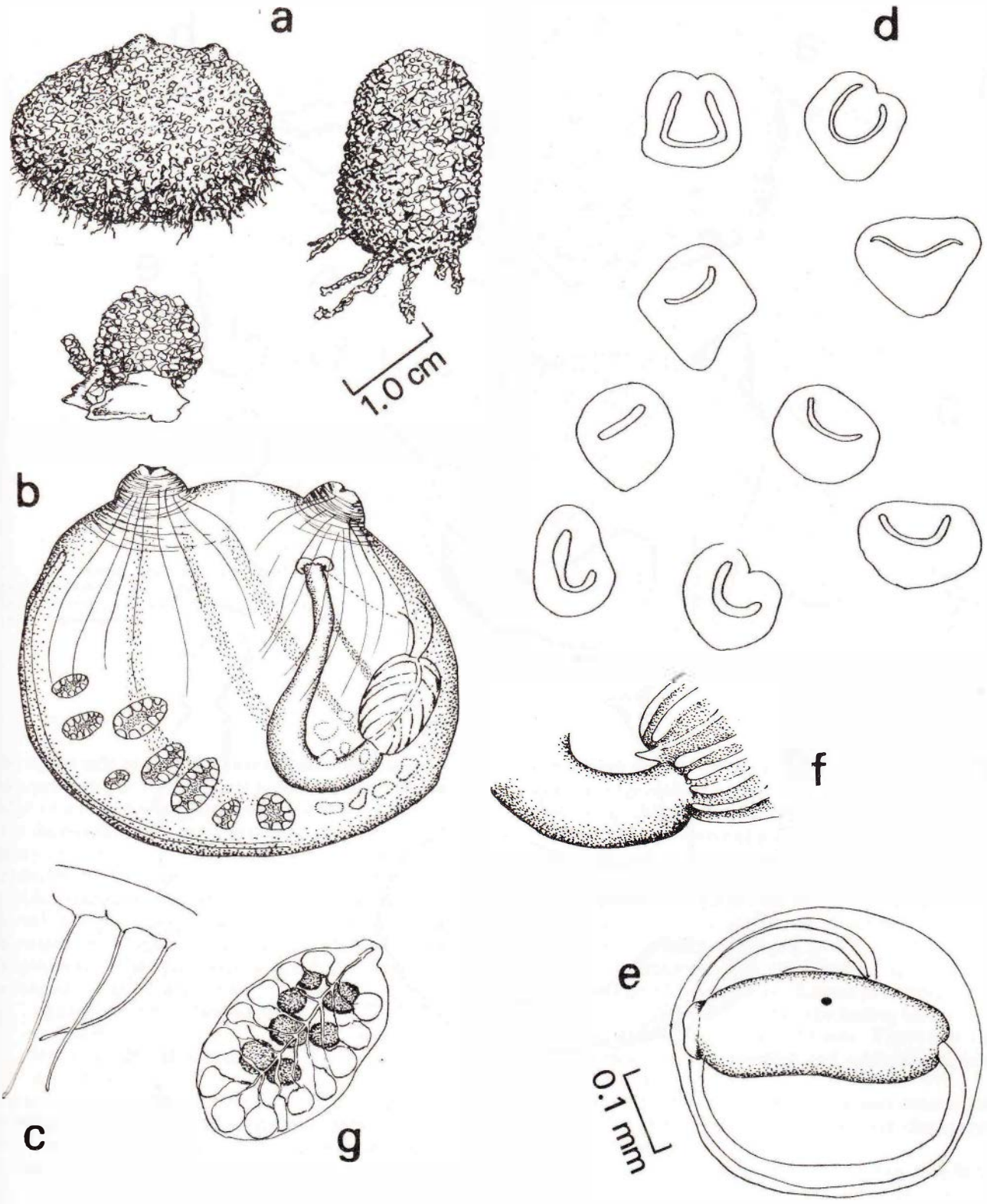

FIG. 42. *Polycarpa zeteta* sp.n.: *a*, intact specimens; *b*, specimen with test removed, from left side; *c*, atrial tentacles; *d*, dorsal tubercle; *e*, larva; *f*, pyloric caecum; *g*, gonad.

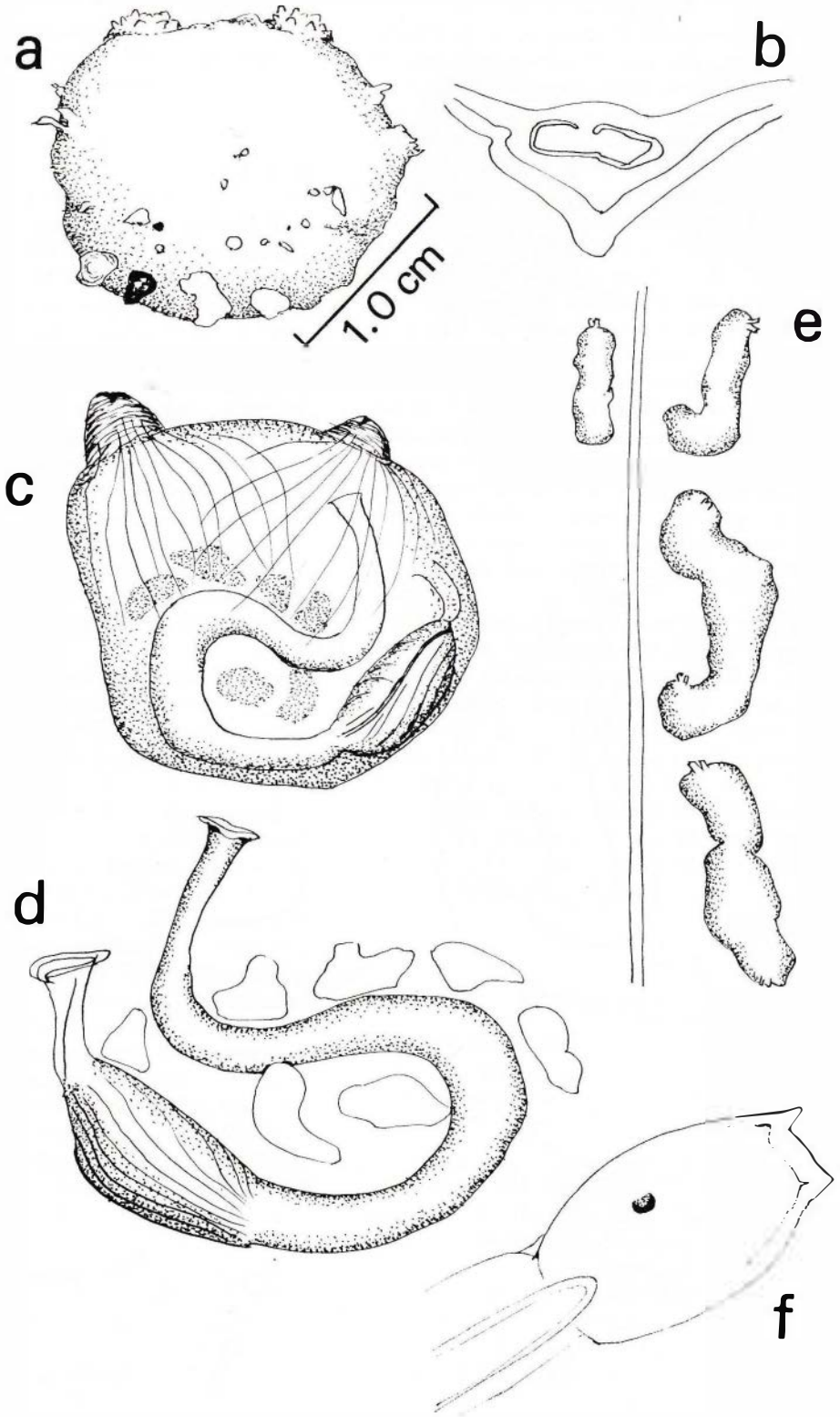

FIG. 43. *Asterocarpa cerea* (Sluiter): *a*, intact specimen; *b*, dorsal tubercle; *c*, specimen with test removed, from left side; *d*, gut and endocarps; *e*, gonads and endostyle; *f*, trunk of larva.

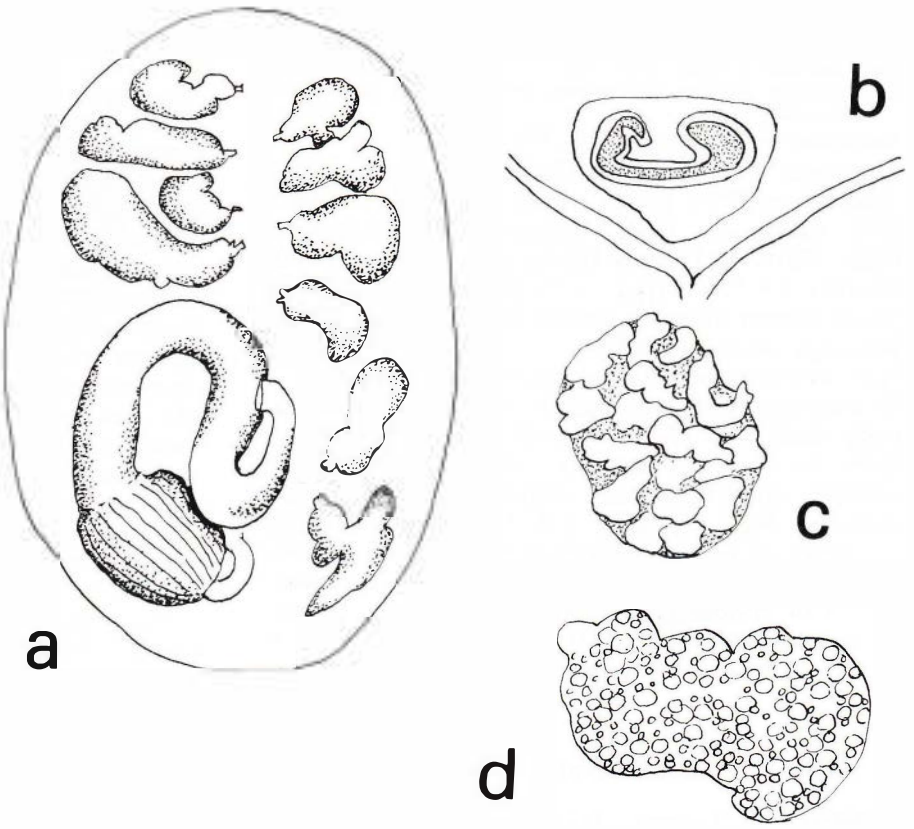

FIG. 44. ?*Asterocarpa cerea* (Sluiter): *a*, specimen with test removed, from below; *b*, dorsal tubercle; *c*, gonad, showing testis; *d*, gonad, showing ovary.

the upper side of the body, are covered with small wart-like projections. Sixteen oral tentacles arising from the edge of a flange were counted but, as part of the siphon was damaged, more were probably present. There are many rather short, broadly based filiform atrial tentacles on the edge of a velum. The dorsal tubercle is a wide triangular pad with a broad C-shaped slit. The dorsal lamina, low at the anterior end, gradually increases in height towards the posterior end. The longitudinal branchial bars are tall flat membranes, arranged on the folds thus:

right side, dorsal lamina 0 (8) 2 (8) 2 (7) 2 (7) 2 endostyle

left side, dorsal lamina 0 (7) 2 (7) 2 (7) 2 (7) 2 endostyle.

Up to 10 or sometimes 15 stigmata occupy the branchial meshes, crossed by parastigmatic bars. About 22 stomachal folds are present but no caecum. The intestine and rectum make a wide S-shaped loop ending in a plain two-lipped anus. Large endocarps are arranged around and within the gut loop on the left side, but none are found on the right side. Gonads are confined to the ventral part of the body, and lie close, and more or less parallel, to the endostyle. They tend to occur in pairs with the individual gonads fused at their blind ends and the ducts at the opposite ends. Five gonads are present on the right and one on the left side. The arrangement of male and female elements was obscure in this specimen, but there appeared to be a tubular ovary occupying most of the gonad and small male follicles on both parietal and mesial faces and scattered through the ovarian tissue. The common sperm duct lies on the mesial face. Brewin (1946), who examined numerous specimens, described the gonads as characteristically arranged in star-shaped clusters and the arrangement in the present specimen is a simplification of that pattern. Larvae are present in the atrial cavity. Typically the tail (including test) is about 1 mm long and the trunk 0.23 mm. There are three small conical anterior papillae and a black cup-shaped ocellus, but no otolith.

REMARKS: The relationships of this and several other species and their possible synonymy are discussed by Brewin (1946).

The specimen from Station D173 (Fig. 44) is very doubtfully placed in this species. The external appearance, the test, oral tentacles, dorsal tubercle and branchial structure are similar, but the stomach is shorter and the gut differently curved. The gonads were not seen to be grouped, even in pairs, but their linear arrangement and ventral position were similar to those in the specimen from Station B223.

Asterocarpa coerulea (Quoy and Gaimard, 1834)

Ascidia coerulea Quoy and Gaimard, 1834: 611–612, pl. 91 figs 8, 9.
Styela coerulea. Cottrell, 1913: 168.
Cnemidocarpa coerulea. Michaelsen, 1922: 445–450 (for further synonymy).
Asterocarpa coerulea. Brewin, 1948; 125–127.

PUBLISHED RECORDS, NEW ZEALAND: North Cape (Michaelsen 1922), Bay of Islands (Quoy and Gaimard 1834, Michaelsen 1922), Slipper Island (Michaelsen 1922), Firth of Thames (Quoy and Gaimard 1834), Hauraki Gulf (Cottrell 1913; Brewin 1948, 1951), Great Barrier Island (Cottrell 1913, Brewin 1950c), Tauranga (Brewin 1952b).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Michaelsen 1922, Brewin 1948): Body dark blue above, whitish below, siphons far apart; 64–108 oral tentacles; slit of dorsal tubercle variable, often horse-shoe shaped; 3–13 longitudinal branchial bars on folds, 2–4 bars between folds; stomach long, curved, with 16–20 folds and no caecum; primary intestinal loop narrow; rectum short; numerous small endocarps on both sides of body; gonads small, fused in clusters, 5–21 clusters on right, 6–11 on left; 1–18 gonads and gonoduct-pairs per cluster.

Styela Fleming, 1822

Styela plicata (Lesueur, 1823)

Ascidia plicata Lesueur, 1823: 5, pl. 3 fig. 6.
Styela plicata. Van Name, 1945: 295–298. Brewin, 1948: 127–129; 1958b: 455. Kott, 1952: 216–217 (for synonymy).

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1948, 1958b).
PUBLISHED RECORDS, ELSEWHERE: Eastern, southern and western Australia; Indonesia, Japan; warm areas of Pacific Ocean, Indian Ocean and western Atlantic Ocean; Mediterranean.
DESCRIPTION (from various published records): Body ovoid, convex ventrally, dull white, surface with 6–8 low irregular longitudinal folds; oral siphon terminal, atrial siphon a little way back; 26–42 oral tentacles; slit of dorsal tubercle C-shaped with inrolled horns; 12–32 longitudinal branchial bars on folds, 4–8 between folds; oesophagus long; stomach wide, with 27–34 folds; primary intestinal loop fairly narrow, secondary loop V-shaped; endocarps very small and numerous, on both sides of body and on intestine; gonads long and narrow, 4–7 on right, two on left separated by apex of intestinal loop.

Styela gracilocarpa sp.n. Fig. 45

MATERIAL EXAMINED: NZOI Stns F103 (2 specimens), F108 (1 specimen), F110 (1 specimen).
HOLOTYPE: A specimen in collection of the New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H–271.
PARATYPES: NZOI, type number P–534, two specimens from NZOI Stn F103; P–535, one specimen from NZOI Stn F110.
TYPE-LOCALITY: NZOI Stn F108, south-east of South Island, 48°19′S, 171°59′E, 1108 m.
DESCRIPTION: The holotype is 2.0 cm in height, 2.5 cm in antero-posterior length and 2.3 cm wide. The other specimens differ in proportions but are approximately the same size as the holotype. The shape varies from ovoid to roughly conical with a flat basal area of attachment. The siphons, one third to a half of the body length apart, project a little, and are four-lobed. Small furrows divide the test into platelets, and the suface is covered with a thin layer of grey ooze. The test is rather thin and flexible. The body wall is thin and nearly transparent and has a generally distributed meshwork of fine muscle strands. About 16 slender oral tentacles are present, some six of which are large and the remainder quite small. The numerous thread-like atrial tentacles, although appearing to be scattered over a zone at the base of the siphon, are in fact arranged in two or three circles. The dorsal tubercle is small, with a simple U-shaped or crescentic opening. In the specimen from Station F110 the oral siphon back as far as the tentacles is lined with many small polyzoans. Endoproct polyzoans were found by Brewin (1960) in the same position in a few specimens of *Pyura pulla* (Sluiter) and *Cnemidocarpa nisiotis* (Sluiter) from the Cook Strait region. The dorsal lamina is a plain-edged membrane increasing in height gradually towards the posterior end. There are four branchial folds on each side, with the following arrangement on the right side of the holotype:

dorsal lamina 5 (20) 4 (14) 7 (16) 7 (12) 3 endostyle.

In the spaces between folds there are generally about five stigmata per mesh. Parastigmatic transverse bars cross the meshes, usually one but sometimes three to each mesh. Endocarps are small and scattered over the inner body wall. The oesophagus is curved, and the stomach spindle-shaped with about 25 folds and a small curved caecum. The intestine is S-shaped and the rectum straight, ending in an anus which is triangular, each side having about four small lobes. One long narrow sinuous ovary is present on each side. The male follicles are arranged in one or a few groups round the end of each ovary. The oviduct has a lobed opening and close to it is the short projecting terminal part of the sperm duct.
REMARKS: The species agrees with none described from New Zealand or southern waters. It is closest in structure to *Styela milleri* Ritter, a species recorded from deep water in the eastern Pacific Ocean. The new species has many fewer longitudinal branchial bars in animals of similar size. Incidentally Ritter (1907), and Van Name (1945) quoting Ritter, give the body length as 22 cm, which is obviously a misprint for 2.2 cm.

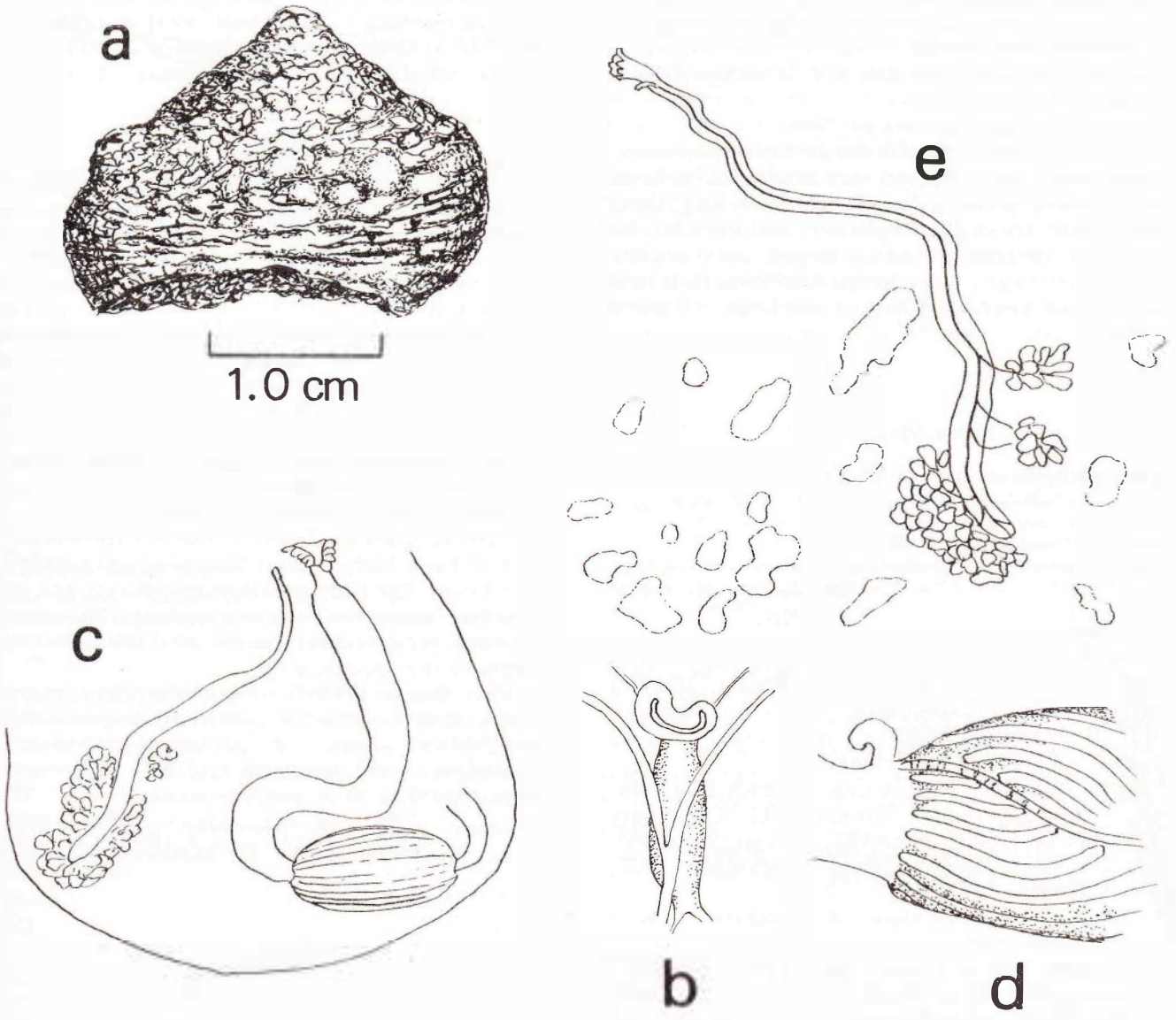

FIG. 45. *Styela gracilocarpa* sp.n.: *a*, intact specimen; *b*, dorsal tubercle and ganglion; *c*, gut and left gonad; *d*, pyloric caecum; *e*, right gonad and endocarps.

Family PYURIDAE Hartmeyer, 1908

Microcosmus Heller, 1877

Microcosmus australis Herdman, 1899

Microcosmus australis Herdman, 1899: 23–25, pl. Cyn. 5 figs 1–6. Millar, 1963: 741–742; 1966: 373. Kott, 1972c: 53; 1976: 85.
Microcosmus claudicans var. *australis* Kott, 1952: 288–289.
Microcosmus claudicans Croxall, 1972: 183. Kott, 1964: 143.
Microcosmus kura Brewin, 1948: 136–138; 1957: 578.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1948), North Auckland (Brewin 1957).

PUBLISHED RECORDS, ELSEWHERE: Western, southern, eastern and northern Australia.

DESCRIPTION (from Brewin 1948): Body rounded, dull red, leathery, overgrown by attached organisms when old; siphonal spines 13–21 μm long; siphonal linings with small filiform projections; 16–20 oral tentacles with three or four orders of branching; slit of dorsal tubercle horseshoe-shaped with twice inrolled horns; 7–9 branchial folds per side (ventral fold incomplete); 4–24 longitudinal bars on folds, 1–3 bars between folds; gut loop extends most of body length; primary loop open only at anterior end; hepatic caeca in one or two lobes; one gonad per side, each of 2–5 masses arranged along axial gonoducts; left gonad partially in primary, partially in secondary intestinal loop.

Microcosmus hirsutus Sluiter, 1900 Fig. 46

Microcosmus hirsutus Sluiter, 1900: 30, pl. 4 fig. 5, pl. 6 fig. 3. Michaelsen, 1922: 409–412.

PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands (Sluiter 1900).

PUBLISHED RECORDS, ELSEWHERE: None.

MATERIAL EXAMINED: NZOI Stn D882 (1 specimen).

DESCRIPTION: Body covered with sand, etc.; siphonal spines curved, pointed, about 120–160 μm long; about 18 bipinnate (or slightly tripinnate) oral tentacles; slit of dorsal tubercle horseshoe-shaped with inrolled horns; seven large (+ one incomplete?) branchial folds per side; gut loop rather narrow; one large oval gonad per side.

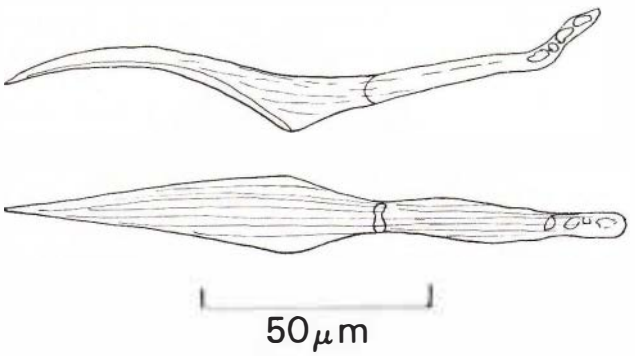

FIG. 46. *Microcosmus hirsutus* Sluiter: siphonal spine viewed from two directions.

Pyura Molina, 1782

Pyura pachydermatina (Herdman, 1881)

Boltenia pachydermatina Herdman, 1881: 81; 1882: 89–90, pl. 7 figs 6–8; 1899: 16–17. Watt, 1892: 334–48, pls 31–34.

Boltenia pedunculata Hutton, 1873: 105.

Pyura pachydermatina. Michaelsen, 1922: 389–399. Brewin, 1946: 125–128; 1950b: 345; 1958a: 440; 1960: 120. Kott, 1952: 262–266 (for further synonymy and discussion); 1972b: 187 (for discussion).

MATERIAL EXAMINED: NZOI Stns B215 (10 specimens), B250 (4 specimens), B255 (3 specimens), B256 (1 specimen), B258 (10 specimens), B264 (10 specimens), D127 (1 specimen), G656 (3 specimens), G657 (2 specimens), G694 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: French Pass (Brewin 1960), Christchurch (Brewin 1950), Canterbury (Herdman 1882, Michaelsen 1922), Otago (Watt 1892, Brewin 1946), Stewart Island (Michaelsen 1922, Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: Australia (but *see* Kott 1972b for discussion).

DESCRIPTION: This well-known species (the "sea tulip" or "sea apple") has an ovate, leathery, longitudinally grooved, pinkish-white body and a much longer stalk sometimes reaching nearly a metre in length; 12–20 much-branched oral tentacles; and six branchial folds per side.

REMARKS: This species is more completely described in the literature listed above. According to Brewin (1952b) it appears to be confined to the South Island. The related species *P. spinosissima* Michaelsen and *P. lutea* (Sluiter) replace it in the North Island and Chatham Islands respectively.

Several forms, varieties or subspecies have been proposed (*see* Michaelsen 1922; Kott 1952, 1972b), but their validity, geographical distribution and characters are still doubtful.

Pyura lutea (Sluiter, 1900) Fig. 47

Cynthia lutea Sluiter, 1900: 26–27, pl. 4 fig. 3, pl. 5 figs 1–3.

Pyura chathamensis Brewin, 1956b: 130–131.

Pyura lutea. Croxall, 1972: 182.

MATERIAL EXAMINED: NZOI Stn C622 (2 specimens).

PUBLISHED RECORDS, NEW ZEALAND: Chatham Islands (Sluiter 1900, Brewin 1956b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: Only the larger of the two specimens is intact. It has a body about 1.5 cm long and a stalk of about 19 cm. The body is dark purple-brown, and has the surface raised into numerous swellings. The tissues are poorly preserved but there is no doubt about the identity of the specimens.

REMARKS: Brewin (1956b) discusses the relationship of this species to the other two stalked *Pyura* species from New Zealand waters – *P. pachydermatina* and *P. spinosissima* – and concludes that it is closer to *P. spinosissima* than to *P. pachydermatina.*

Brewin (1956b) in describing specimens from Waitangi as a new species, *P. chathamensis*, failed to

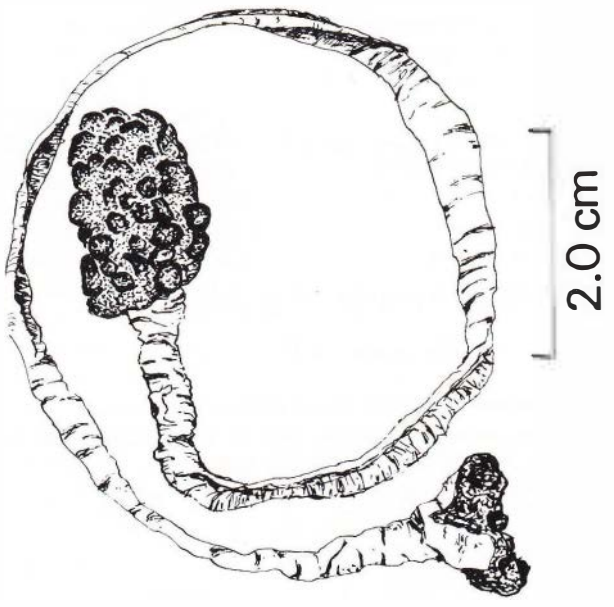

FIG. 47. *Pyura lutea* (Sluiter): intact specimen

mention *P. lutea* which Sluiter (1900) had created for a stalked *Pyura* from Red Cliff, Chatham Islands. Croxall (1972) noted that the descriptions have no significant differences and that *P. lutea* is the correct name.

Pyura spinosissima Michaelsen, 1922

Pyura pachydermatina var. spinosissima Michaelsen, 1922: 394–396.
Pyura spinosissima. Brewin, 1952b: 193–194 (mis-spelled *spinossissima*).

PUBLISHED RECORDS, NEW ZEALAND: Napier and Tokuma Bay (Brewin 1952b), Cape Kidnappers (Michaelsen 1922).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION: *See* Michaelsen 1922, Brewin 1952b.
REMARKS: The species differs from *P. pachydermatina* (Herdman) in the numerous, irregularly distributed tubercles which cover the body surface and in several internal characters (Brewin 1952b).

Pyura subuculata (Sluiter, 1900)

Cynthia subuculata Sluiter, 1900: 27–28, pl. 5 figs 4–7.
Pyura subuculata. Michaelsen, 1922: 406–409. Brewin, 1948: 129–131; 1950c: 354; 1951: 104; 1952b: 188; 1957: 578; 1958a: 440; 1960: 119.

PUBLISHED RECORDS, NEW ZEALAND: Cape Brett (Michaelsen 1922), North Auckland (Brewin 1957), Great Barrier Island (Brewin 1950c), Hauraki Gulf (Brewin 1948, 1951), Napier and Tauranga (Brewin 1952b), Cook Strait (Brewin 1960), French Pass (Sluiter 1900), Sumner (Sluiter 1900), Lyttelton (Michaelsen 1908), Stewart Island (Michaelsen 1922, Brewin 1958a).
PUBLISHED RECORDS, ELSEWHERE: South Australia (Kott 1952).
DESCRIPTION (from Michaelsen 1922, Brewin 1948): Body bare, yellowish grey, faintly wrinkled; siphons long; siphonal spines 10–14 μm long; 20–32 oral tentacles with three or four orders of branching; slit of dorsal tubercle variable, often horseshoe-shaped with inrolled horns; 7–9 branchial folds per side; 3–19 longitudinal bars on folds, 1–4 bars between folds; gut loop wide, occupying much of left side; gut diameter nearly uniform; hepatic caeca in several very small lobes and one large lobe; one long curved gonad per side (left one in gut loop) with numerous lobes.

Pyura suteri Michaelsen, 1908

Pyura subuculata var. *suteri* Michaelsen, 1908: 259, pl. 2 figs 22–24.
Pyura suteri. Brewin, 1950a: 60; 1950b: 345; 1952b: 188; 1956b: 122; 1958a: 440.
Pyura subuculata. Brewin, 1946: 119–121.

PUBLISHED RECORDS, NEW ZEALAND: Tauranga (Brewin 1952b), Christchurch (Michaelsen 1908, Brewin 1950b), Otago (Brewin 1946, 1950a), Stewart Island (Brewin 1958a), Chatham Islands (Brewin 1956b).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Brewin 1946, specimens described as *P. subuculata*; *see* Brewin 1948, p. 130): Body small, dull purple, finely wrinkled, bare; siphonal spines 33–55 μm long; 22–32 oral tentacles with short primary, and sometimes very short secondary, branches; slit of dorsal tubercle variable, usually horseshoe-shaped facing right, horns inrolled; seven branchial folds per side; 3–15 longitudinal bars on folds, 2–4 bars between folds; gut a wide D-shaped loop in posterior half of body, of nearly uniform diameter; hepatic cacea of five lobes; one long curved gonad per side (left one in gut loop) with numerous lobes.
REMARKS: *See* Brewin (1948) and Croxall (1972) regarding the former confusion of this species with *P. subuculata.*

Pyura rugata Brewin, 1948

Pyura rugata Brewin, 1948: 132–133, fig. 7, pl. 9 figs 4, 13B; 1957: 578; 1960: 120.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1948), Hokianga Harbour (Brewin 1957), Cook Strait (Brewin 1960).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Brewin 1948): Body orange-pink, rough and irregularly furrowed; siphonal spines 9–13 μm long; 21–39 oral tentacles with three or four orders of branching; slit of dorsal tubercle horseshoe-shaped with inrolled horns; seven branchial folds per side; 4–21 longitudinal bars on folds, 1–3 bars between folds; gut extends whole length of body, with wide loop; gut of nearly uniform diameter; hepatic caeca in one large and three small lobes; one long curved gonad per side (left one in gut loop) with numerous lobes.

Pyura picta Brewin, 1950 Fig. 48

Pyura picta Brewin, 1950a: 58–60, fig. 4; 1958a: 440.

MATERIAL EXAMINED: Portobello Stn MU67–119 (2 specimens).
PUBLISHED RECORDS, NEW ZEALAND: Otago coastal waters (Brewin 1950a), Stewart Island (Brewin 1958a).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION (from Brewin 1950a): Body pear-shaped, oral siphon terminal, atrial subterminal; surface bare with ridges in honeycomb pattern; siphonal spines about 11 μm long; 28–44 bipinnate oral tentacles; slit of dorsal tubercle variable, usually horse-shoe shaped with inrolled horns; seven complete branchial folds and usually an eighth incomplete (ventral) fold per side; 3–25 longitudinal bars on folds, 1–4 bars between folds; gut loop wide, in posterior half of body; gut of nearly uniform diameter; hepatic caeca in five lobes; one curved gonad on each side (left one in gut loop), with several lobes.
REMARKS: The specimens taken by Dr Batham off Otago conform to this description and clearly show the typical sculpturing of the surface.

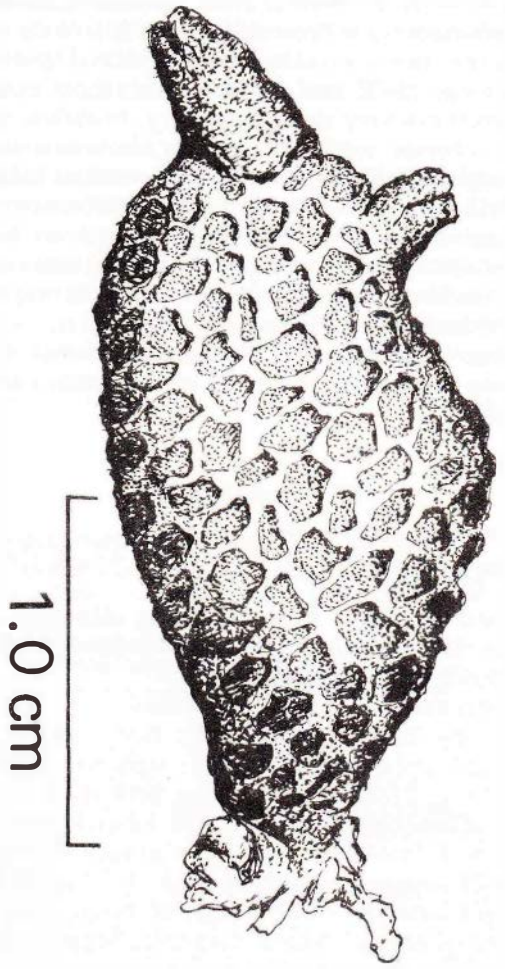

FIG. 48. *Pyura picta* Brewin: intact specimen.

Pyura carnea Brewin, 1948

Pyura carnea Brewin, 1948: 134–136, fig. 8, pl. 9 figs 6, 11, 13C; 1958a: 440.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1948), Foveaux Strait (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1948): Body usually sand-coated; test in two layers – outer thick, usually sand-impregnated, and inner thin – connected by strands, the two-layered structure continuing to ends of siphons (compare *P. cancellata*); siphonal spines 15–20 μm long; 20–32 oral tentacles with three or four orders of branching; slit of dorsal tubercle horse-shoe shaped with inrolled horns, or more complex; 8–10 (usually 9) branchial folds per side; 3–28 longitudinal bars on folds, 1–7 bars between folds; gut occupies much of left side; hepatic caeca in one large and a few small lobes; one long curved gonad on each side (left one in gut loop), consisting of several lobes.

Pyura cancellata Brewin, 1946

Pyura cancellata Brewin, 1946: 121–123, fig. 17, pl. 4 figs 6, 7, 12b; 1948: 134; 1950a: 60; 1950b: 345; 1951: 104; 1952b: 188; 1956b: 122; 1957: 578; 1958a: 440; 1960: 120. Kott, 1973: 254–255.

PUBLISHED RECORDS, NEW ZEALAND: Hauraki Gulf (Brewin 1948, 1951), Bay of Islands (Brewin 1957), Napier and Tauranga (Brewin 1952b), Cook Strait (Brewin 1960), Chatham Islands (Brewin 1956b), Christchurch (Brewin 1950b), Otago Peninsula (Brewin 1950a), Portobello Peninsula (Brewin 1946), Stewart Island (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: Southern Australia.

DESCRIPTION (from Brewin 1946): Body yellow-brown, smooth, leathery, rectangular with rampart-like extension of test round siphons; test in two layers (except on siphons and ramparts) – outer leathery and inner elastic – connected by strands; siphonal spines 20–26 μm long; 16–26 bipinnate oral tentacles; slit of dorsal tubercle variable; 6–8 (usually 7) branchial folds per side; 3–22 longitudinal bars on folds, 2–4 bars between folds; gut occupies much of left side, forming D-shaped loop; hepatic caeca in several lobes along stomach; one long curved gonad on each side (left one in gut loop), consisting of many lobes.

Pyura trita (Sluiter, 1900)

Cynthia trita Sluiter, 1900: 29–30, pl. 6 figs 1, 2.
Microcosmus hirsutus (part) Sluiter, 1900: 30 (*see* Michaelsen 1922).
Pyura trita. Michaelsen, 1922: 399–406, figs 10, 11. Brewin, 1950: 9–10; 1956b: 122; 1957: 578; 1958a: 440. Kott, 1954: 128–129.
Halocynthia carnleyensis Bovien, 1921: 36–37.

PUBLISHED RECORDS, NEW ZEALAND: Most authors have not distinguished between the forms *typica* and *crinita* established by Michaelsen (1922) and the following records refer simply to the species.

North Cape (Michaelsen 1922), Little Barrier Island (Michaelsen 1922), Rangitoto (Michaelsen 1922), Colville Channel (Michaelsen 1922) New Plymouth (Michaelsen 1922), Chatham Islands (Sluiter 1900), Stewart Island (Michaelsen 1922, Brewin 1958a) Auckland Islands (Bovien 1921, Brewin 1950d), Campbell Island (Bovien 1921).

PUBLISHED RECORDS, ELSEWHERE: Tasmania.

Pyura trita (Sluiter) f. **typica** Michaelsen, 1922 Fig. 49

Pyura trita f. *typica* Michaelsen, 1922: 399–406.

MATERIAL EXAMINED: NZOI Stns A887 (1 specimen), A891 (1 specimen), A892 (6 specimens), B218 (3 specimens), ?B272 (1 specimen), B540 (2 specimens), B548 (4 specimens), C439 (1 specimen), D121 (31 specimens), E107 (1 specimen), E113 (4 specimens), E114 (18 specimens), ?E809 (1 specimen), G660 (19 specimens); G669 (5 specimens), G674 (3 specimens), G680 (3 specimens), G685 (5 specimens), G689 (many specimens), G707 (many specimens), G879 (many specimens).

DESCRIPTION: The specimens range from 6 mm to 5.6 cm in length. In small animals the surface of the test is divided into irregular plates. Larger animals show

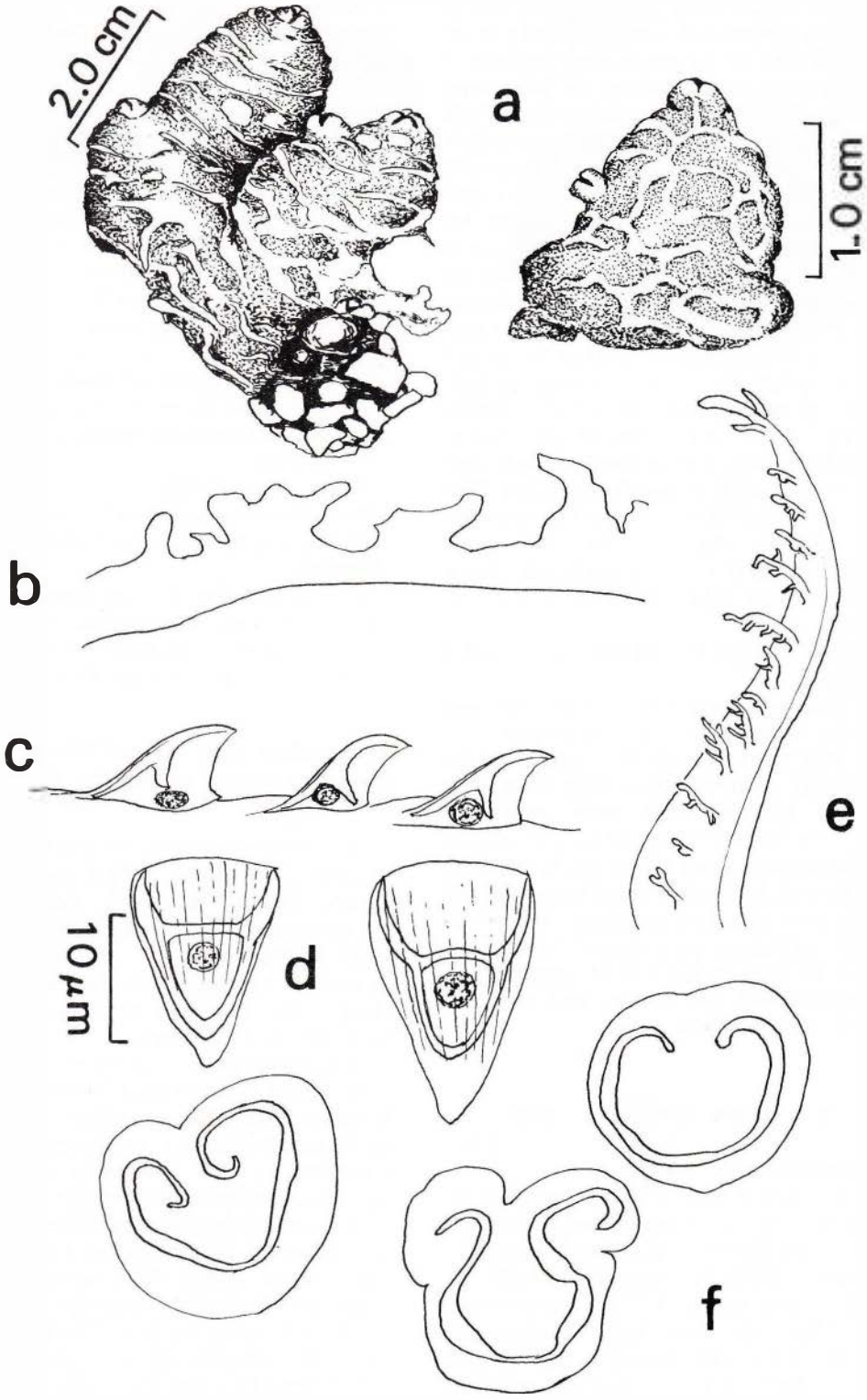

FIG. 49. *Pyura trita* (Sluiter) forma *typica* Michaelsen: *a*, two specimens from Stn D121 (left) and one from Stn A892; *b*, section through part of test; *c*, siphonal spines in side view; *d*, siphonal spines in surface view; *e*, oral tentacle; *f*, dorsal tubercle of three specimens.

characteristic narrow ridges, often passing partly round the body or obliquely placed and joining up to form an irregular network. Little or no encrusting material is generally present, except sometimes on the basal area of attachment where small stones and broken shell adhere to the test. Occasionally fine sand forms a thin layer on the general surface. Most specimens are ovoid and upright, with a more or less narrowed lower end which may be prolonged as a thick tongue of test by which attachment is made to broken shell, stone, or a group of pebbles. The colour varies from ochre to warm brown. The body wall muscles are strong sheets spreading from the siphons over the body, but less well developed and sometimes almost absent in the lower half. The siphonal spines are 20–40 μm long, wedge-shaped with the projecting end wide and nearly straight-edged. The 12–24 oral tentacles are widely spaced and thinly branched, having short primary and very short (sometimes absent) secondary branches. The dorsal tubercle has a C-shaped or U-shaped slit with the horns variously but only slightly coiled. The usual number of branchial folds is seven on each side, but a few specimens have eight folds on the right side. A typical arrangement is:

dorsal line 3 (16) 6 (17) 5 (17) 6 (19) 3 (21) 3 (12) 4 (10) 2 endostyle.

The dorsal languets, in a long row, are slender and closely spaced. The oesophagus is gently curved. The stomach is long and narrow, with the hepatic caeca more or less distinctly grouped into a long mass near the intestinal end and a small mass near the oesophageal end. The loop of the intestine and rectum is widely open. Numerous small lobes divide the anal margin. The left gonad, in the intestinal loop, and the right gonad, in a corresponding position, are of the usual *Pyura* type: numerous pear-shaped blocks are attached by a narrow stalk to the narrow axial part of the gonad accommodating the oviduct and common sperm duct, which end near the anus.

Pyura trita (Sluiter) f. **crinita** Michaelsen, 1922 Fig. 50

Pyura trita f. *crinita* Michaelsen, 1922: 399-406.

MATERIAL EXAMINED: NZOI Stns A887 (5 specimens), A916 (4 specimens), A917 (1 specimen), B223 (1 specimen), B233 (2 specimens), ?B272 (1 specimen), B568 (5 specimens), ?C958 (2 specimens), D121 (2 specimens), E412 (2 specimens), F77 (4 specimens).

DESCRIPTION: A large specimen has a maximum diameter of 3.9 cm. All specimens are thickly coated with sand, broken shell or small pebbles, and are irregularly ovoid in shape. The siphons are visible in only a few animals. The structure of the test is peculiar and characteristic. A thin inner layer in contact with the body wall gives rise to numerous thin processes which branch and fuse – particularly at their outer ends – to form an outer layer of test. The coating of sand, etc., is embedded amongst the test processes and in the outer test layer. The test therefore appears to consist of two layers – an outer sandy layer separated by test processes from an inner sand-less layer.

REMARKS: Despite the conspicuous difference in test structure f. *crinita* resembles f. *typica* in the size and shape of siphonal spines, the structure of oral tentacles, the dorsal tubercle, arrangement of branchial folds and shape of gut and gonads. Two other species have been described as having a test which is cancellous and separable into two layers: *P. cancellata* Brewin, 1946 and *P. carnea* Brewin, 1948. In *P. cancellata* the outer test layer does not enclose sand grains, and the presence of a "short rampart-like extension of test surrounding each aperture" (Brewin 1946) is a characteristic feature not found in *P. trita* f. *crinita*. *P. carnea* appears to be distinguished by its much more complex oral tentacles, which show three or four orders of branching.

Michaelsen (1922), in the original account of f. *crinita*, does not point out the two-layered nature of the test, but this nevertheless is the test structure which he describes.

It is remarkable that two species and a form of a third species of *Pyura*, all from the waters of New Zealand, have the same unusual test structure. If systematically distinct, they are at least closely related.

Pyura pilosa Monniot and Monniot, 1973 Fig. 51

Pyura pilsoa Monniot and Monniot, 1973: 722–725, fig. 2A.

Pyura jacatrensis (**non** Sluiter, 1890) Kott, 1954: 127. Millar, 1960: 125–126.

Pyura vittata (**non** Stimpson, 1852) Kott, 1969a: 138–139.

MATERIAL EXAMINED: NZOI Stns A695 (>100 specimens), A696 (1 specimen), A698 (1 specimen), C730 (16 specimens), E233 (1 specimen), E234 (1 specimen), E235 (7 specimens).

PUBLISHED RECORDS; NEW ZEALAND: Macquarie Island (Kott 1954, recorded as *P. jacatrensis*; Kott 1969a, recorded as *P. vittata*).

PUBLISHED RECORDS, ELSEWHERE: Kerguelen (Kott 1954, recorded as *P. jacatrensis*; Monniot and Monniot 1973; Monniot 1978), Marion Island (Millar 1960, recorded as *P. jacatrensis*), Crozet Island (Monniot 1978).

DESCRIPTION: All specimens in the collection are heavily coated with grit, broken shell or small pebbles, except on the siphons, which are relatively bare. Large specimens are about 4 cm in diameter, measured over the coat of debris. The siphons are wrinkled and covered with small sharp spines. Elsewhere spines were not found on the surface. The test is only moderately thick. The adhering debris is partially embedded in the test. Many of the specimens are attached by a large part of the side within the concavity of a dead bivalve shell. Numerous thin muscles radiate across the body from the bases of the siphons, which themselves have closely spaced circular muscles. The spines lining the siphons are 80–200 μm long, and sharply pointed. The oral tentacles, generally numbering about 18, are once pinnate with, occasionally, only traces of a few small

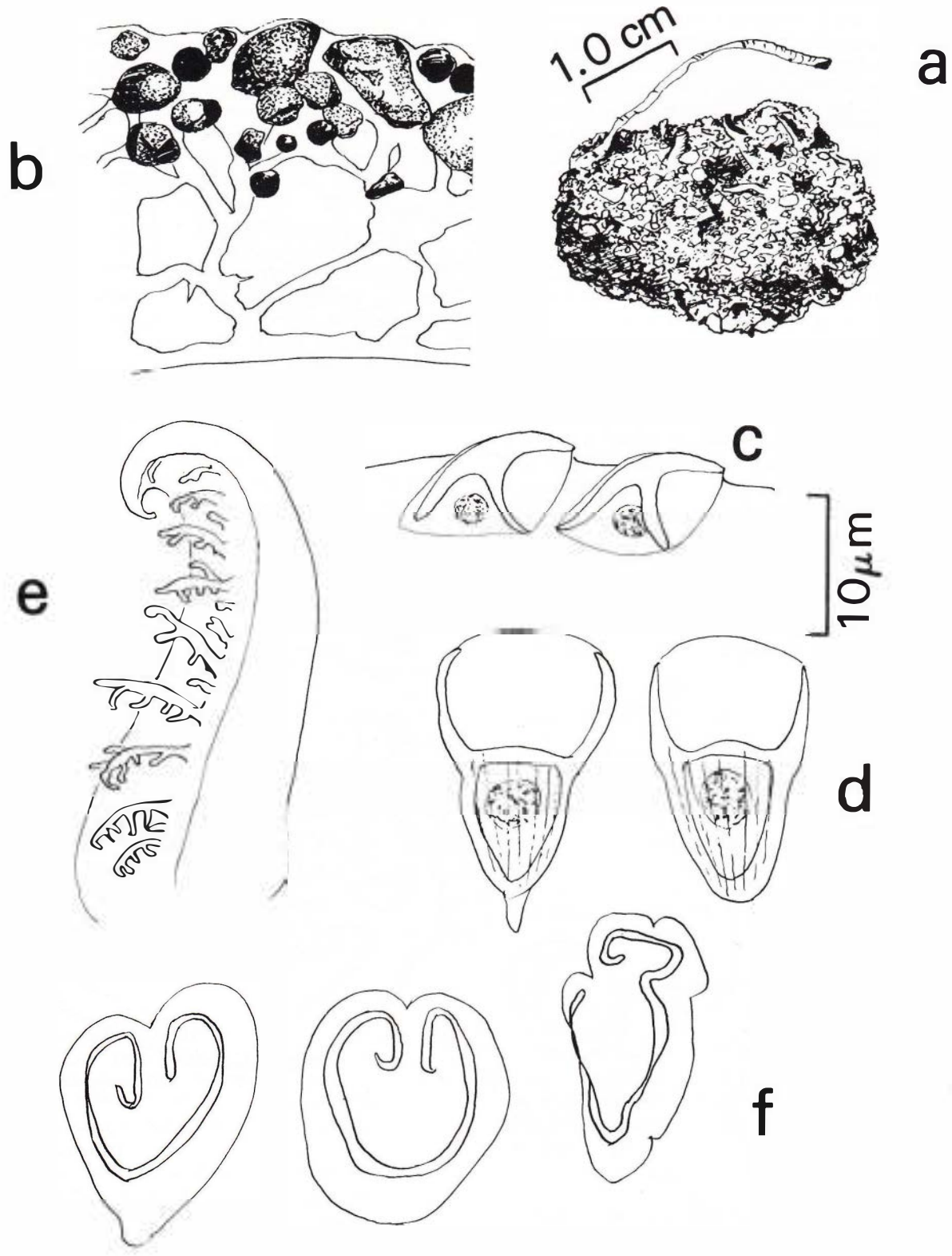

FIG. 50. *Pyura trita* (Sluiter) forma *crinita* Michaelsen: *a*, intact specimen; *b*, section through part of test; *c*, siphonal spines in side view; *d*, siphonal spines in surface view; *e*, oral tentacle; *f*, dorsal tubercle of three specimens.

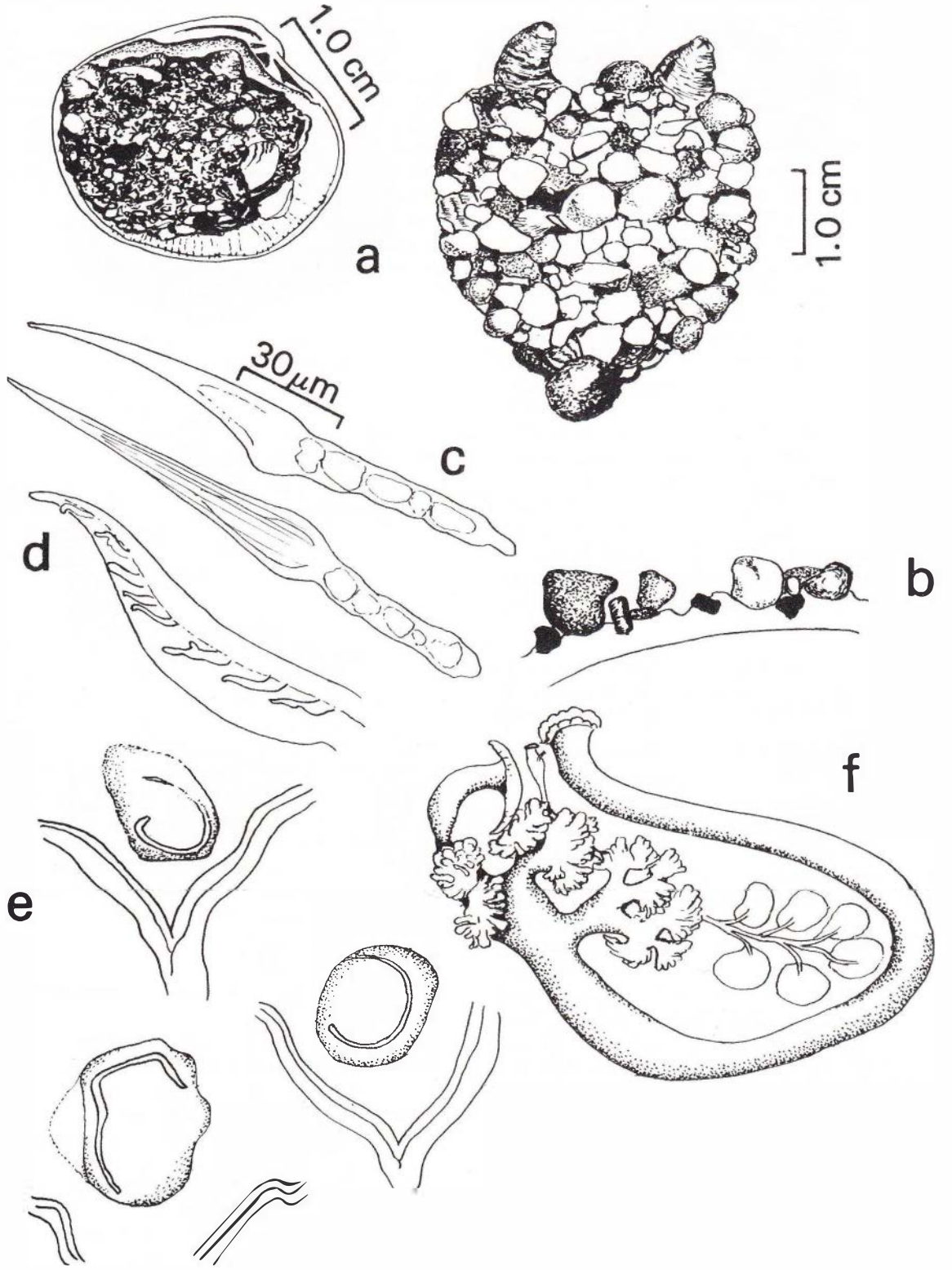

FIG. 51. *Pyura pilosa* Monniot and Monniot: *a*, two specimens; *b*, section through part of test; *c*, siphonal spines; *d*, oral tentacle; *e*, dorsal tubercle of three specimens; *f*, gut and left gonad.

secondary branches. There is an atrial velum. The opening of the dorsal tubercle is a simple C, with the interval often to the right. Six branchial folds are present. A typical arrangement of longitudinal bars is:

dorsal line 3 (14) 4 (20) 4 (23) 3 (20) 3 (12) 3 (9) 2 endostyle.

The dorsal languets are united at their bases by a lamina. The oesophagus is strongly curved, the stomach narrow and provided with branching caeca approximately grouped in three masses. The intestine forms a wide loop and the terminal part of the rectum is bent dorsally, ending in an anus with numerous shallow lobes. The left gonad, within the gut loop, is gently curved, and the right gonad tends to be more strongly curved. Each has an axial tubular ovary and rounded projecting sacs accommodating extensions of the ovary together with the testicular follicles. The gonoducts open close together, at the level of the anus. No endocarps are present.

REMARKS: Monniot and Monniot (1973) founded this species for a specimen which they examined from Kerguelen, together with specimens erroneously named *P. jacatrensis* by Kott (1954) and Millar (1960) and *P. vittata* by Kott (1969a), from Macquarie, Kerguelen and Marion Islands.

The new and abundant material from Macquarie Island confirms the characters noted by Monniot and Monniot except that in it: (1) the small spines are confined to the siphons, instead of being generally distributed on the surface of the test, a feature presumably related to the presence of encrusting debris; (2) the opening of the dorsal tubercle seldom faces forward; and (3) the gonads and gonoducts are more curved. These differences are not considered sufficient to erect a new species, but possibly indicate some genetic separation of the population at Macquarie Island.

Monniot and Monniot (1973) have clarified the characters and distribution of several species of *Pyura* hitherto confused, and it is now unlikely that either *P. vittata* or *P. jacatrensis* will be found at the Subantarctic islands.

Pyura pulla (Sluiter, 1900) Fig. 52

Cynthia pulla Sluiter, 1900: 28–29, pl. 5 figs 8–11.
Pyura pulla. Michaelsen, 1922: 385–389. Brewin, 1946; 124–125; 1950b: 345; 1956b: 122; 1957: 578; 1958a: 440; 1960: 120.

MATERIAL EXAMINED: NZOI Stns B272 (2 specimens), D443 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: Bay of Islands (Brewin 1957), New Plymouth and Wellington (Michaelsen 1922), Cook Strait (Brewin 1960), Queen Charlotte Sound (Michaelsen 1922), Sumner (Sluiter 1900), Christchurch (Brewin 1950b), Portobello (Brewin 1946), Stewart Island (Michaelsen 1922, Brewin 1958a), Chatham Islands (Brewin 1956b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: The body is ovoid with the upper end somewhat flattened and the lower end narrow. The siphons are at opposite corners of the upper end and their lobes are short finger-like projections. Sand, grit, and broken shell cover the whole surface. The largest specimen is 6 cm by 5 cm in diameter. The body wall, especially of the upper flattened area, is muscular. Strong circular muscles surround the siphons and extend over the flat area. Radial longitudinal muscles pass down over the sides of the body but are poorly developed on the ventral area. The sharply pointed spines lining the siphons are 100–140 μm long. About 20 oral tentacles are present. They are wide and regularly bipinnate. The dorsal tubercle has a C-shaped slit with the open interval facing forward and the horns coiled inwards. Five branchial folds are present on each side, with the following arrangement of longitudinal bars in one specimen examined:

dorsal line 7 (26) 6 (29) 4 (30) 3 (21) 4 (12) 4 endostyle.

There are about 36 slender, pointed dorsal languets. The oesophagus is curved and the stomach narrow with a long series of branched hepatic lobes. The intestinal loop is narrow and its upper limb is marked by a row of about five swellings along the dorsal side. These were also noted by Brewin (1946). The rectum is strongly bent up towards the atrial siphon and ends in a narrow smooth-edged anus. The left gonad occupies the intestinal loop and the right gonad a corresponding position on the opposite side.

Family MOLGULIDAE Lacaze-Duthiers, 1877

Eugyra Alder and Hancock, 1870

Eugyra brewinae Millar, 1960

Eugyra brewinae Millar, 1960: 143–144, fig. 65.

PUBLISHED RECORDS, NEW ZEALAND: North Cape (Millar 1960).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Millar 1960): Body small, sand-coated; oral tentacles 10–12, tripinnate; slit of dorsal tubercle longitudinal, nearly straight; six longitudinal branchial bars each side; low infundibula each with two spiral stigmata; oesophagus short; stomach short, barrel-shaped; anterior part of intestinal loop open; one gonad each side (left one in primary intestinal loop); ovary sac-shaped, testis of lobed follicles radiating around ovary; sperm duct opens half-way along ovary (not beside oviduct); renal sac small, posteriorly placed.

Eugyra novaezealandiae Brewin, 1950

Eugyra novaezealandiae Brewin, 1950b: 351–352, figs 4, 5.

PUBLISHED RECORDS, NEW ZEALAND: Christchurch (Brewin 1950b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION (from Brewin 1950b): Body unattached, spherical to elliptical; siphons close together; short fine test hairs on surface except round siphons; 16–18

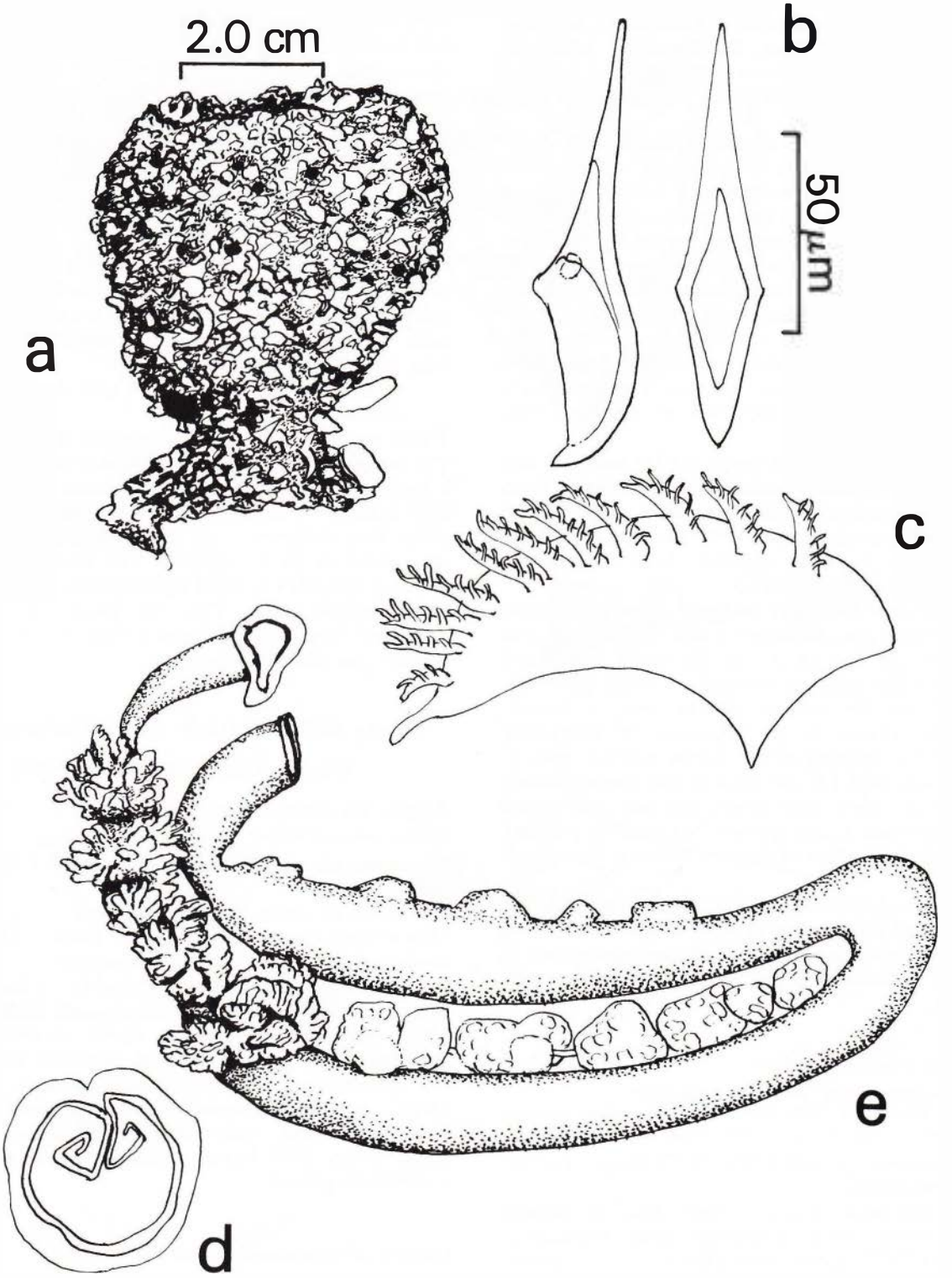

FIG. 52. *Pyura pulla* (Sluiter): *a*, intact specimen; *b*, siphonal spines; *c*, oral tentacle; *d*, dorsal tubercle; *e*, gut and left gonad.

tripinnate oral tentacles; slit of dorsal tubercle small, almost a closed ring; six wide longitudinal branchial bars each side; infundibula each with two unbroken spiral stigmata; oesophagus short; stomach short, wide, with longitudinal glandular areas; primary intestinal loop open at anterior end; one gonad each side (left one in primary intestinal loop); ovary spherical; testes much-branched, close to ovary; sperm duct opens beside oviduct.

Eugyra munida sp.n. Fig. 53

MATERIAL EXAMINED: Portobello Stn MU76–169 (6 specimens).

HOLOTYPE: A specimen of 1.0 cm diameter, in collection of the National Museum of New Zealand, Wellington, New Zealand, type number ASC 10.

PARATYPES: NMNZ, type number ASC 09, five specimens from same sample as holotype.

TYPE-LOCALITY: Portobello Stn MU76–169, continental shelf east of Otago, South Island, 45°47′S, 170°45′E, 12 m.

DESCRIPTION: The specimens range in maximum diameter from 0.9 to 1.4 cm. They are ovoid and somewhat flattened laterally, at least in the preserved state, and uniformly coated with sand except on the siphons, which are relatively bare. The siphons are quite close together on the upper margin of the body and project slightly. Fine test fibrils are present on much of the body and project between the sand grains. Despite the coating of sand the body remains flexible. The body wall is thin and transparent. Numerous narrow longitudinal muscles pass from the ends of the siphons to the base of the body. Circular muscles are regular and close on the siphons and less regular over the body. The oral siphon bears about 12 teeth on its margin and the atrial siphon about 30. The oral tentacles have primary and secondary branches and a few very small third-order branches. The dorsal tubercle is variable with a simple elongate C-shaped or weakly V-shaped opening. The dorsal lamina is not very tall. There are six internal longitudinal bars on each side of the branchial sac, and two rows of stigmata between adjacent transverse bars. The spiral stigmata form conical infundibula with about 12 coils in the larger stigmata. The oesophagus is short and curved; the stomach not very wide and provided with low elongated swellings on the wall. The intestine forms an open primary loop and a widely open secondary loop. The terminal section of the rectum bends forward and opens in an indistinctly lobed anus situated only slightly anterior to the level of the oesophageal mouth. On the left side the gonad lies within and somewhat overlapping the primary intestinal loop. It is ovoid, with a central tubular ovary surrounded by numerous lobed male follicles. The oviduct projects beyond the end of the gonad. The common sperm duct lies along the inner surface of the ovary, and discharges by three or four short ducts placed at intervals along its length. There is no gonad on the right side. No renal sac is present such as is found in other species of *Eugyra* and in molgulids generally. Three inconspicuous patches of differentiated tissue lie on the right body wall. In each of these are numerous dome-shaped hollow thickenings of the epithelium. It is possible that these patches of tissue replace the missing renal sac.

REMARKS: The species is distinguished by the absence of a right gonad and of a renal sac, and the presence of patches of differentiated tissue on the right side.

Molgula Forbes, 1848

Molgula herdmani Brewin, 1958 Fig. 54

Molgula herdmani Brewin, 1958a: 451, fig. 3D.

MATERIAL EXAMINED: NZOI Stns B233 (1 specimen), B270 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: Stewart Island (Brewin 1958a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: One of the specimens was incomplete; the other measured 2 cm by 1 cm. The following summary description is based partly on these specimens and partly on Brewin's (1958a) original account of the species. Test covered with sand, but remains flexible; circular muscles and longitudinal muscles (radiating from the siphons) confined to the upper part of the body; 16–18 oral tentacles with three orders of branching; opening of dorsal tubercle C- or U-shaped; six branchial folds on each side with one or two longitudinal bars between folds and 4–14 bars on the folds; intestinal loop rather flat and almost closed; anus smooth-edged; left gonad immediately dorsal to the upper limb of the intestine; right gonad bent round renal sac and extending below it almost to its posterior end; oviduct short, and sperm duct somewhat longer and arising only a short distance from it.

Molgula bathamae sp.n. Fig. 55

MATERIAL EXAMINED: Portobello Stn MU68–13 (3 specimens).

HOLOTYPE: A specimen of maximum diameter 1.2 cm, in collection of the National Museum of New Zealand, Wellington, New Zealand, type number ASC 12.

PARATYPES: NMNZ, type number ASC 11, two specimens from same sample as holotype.

TYPE-LOCALITY: Portobello Stn MU68–13, continental slope east of Otago, South Island, 45°56′S, 171°00′E, 480 m.

DESCRIPTION: The largest specimen is 1.3 by 1.0 cm in diameter and the smallest 1.0 by 0.9 cm, measured over the sand and shell debris which completely covers the surface. Slender test fibrils are present on the lower part of the body. The siphons are scarcely visible externally in preserved specimens, but a collector's note ("siphons translucent, unpigmented") indicates that they are apparent in life. The test is thin and

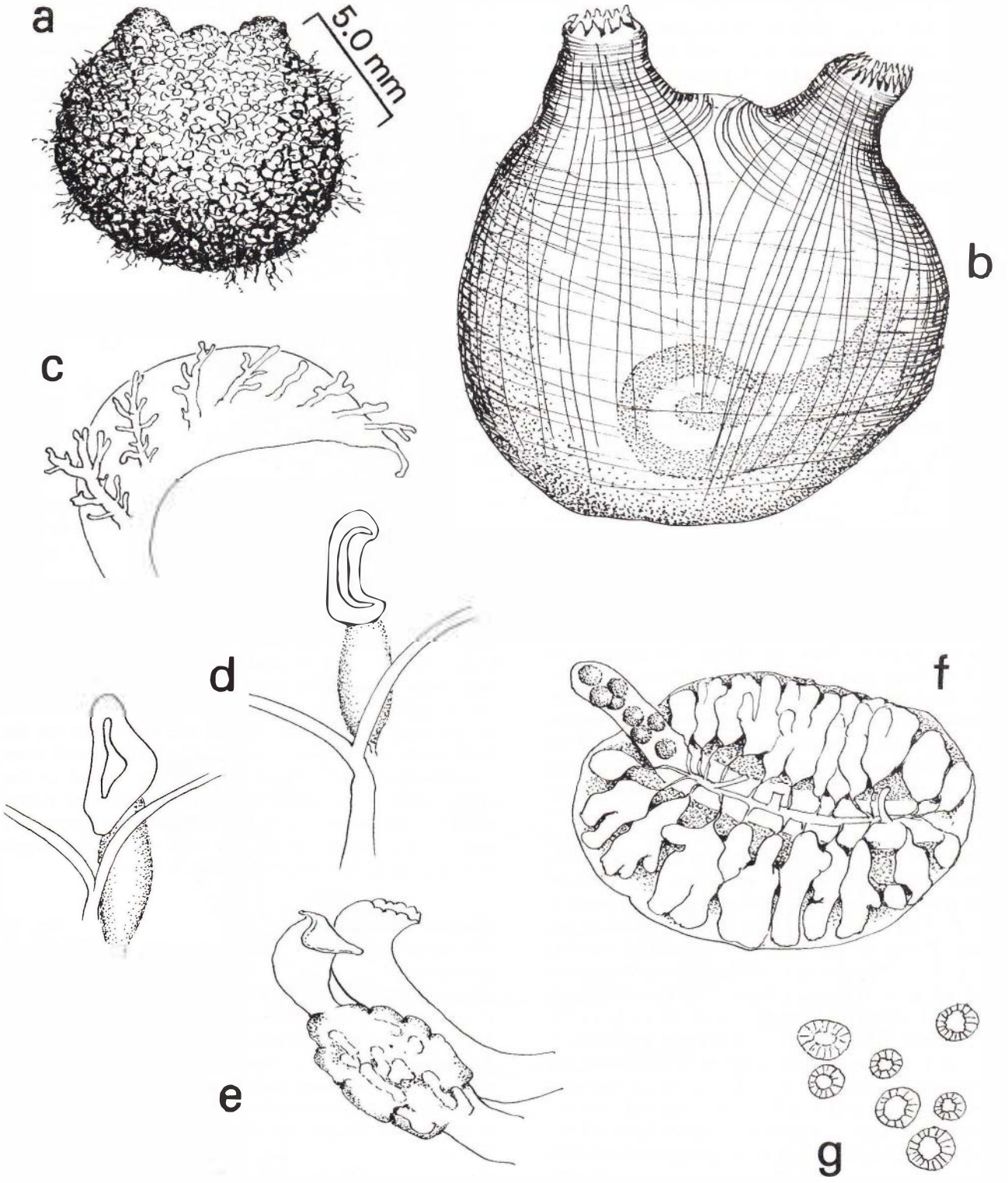

FIG. 53. *Eugyra munida* sp.n.: *a*, intact specimen; *b*, specimen with test removed; *c*, oral tentacle; *d*, dorsal tubercle; *e*, stomach, oesophagus and rectum; *f*, gonad; *g*, part of differentiated (renal?) tissue from right body wall.

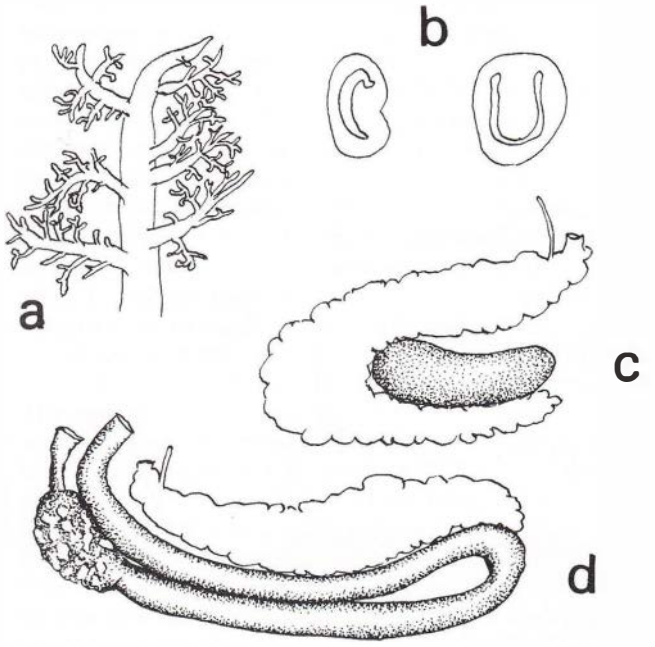

FIG. 54. *Molgula herdmani* Brewin: *a*, oral tentacle; *b*, dorsal tubercle of two specimens; *c*, right gonad and renal sac; *d*, gut and left gonad.

flexible. Circular muscles surround the siphons and extend a short way onto the body. Longitudinal muscles radiate from the siphons but do not reach halfway down the sides of the body. Some pigment is present on the dorsal part of the body wall. About 16 oral tentacles of various sizes are present and the larger ones are bipinnate, with, in addition, a few small third order branches. The dorsal tubercle is a small oval pad with a straight or very slightly curved longitudinal slit. The dorsal lamina has a narrow inrolled margin with no teeth. There are six branchial folds on each side. The following is a typical arrangement of longitudinal bars:

dorsal lamina 0 (8) 0 (14) 0 (13) 0 (14) 1 (12) 1 (12) 0 endostyle.

The spiral, divided stigmata are in infundibula, most of which are double-headed. Radial vessels cross the stigmata. Both oesophagus and stomach are short, and the wall of the stomach is raised in small rounded caeca. The primary intestinal loop is more open than in *M. herdmani* as illustrated by Brewin (1958a). The anal border is plain. Each gonad bends dorsally at its posterior end and ventrally at its anterior end. The oviduct is quite long and straight, and the sperm duct, arising at some distance from the base of the oviduct, runs parallel to it and is equally long. The left gonad lies above the intestinal loop and is in contact with it for part of its length. The right gonad bends around the end of the small bean-shaped renal sac, but does not enclose it to the same extent as in *M. herdmani* or *M. malvinensis.*

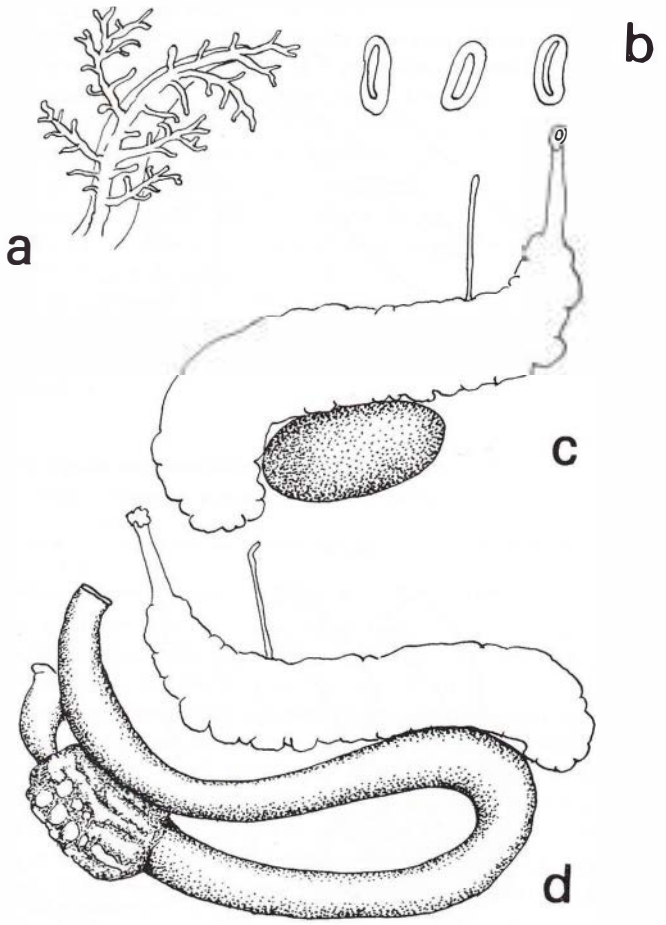

FIG. 55. *Molgula bathamae* sp.n.: *a*, oral tentacle; *b*, dorsal tubercle of three specimens; *c*, right gonad and renal sac; *d*, gut and left gonad.

REMARKS: This species is obviously closely related to *M. herdmani* Brewin, which was first taken on coastal rocks on Stewart Island. It differs consistently in the following characters. First, the opening of the dorsal tubercle in the new species is a nearly straight simple longitudinal slit, but in *M. herdmani* is C-shaped. Second, the right gonad only curves around the anterior end of the renal sac, but in *M. herdmani* the ventral part extends below the whole length of the sac. Third, the intestinal loop is noticeably more open.

The specific name commemorates the late Dr Elizabeth J. Batham, for many years Director of the Portobello Marine Laboratory.

Molgula longivascula sp.n. Fig. 56

part *Molgula malvinensis* Kott, 1954, specimens from Macquarie Island.

(**not** *M. malvinensis* Ärnbäck, 1938, type specimens from Falkland Islands. Millar 1960, specimens from South Georgia).

MATERIAL EXAMINED: NZOI Stns A694 (1 specimen), A695 (38 specimens), A696 (2 specimens), A698 (2 specimens).

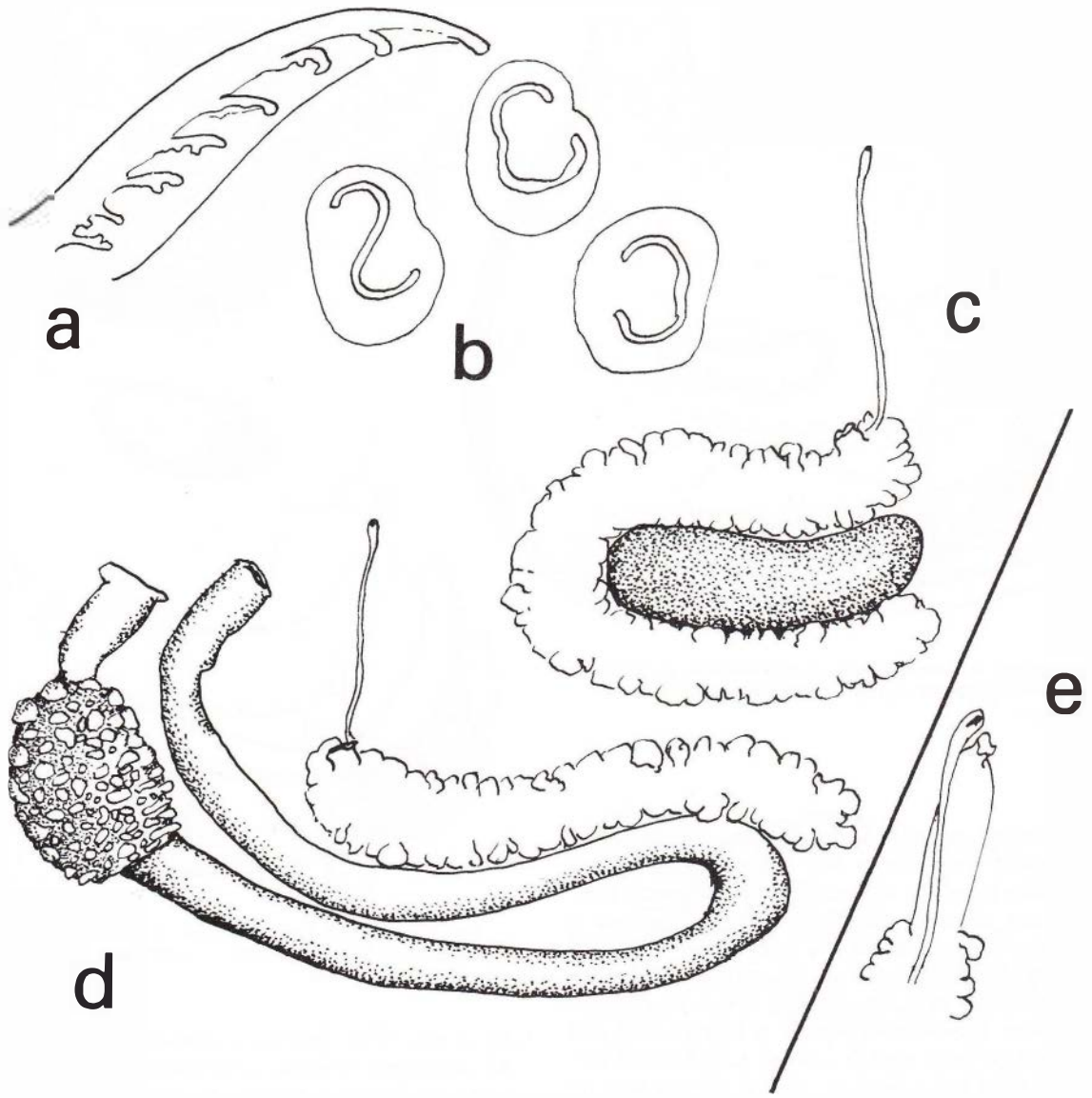

FIG. 56. *Molgula longivascula* sp.n.: *a*, oral tentacle; *b*, dorsal tubercle of three specimens; *c*, right gonad and renal sac; *d*, gut and left gonad; *e*, genital ducts of *Molgula malvinensis* Ärnbäck for comparison (specimen from South Georgia, "Discovery" collection).

HOLOTYPE: A specimen of maximum diameter 3.5 cm in collection of New Zealand Oceanographic Institute, DSIR, Wellington, New Zealand, type number H–270.
PARATYPES: NZOI, type number P–528, two specimens from same sample as holotype.
TYPE-LOCALITY: NZOI Stn A695, near Macquarie Island, 54°36.4′S, 158°57′E, 91 m.
PUBLISHED RECORDS, NEW ZEALAND: Macquarie Island (Kott 1954 as *M. malvinensis*).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION: The body is covered with sand, small pebbles or broken shell, and is often attached to the concave surface of a dead bivalve shell. The siphons tend to be less encrusted with debris. They scarcely project and are never prominent. Filamentous test processes are sometimes visible. Large specimens reach 4 cm in diameter, measured over the encrusting debris. Strong longitudinal muscle bands pass along the siphons and radiate to about half-way down the body. Transverse muscles are thinner but closely spaced over the same area and may be particularly dense in a dorsal band between the bases of the siphons. There are usually about 16 oral tentacles, with a relatively simple form of branching. The 6–9 short primary branches on

each side of the tentacle are themselves either undivided or bear only a very few short secondary projections. The opening of the dorsal tubercle is usually a simple C facing either to left or right, or is reverse S-shaped. The dorsal lamina is low at the anterior end and gradually increases in height posteriorly. Its edge is inrolled, thus concealing the minute teeth which are present. Characteristically there are seven branchial folds on the right side and six on the left; in a very few specimens seven folds or six folds were found on each side. A typical arrangement of longitudinal bars is, on the right side:

dorsal lamina 1 (10) 1 (14) 1 (11) 1 (10) 0 (10) 0 (8) 0 (7) 0 endostyle.

The spiral stigmata are divided into short and long openings and are crossed irregularly by thin transverse bars. The oesophagus is curved and the short stomach provided with numerous small rounded swellings. The intestine makes a long narrow loop and the anus, which lies close to the oesophageal mouth, is plain-edged. The left gonad lies immediately above the intestine and its anterior end bends ventrally to follow the curvature of the intestine. At its posterior end is a short inconspicuous oviduct. The sperm duct arises beside, or occasionally a short distance from the oviduct and is a long slender tube attached to the body wall and opening far from the oviduct. The male follicles are small and numerous. The right gonad, structurally similar to the left one, is much more curved and passes close along both dorsal and ventral sides of the renal sac to encircle it almost completely. The renal sac is a slightly curved sausage-shaped body.

REMARKS: I include in the new species some specimens from Macquarie Island assigned (by Kott 1954) to *M. malvinensis* Ärnbäck. Kott noted that in these specimens the sperm duct extends beyond the oviduct to end near the atrial opening. This is an arrangement unlike that of the typical *M. malvinensis.*

The new species, however, is in most respects very like *M. malvinensis*, which was first described from the Falkland Islands (Ärnbäck 1938). There is little doubt that these two species, together with *M. herdmani* Brewin and *M. bathamae* sp.n., form a closely related group. Kott (1969a) includes *M. herdmani* as a synonym of *M. malvinensis*, a species which she interprets as widely distributed and variable. The taxonomic status accorded to the various populations is very much a matter of subjective judgment, but the relative constancy of the characters distinguishing the populations from separate areas implies a degree of genetic difference which I, unlike Kott, regard as specific.

Molgula amokurae Bovien, 1921

Molgula amokurae Bovien, 1921: 34–36, fig. 1.
Ctenicella amokurae. Brewin, 1950d: 5.

PUBLISHED RECORDS, NEW ZEALAND: Auckland Island (Bovien 1921).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: Body globular, sandy; about 16 once-pinnate oral tentacles; slit of dorsal tubercle S- or C-shaped; seven low branchial folds per side; 3–5 longitudinal bars on folds (bars between folds not mentioned by Bovien); gut strongly curved, primary loop only slightly open anteriorly; one disc-shaped gonad per side, left one in gut loop; ovary occupying small dorsal sector, testis of radiating follicles; renal sac with straight upper margin.

REMARKS: The species is distinguished from *M. mortenseni* Michaelsen by the more branched tentacles, less curved gut, and curved renal sac of the latter species.

Molgula novaeselandiae (Michaelsen, 1911)

Caesira (Molgula) novaeselandiae Michaelsen, 1911: 166–170, figs 18, 19.
Ctenicella novaeselandiae. Michaelsen, 1922: 373. Brewin, 1950b: 345.
Molgula novaezelandiae (sic!). Kott, 1957b: (pages un-numbered).

PUBLISHED RECORDS, NEW ZEALAND: Lyttelton (Michaelsen 1911), Macquarie Island (Kott 1957b).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: Body laterally flattened, sac-like; siphons close together and large; surface (except dorsal) with test hairs; oral tentacles bipinnate; slit of dorsal tubercle reversed S-shape; six branchial folds per side; 1–4 longitudinal bars on folds, no bars between folds; gut strongly curved, primary loop closed; one gonad per side; ovary curved, sausage-shaped; testis a group of small follicles at lower end of ovary; renal sac short and deep.

Molgula sluiteri (Michaelsen, 1922) Fig. 57

Ctenicella sluiteri Michaelsen, 1922: 373–378, figs 3–5.
Molgula martensi (**non** *M. martensii* Traustedt) Sluiter, 1900: 32.
Molgula sluiteri. Brewin, 1950a: 61–63; 1958a: 440; 1960: 120. Kott, 1954: 136–137; 1969a: 152–153.

MATERIAL EXAMINED: NZOI Stn E834 (8 specimens).

PUBLISHED RECORDS, NEW ZEALAND: Cook Strait (Brewin 1960), Otago Peninsula (Brewin 1950a), Chatham Islands (Sluiter 1900, recorded as *Molgula martensi* Traustedt, subsequently identified by Michaelsen 1922), Stewart Island (Michaelsen 1922, Brewin 1958a), Macquarie Island (Kott 1954, 1969a).

PUBLISHED RECORDS, ELSEWHERE: None.

DESCRIPTION: The body reaches 13–14 mm in greatest diameter, is flattened on the upper end where the siphons are placed close together, and may be somewhat flat-sided owing to pressure of neighbouring individuals. Sand covers the whole surface, and a few test fibrils project through the coating. The body wall muscles are mainly confined to the siphons and upper part of the body, consisting of circular and radial strands. Sixteen to 20 oral tentacles are present. They are wide, with a deep keel and short primary branches bearing a few short secondary branches. The opening of the dorsal tubercle is of a simplified S or C shape.

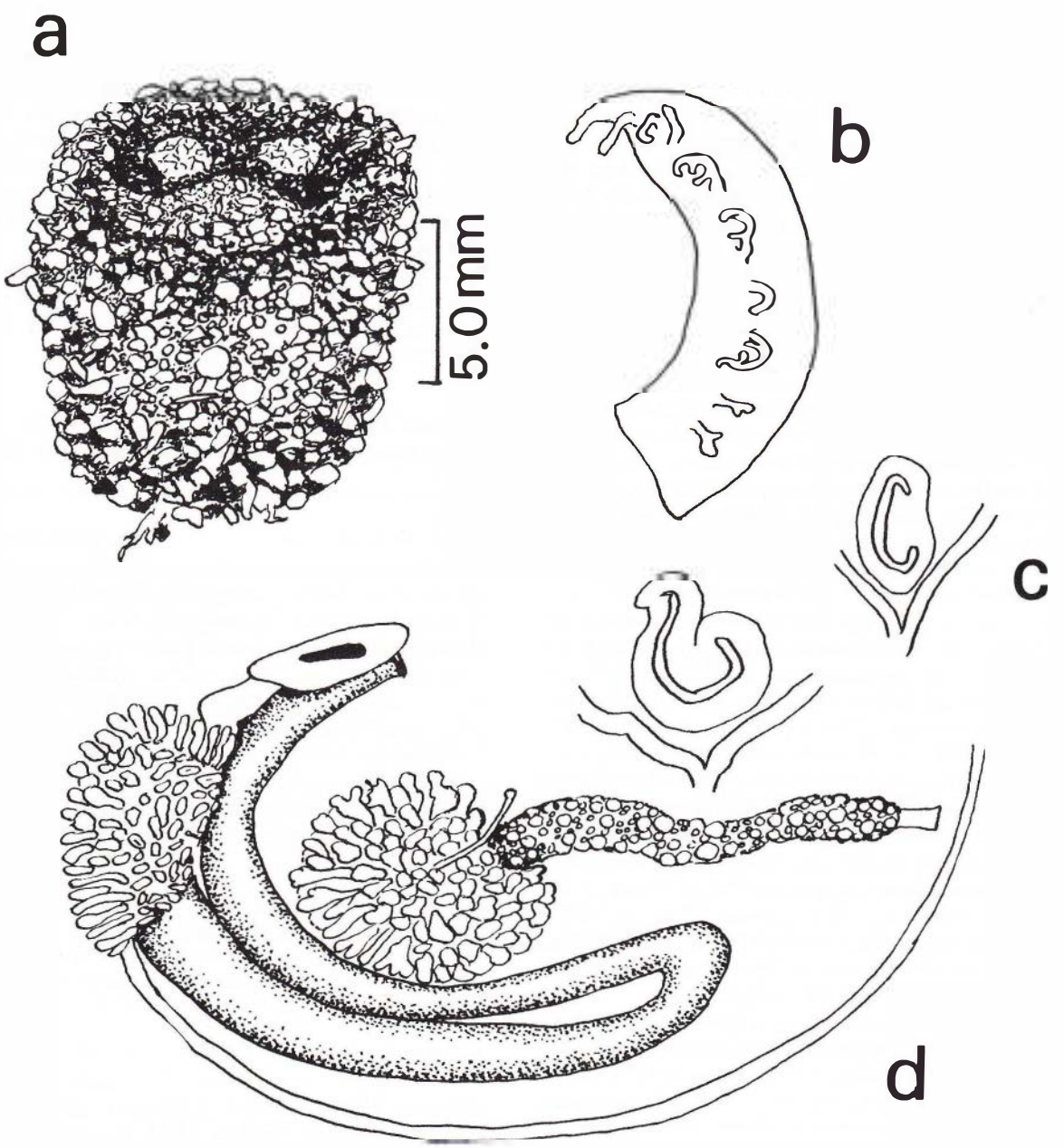

FIG. 57. *Molgula sluiteri* (Michaelsen): *a*, intact specimen; *b*, oral tentacle; *c*, dorsal tubercle of two specimens; *d*, gut and left gonad.

There are seven branchial folds on each side and the following arrangement of longitudinal bars found in one specimen is typical:

dorsal line 0 (2) 0 (2) 0 (4) 0 (3) 0 (3) 0 (2) 0 (3) 0
endostyle.

The oesophagus is short, the wall of the stomach provided with numerous, closely spaced, round or elongate swellings and the intestine forms a closed loop. The anus, which lies beside the oesophageal opening, is smooth-edged. Brewin (1950a) figures the anus considerably farther from the oesophageal mouth. The gonads are of characteristic form and orientation. On each side a narrow, slightly sinuous, tubular ovary extends from the primary gut loop obliquely in an antero-ventral direction, to end in a short straight oviduct close to the mid-ventral line. The testis is a mass of radiating follicles grouped at the blind end of the ovary, and opening by a single short common sperm

duct which lies at the base of the ovary instead of passing along the ovary to open beside the oviduct as is the case in many species. Brewin (1950a) states that "gonoducts open near the endostyle" but may not have distinguished the sperm duct. The renal sac is a slightly curved sausage-shaped body lying close to the right testis. Several specimens have larvae, embryos or eggs in the atrial cavity. The larval trunk is about 0.23 mm long and the tail about 0.84 mm (including the test fin). A single black sensory spot is present, probably an otolith. Brewin (1950a) found larvae in specimens collected in May 1946 and March 1947.

Molgula mortenseni (Michaelsen, 1922) Fig. 58

Ctenicella mortenseni Michaelsen, 1922: 365–373, figs 1, 2.
Molgula mortenseni. Brewin, 1951: 111–112; 1952b: 118; 1957: 578; 1958a: 440; 1960: 120.

MATERIAL EXAMINED: NZOI Stns B218 (2 specimens), B233 (3 specimens), B254 (1 specimen), B270 (3 specimens), B271 (4 specimens), E116 (2 specimens).
PUBLISHED RECORDS, NEW ZEALAND: Bay of Islands (Brewin 1957), Hauraki Gulf (Michaelsen 1922, Brewin 1951), Napier and Cape Kidnappers (Brewin 1952b), New Plymouth (Michaelsen 1922), Tokuma Bay (Michaelsen 1922), Cook Strait (Brewin 1960), Stewart Island (Michaelsen 1922, Brewin 1958a).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION: The body is ovoid to globular and usually completely coated with sand and broken shell. The siphons are small but distinct projections situated rather close together on the upper side. Large specimens are 2.0–2.2 cm in diameter. Quite strong longitudinal muscles radiate from the siphons. The circular muscles are mainly confined to the siphons. About 20 oral tentacles are present. The largest tentacles are broad, with regular primary and secondary branches. In one specimen examined there are, parallel to the row of main primary branches, two rows of small simple projections. The opening of the dorsal tubercle is constantly a longitudinal S-shaped slit. Brewin (1951) illustrated the S in a reversed orientation from that of the present spcimens and of the figure in Michaelsen (1922). The dorsal lamina is short and irregularly toothed in the present specimens, although both Michaelsen and Brewin found it to be smooth-edged. There are seven branchial folds on each side, with the following a typical arrangement of longitudinal bars:

dorsal lamina 0 (8) 0 (9) 0 (9) 0 (9) 0 (8) 0 (7) 0 (5) 0 endostyle.

The spiral stigmata are broken into short openings. Irregular radial vessels cross the stigmata and bear on their inner edges numerous short papillae. Papillae were mentioned by Michaelsen but not by Brewin. The oesophagus is short and relatively straight. The stomach is rounded and its walls covered with oval or elongate caeca. The narrow intestine and rectum form an almost closed primary loop and a widely open secondary loop ending in a smooth-lipped anus. The right gonad lies above the curved renal sac and the left gonad above the intestine. Each is a bulky body with, on the mesial face, the ventral part occupied by numerous small male follicles and the dorsal part by the ovary. The oviduct and sperm duct are short and open close together.
REMARKS: The species is characterised by the sandy coating, bipinnate tentacles, shape of dorsal tubercle slit, arrangement of longitudinal branchial bars, and the structure of the gonads.

Molgula pulchra Michaelsen, 1900 Fig. 59

Molgula pulchra Michaelsen, 1900: 128–131, pl. 3 figs 17, 18; 1907: 81. Sluiter, 1932: 1–2. Van Name, 1945: 409–410. Kott, 1954: 135; 1969a: 150–151.
Molgula pyriformis (part, **not** Herdman, 1881) Michaelsen, 1900: 131–132; 1907: 81.
Molgula georgiana Michaelsen, 1900: 132–135. Sluiter, 1932: 2.
Caesira georgiana. Hartmeyer, 1909–1911: 1323.
Caesira pulchra. Hartmeyer, 1909–1911: 1324.
Caesira pyriformis var. *kerguelenensis* Hartmeyer, 1911: 519–522.

MATERIAL EXAMINED: NZOI Stns A695 (2 specimens), A696 (9 specimens).
PUBLISHED RECORDS, NEW ZEALAND: Macquarie Island (Kott 1954; 1969a).
PUBLISHED RECORDS, ELSEWHERE: South Georgia, Magellanic region, Kerguelen, Crozet Island, Antarctic continent.
DESCRIPTION: Specimens, which are usually attached to a piece of shell, range from 4.7 to 17.0 mm in greatest diameter. They are thickly coated with sand and broken shell over the whole surface except the siphons, which are relatively bare. The body is ovoid, spherical or somewhat conical, with the slightly projecting siphons quite close together. The test is thin and, in spite of its coating, remains flexible. Patches of brown or purple-brown pigment are present on the siphons and upper part of the body wall of some specimens. Circular muscle strands surround the siphons and spread to the adjacent parts of the body. Longitudinal strands on the siphons spread out over the body. The musculature is not strongly developed and the body wall is relatively thin and transparent. The oral tentacles, numbering about 12, are short and provided with only a few short simple branches. The dorsal tubercle is a small oval longitudinal pad with a straight or very slightly curved slit. The dorsal lamina is a short but quite high membrane. Most specimens have seven branchial folds on each side, but in one small specimen only six are present. The folds are low, but sharply defined and widely separated. Longitudinal bars are confined to the ventral face of each fold, and a typical arrangement is:

dorsal line 0 (1) 0 (2) 0 (3) 0 (3) 0 (3) 0 (2) 0 (1) 0 endostyle.

The spiral stigmata are regularly divided. The oesophagus is short and curved and the stomach short, with numerous low caeca on the walls. The intestine is

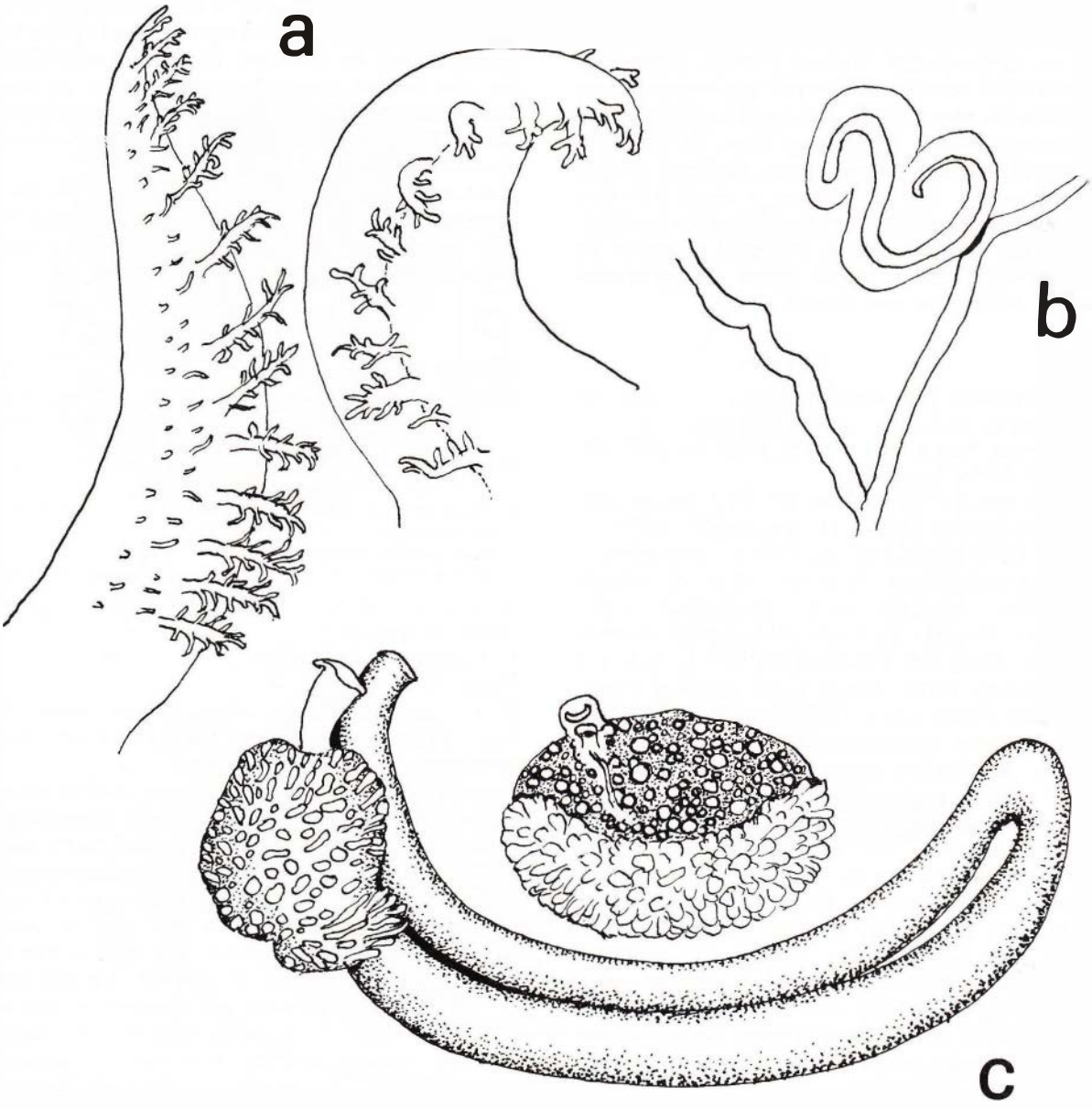

FIG. 58. *Molgula mortenseni* (Michaelsen): *a*, oral tentacle; *b*, dorsal tubercle; *c*, gut and left gonad.

narrow and forms a flat almost closed loop. The anus has two shallow lips. The left gonad is either in contact with the upper limb of the intestine or is a short distance above it, and the right gonad is a little above the bean-shaped renal sac. Each gonad has a small rounded ovary with a short wide oviduct, and a testis which is often larger than the ovary and consists of a mass of radiating follicles. The sperm duct is characteristically convoluted and folded repeatedly on the face of the ovary. It projects freely beyond the oviduct.

This species incubates its eggs, and some specimens had embryos and fully developed, tailed larvae in the atrial cavity. The larval trunk is about 0.38 mm long, and has a single black sensory organ.

REMARKS: In some previous accounts of the species, the opening of the dorsal tubercle is described as C-shaped, and this is evidently a variable feature.

Molgula macquariensis Kott, 1954 Fig. 60

Molgula macquariensis Kott, 1954: 138.

MATERIAL EXAMINED: NZOI Stns A694 (1 specimen), A695 (86 specimens), A696 (6 specimens).

PUBLISHED RECORDS, NEW ZEALAND: Macquarie Island (Kott 1954).

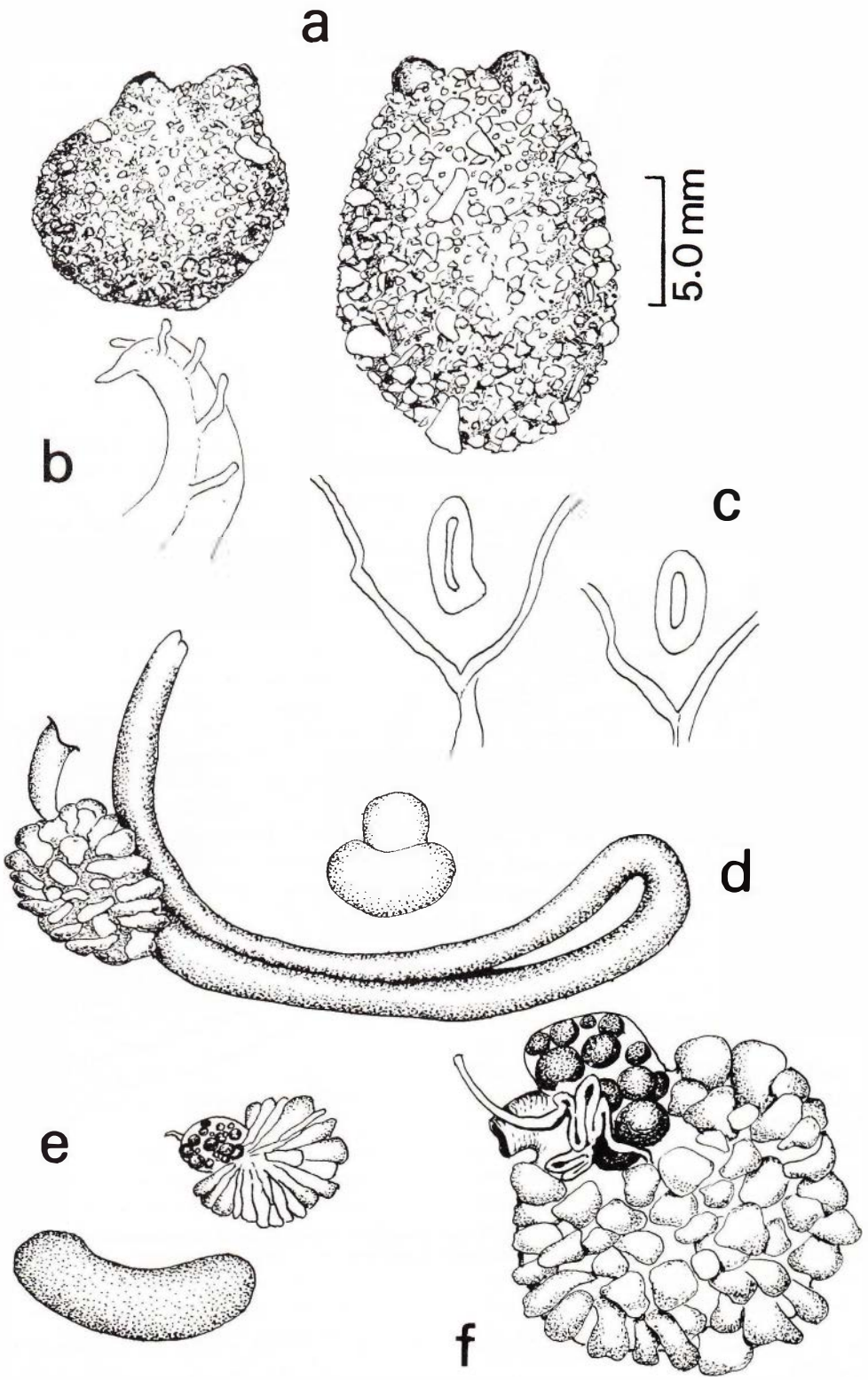

FIG. 59. *Molgula pulchra* Michaelsen: *a*, intact specimens; *b*, oral tentacle; *c*, dorsal tubercle of two specimens; *d*, gut and left gonad; *e*, right gonad and renal sac; *f*, detail of gonad, to show convoluted sperm duct.

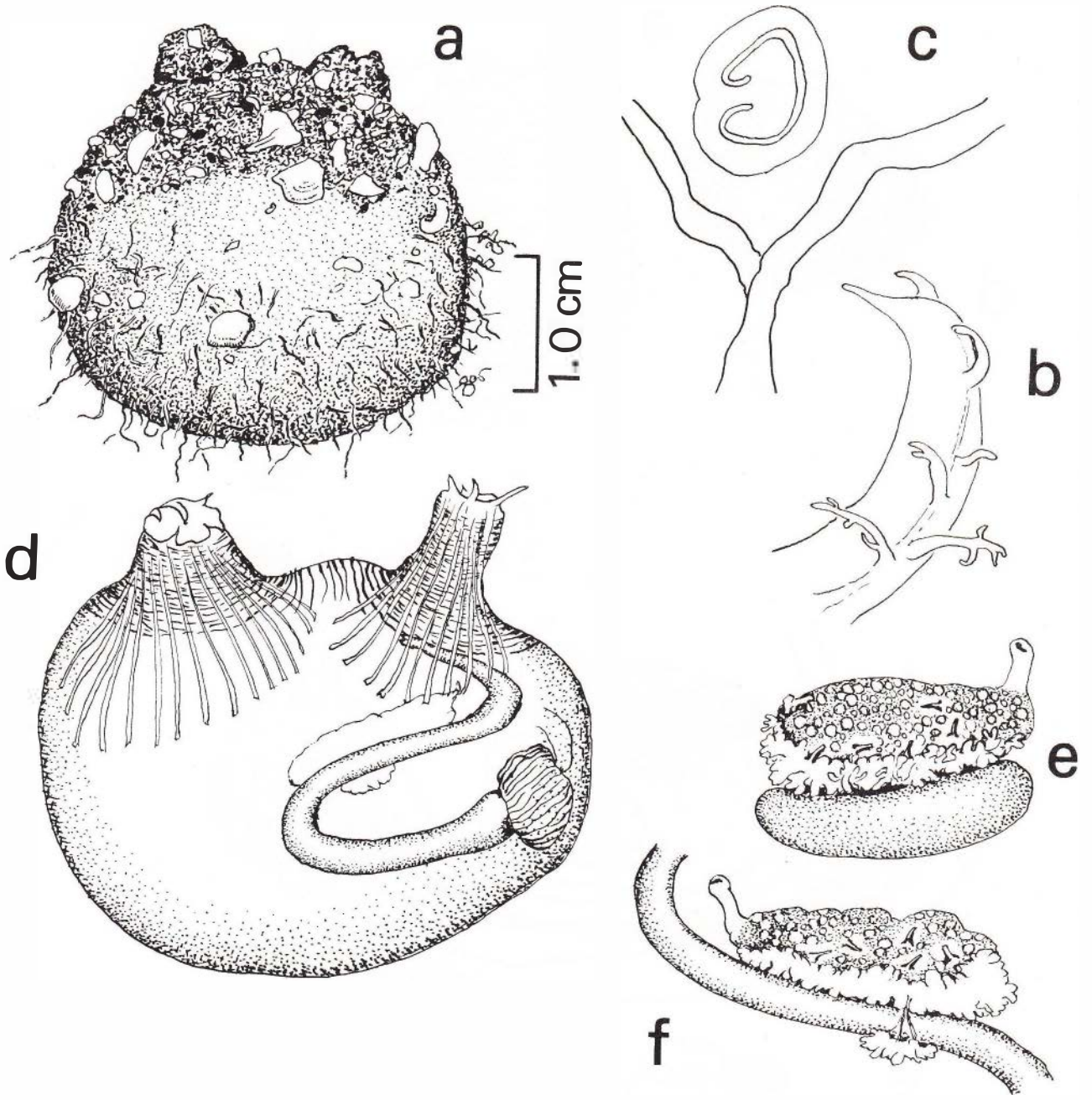

FIG. 60. *Molgula macquariensis* Kott: *a*, intact specimen; *b*, oral tentacle; *c*, dorsal tubercle; *d*, specimen with test removed, from left side; *e*, right gonad and renal sac; *f*, left gonad and part of intestine.

PUBLISHED RECORDS, ELSEWHERE: Kerguelen and Crozet Islands (Monniot 1978).

DESCRIPTION: The body in the preserved state is usually laterally flattened, but may have been more globular in life. The slightly projecting siphons are situated fairly close together on the upper side of the body. Sand and broken shell are relatively dense on the uppermost third of the body and sparse elsewhere. Filaments of test are present mainly on the lower half. The test is soft and, where not coated with debris, semi-transparent. The largest specimens measure about 5 cm in diameter. Only the upper part of the body is muscular, with prominent longitudinal muscles passing down the siphons and out from their bases to end abruptly about one third to one half of the distance to the ventral line. Strong circular muscles are also

present on the siphons, the adjacent part of the body and the area between the siphons. There are about 16 oral tentacles of different sizes. They have a stout main stem, and a few primary branches, some of which bear small secondary branches. The dorsal tubercle is quite large, with a C-shaped opening typically facing to the right and slightly back, and with inturned horns. Occasionally the C faces to the left. The dorsal lamina is moderately tall and its edge is weakly scalloped or undulating but not toothed. Most specimens examined have seven branchial folds on each side, but a few have only six on the left. A typical arrangement of longitudinal bars (in a specimen of 3 cm diameter) is:

dorsal line 0 (14) 3 (15) 3 (17) 3 (16) 4 (10) 3 (15) 5 (4) 3 endostyle.

The bars are tall and flat. The stigmata are broken into irregular short and long openings. The oesophagus is short and curved. The stomach is short and wide and the whole wall is developed into a series of longitudinal ridges or folds corresponding to the numerous rounded caeca of some other species of *Molgula*. The intestine and rectum make an S-shaped bend, leaving a quite widely open primary intestinal loop, which, however, tends to be obliterated in contracted specimens. The anus has two simple lips. The renal sac is an elongate bean-shaped body. The right gonad lies immediately dorsal to this, and the left gonad is above the dorsal limb of the intestine. Each consists of a sausage-shaped ovary, and, mainly on its ventral face, an irregular band of small lobed male follicles. In the left gonad a group of these follicles is usually found immediately below the dorsal intestinal limb and somewhat isolated from the main gonadal mass. A single tubular oviduct projects from the posterior end of each gonad. Two to five common sperm ducts are situated on the mesial face of the gonad in place of the single duct more usually found in other species.

REMARKS: This species is characterised by the nature of the test, the strong and sharply demarcated dorsal musculature, the structure of the dorsal tubercle, tentacles, and stomach, the presence of longitudinal bars between branchial folds, the number of sperm ducts, and the tendency of the testis to spread into the intestinal loop.

Kott (1954) described the species from 69 m off Macquarie Island. She did not mention the structure of the stomach or the number of sperm ducts, but in other features her account fits the new material. Subsequently, Kott (1969a) regarded the species as synonymous with *M. pedunculata* Herdman. In *M. pedunculata*, however, the wall of the stomach has rounded caeca or areolations, the primary intestinal loop is closed, and the testis confined within the outline of the gonad.

Kott (1954, 1969a) also described a species, *M. kerguelenensis*, which resembles the new material in certain features, particularly the presence of several sperm ducts on each gonad. But that species has no longitudinal bars between branchial folds and apparently a different form of stomachal caeca.

Molguloides Huntsman, 1922

?Molguloides ?vitreus (Sluiter, 1904) Fig. 61

Molgula vitrea Sluiter, 1904: 119–120, pl. 14 figs 17–19. Van Name, 1918: 68–70.
Caesira vitrea. Hartmeyer, 1909–1911: 1324.
Molguloides vitrea. Kott, 1969a: 159.
Molguloides tenuis Kott, 1954: 138–139.

MATERIAL EXAMINED: NZOI Stns E82 (1 specimen), J41 (1 specimen).

PUBLISHED RECORDS, NEW ZEALAND: None.

PUBLISHED RECORDS, ELSEWHERE: Antarctic; Philippines; Indonesia.

DESCRIPTION: The larger specimen (Station E82) was fragile and a number of details were not determined. It is 4 cm long and 2.8 cm wide, approximately rectangular in outline and soft and very flexible. The test is gelatinous and translucent grey, and has numerous short tag-like processes. A little sediment adheres to the surface. The siphons are almost at opposite corners of the upper end, the atrial siphon being slightly longer than the oral. Each is surrounded by circular muscle strands which are also present over the rest of the body. Thicker longitudinal muscles pass down the oral siphon and some of these continue to near the base of the body. Similar muscles originate on the sides of the atrial siphon. Ten oral tentacles, of alternating sizes, were counted. They are tri-pinnate and much branched. The dorsal tubercle was not seen clearly. On the left branchial wall eight folds are present but the number on the right side was not discovered. The folds have 9–15 longitudinal bars and at most one bar lies between folds. Tall infundibula project into the folds, each consisting of numerous turns of the spiral stigma, interrupted at intervals, and crossed by several radial vessels. The oesophagus is short and nearly straight and the stomach is short, with a number of longitudinal folds on the wall representing the hepatic caeca commonly found in other molgulids. The intestine makes an open, almost circular, primary loop, and the rectum is long and straight and ends in an anus which is only very slightly indented. The gonads lie far back in the body, the left one in the primary intestinal loop. The detailed structure was not determined, although ovarian tissue and peripheral male follicles were seen. Whether the gonad has the spiral formation described in other accounts of the species (Sluiter 1904, Van Name 1918) is not known. The right gonad lies opposite to the left, but the renal sac was not found, the body having been damaged in this region.

The smaller specimen (Station J41) confirms most features of the larger one. It shows the dorsal tubercle to have a longitudinal, slightly sinuous slit. The gonad does not show any spiral arrangement and consists of an ovoid ovary applied to a wider disc-shaped testis of

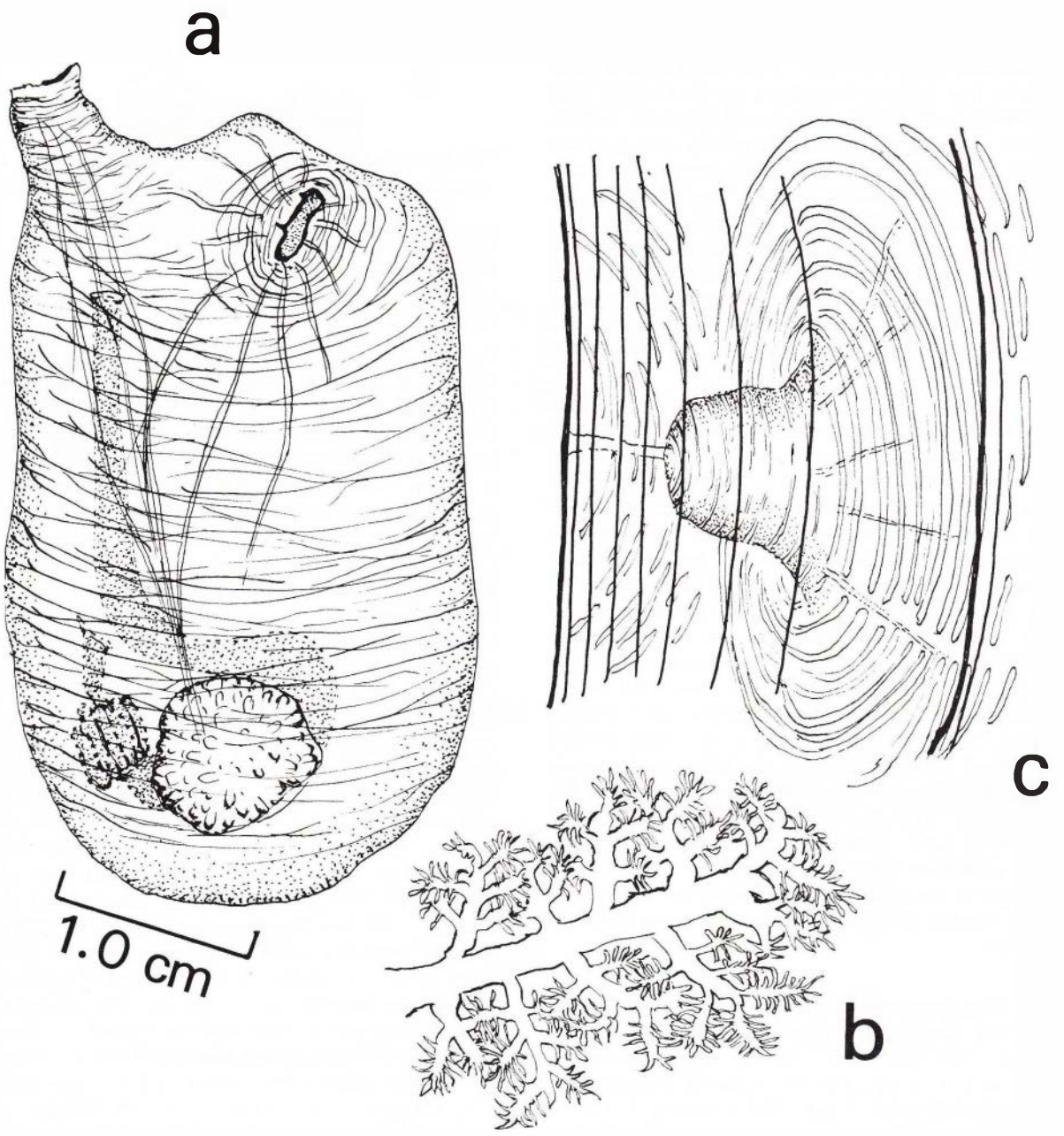

FIG. 61. ?*Molguloides ? vitreus* (Sluiter): *a*, specimen with test removed, from right side; *b*, oral tentacle; *c*, part of branchial wall.

many small follicles. The bean-shaped renal sac lies below the right gonad, at the base of the body.

REMARKS: Identification of this *Molguloides*? as *M. vitreus* (Sluiter) is doubtful because of uncertainty regarding some anatomical details.

Previous records indicate a distribution from the Antarctic northwards into the south-western Pacific Ocean, in depths from about 400 m to more than 4000 m. Its occurrence at 402 m on the Chatham Rise is not improbable.

Pareugyrioides Hartmeyer, 1914

Pareugyrioides filholi (Pizon, 1898) Fig. 62

Molgula filholi Pizon, 1898: 347–354, pl. 12 figs 1–5, pl. 15 figs 4, 5.
Molgula inversa Sluiter, 1900: 32–33. Hartmeyer, 1914: 11.
Paramolgula filholi. Michaelsen, 1922: 378–385. Brewin, 1958a: 450–451; 1960: 120.
Pareugyrioides filholi. Kott, 1969a: 163–164.

MATERIAL EXAMINED: NZOI Stns B221 (2 specimens), B223 (4 specimens), B250 (2 specimens), B264 (2

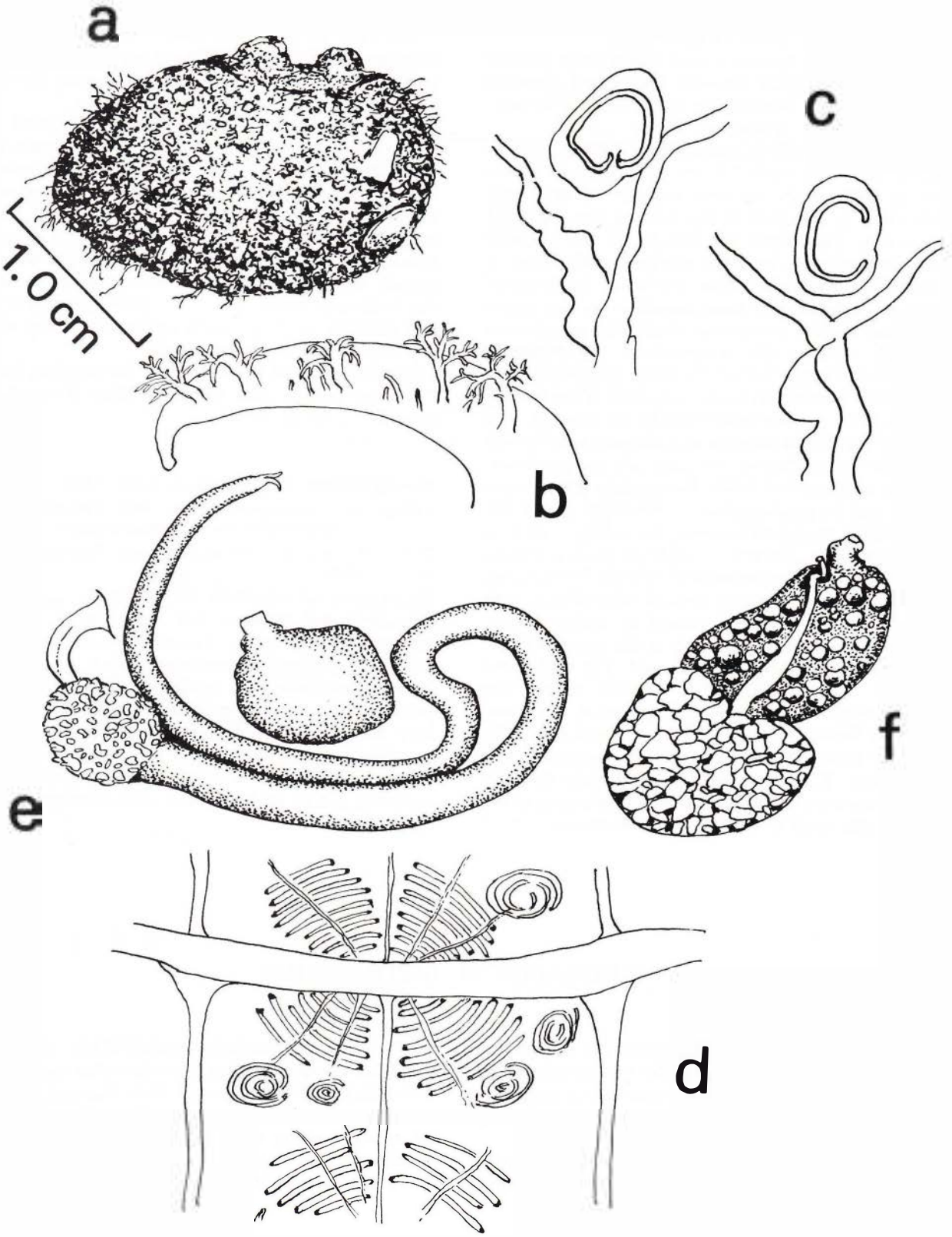

FIG. 62. *Pareugyrioides filholi* (Pizon): *a*, intact specimen; *b*, oral tentacle; *c*, dorsal tubercle of two specimens; *d*, part of branchial wall; *e*, gut and left gonad; *f*, detail of gonad.

specimens), B265 (1 specimen), B669 (2 specimens), B672 (1 specimen), B689 (3 specimens).
PUBLISHED RECORDS, NEW ZEALAND: Cook Strait (Sluiter 1900, Michaelsen 1922), Stewart Island and Foveaux Strait (Pizon 1898, Michaelsen 1922, Brewin 1958a).
PUBLISHED RECORDS, ELSEWHERE: None.
DESCRIPTION: The body is usually about 2 cm in greatest diameter, but may reach 2.5 cm. It is ovoid or nearly round in outline. A variable amount of sand and broken shell is attached to the surface but the body remains soft. Test fibrils are developed to a variable degree. In dissection an inner parchment-like layer of test is readily separated from the outer sand-coated layer. The siphons are close together on the upper surface, and slightly projecting. Body wall muscles are moderately strong, the longitudinal bands being confined to the dorsal half of the body. Brown pigment (in preserved specimens) is often present in the tissues. Fifteen to 24 tri-pinnate oral tentacles are present. The opening of the dorsal tubercle is C-shaped, usually with inturned horns and facing obliquely left and posterior. There are no branchial folds, but in their place seven tall flat-faced longitudinal bars. The edges of the flat face have been mistaken for two longitudinal bars on a fold (Sluiter 1900, Hartmeyer 1914 in descriptions of *Molgula inversa*, a synonym of *P. filholi*). Under each longitudinal bar is a row of conical infundibula, with interrupted spiral stigmata crossed by radial vessels. Small accessory spiral stigmata lie at the margins of the infundibula. The oesophagus is curved. The wall of the stomach is covered with small rounded caeca. The primary intestinal loop is closed except at the apex, where both limbs of the loop are bent back markedly towards the posterior end. The anus has two somewhat indented lips. The right gonad lies a little distance above the curved renal sac, and the left gonad is in the secondary intestinal loop close to its backwardly-bent apical part. Each gonad consists of a sausage-shaped ovary and at its lower end a compact testis with numerous small follicles. The short oviduct is terminal and the common sperm duct passes along the face of the ovary to open beside the oviduct.
REMARKS: The known distribution is restricted to the western waters of the North and South Islands and as far south as Stewart Island. Kott (1969a) regarded the species which she had previously named *P. macquariensis* Kott, 1954 as conspecific with *P. filholi*, thereby extending the known range of the latter to Macquarie Island. But *P. macquariensis* has differently orientated gonads and has an intestinal loop completely lacking the backward bend which is characteristic of *P. filholi* and common to all accounts or figures of that species, and this record is unacceptable.

The inclusion of the species in the ascidian fauna of Chatham Islands and Chatham Rise (Croxall 1972) appears to be an error.

Pareugyrioides macquariensis Kott, 1954

Pareugyrioides macquariensis Kott, 1954: 139–140, figs 22–24. (generic name spelled *Paraeugyroides* in error).

PUBLISHED RECORDS, NEW ZEALAND: Macquarie Island (Kott 1954).
DESCRIPTION (from Kott 1954): Body up to 3 mm diameter; test delicate but sand-coated; body wall delicate, with weak muscles; seven longitudinal branchial bars on right and eight on left; four transverse bars; infundibula with wide, broken spiral stigmata; primary intestinal loop narrow; secondary intestinal loop widely open; one gonad each side, the left one in secondary intestinal loop; ovary tubular, directed ventrally away from atrial siphon; testis of lobes radiating round end of ovary; curved renal sac below right gonad.

GEOGRAPHICAL DISTRIBUTION

In this account 159 ascidian species are recognised (ignoring some of the more doubtful records) from the waters of North, South, Stewart, Chatham, Campbell, Auckland and Macquarie Islands and the intervening areas (Fig. 63, Table 1).

About the same number of species are known from the North and South Islands (the latter including Stewart Island), and in both cases nearly one half have not been recorded either from the other island or from elsewhere within or beyond New Zealand. These two areas are remarkably similar in the various percentages of species which they share with the Chatham, the Campbell and Auckland, and the Macquarie Islands. Nineteen percent of the North Island species have been

FIG. 63 (*opposite*). Map of New Zealand and adjacent areas from which specimens dealt with in this memoir were collected. Heavy lines separate the geographical zones discussed in the text and used in Table 1. FN = northern North Island; CN = central North Island; CS = Cook Strait; SI & ST = South Island and Stewart Island; CH = Chatham Islands and Chatham Rise; C & A = Campbell and Auckland Islands; M = Macquarie Island.

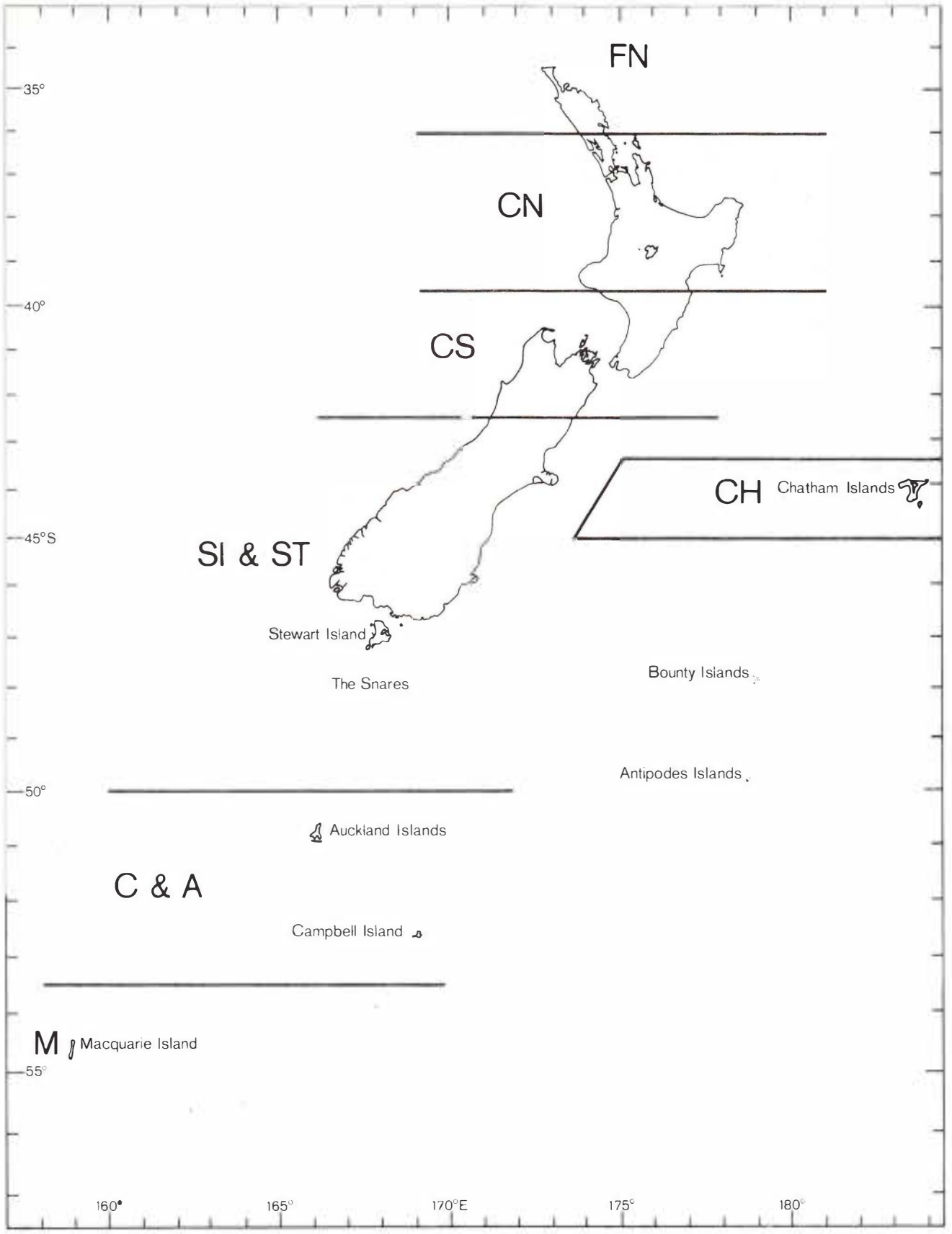

TABLE 1. Distribution of ascidian species from the New Zealand region by geographical zones

SPECIES	GEOGRAPHICAL ZONES						
	FN	CN	CS	SI & ST	CH	C & A	M
Pyura trita							
Sycozoa sigillinoides							
Cystodytes dellechiajei							
Cnemidocarpa bicornuta							
Cnemidocarpa nisiotis							
Pyura cancellata							
Pyura pulla							
Molgula mortenseni							
Aplidium scabellum							
Aplidium circumvolutum							
Aplidium thomsoni							
Pyura subuculata							
Didemnum maculatum							
Polysyncraton chondrilla							
Hypsistozoa fasmeriana							
Cnemidocarpa madagascariensis var. *regalis*							
Synoicum arenaceum							
Pyura rugata							
Aplidium seeligeri							
Synoicum kuranui							
Aplidium cottrelli							
Aplidium notti							
Pseudodistoma opacum							
Didemnum densum							
Leptoclinides diemenensis							
Okamia thilenii							
Arnbackia novaezelandiae							
Theodorella torus							
Asterocarpa coerulea							
Podoclavella kottae							
Clavelina claviformis							
Polycitorella mariae							
Sycozoa anomala							
Atapozoa marshi							
Synoicum apectetum							
Aplidium unicornum							
Aplidium glaphyrum							

TABLE 1 *continued*, 2

SPECIES	GEOGRAPHICAL ZONES						
	FN	CN	CS	SI & ST	CH	C & A	M
Aplidium quadrisulcatum							
Protopolyclinum pedunculatum							
Pseudodistoma aureum							
Ritterella vestita							
Agnesia glaciata							
?Botryllus separatus							
Eugyra brewinae							
Corella eumyota							
?Botrylloides leachi							
Didemnum tuberatum							
Metandrocarpa protostigmatica							
Asterocarpa cerea							
Didemnum lambitum							
Polyclinum cerebrale							
Alloeocarpa minuta							
Pyura suteri							
Eudistoma circumvallatum							
Diplosoma listerianum							
Botryllus schlosseri							
Pareugyrioides filholi							
Distaplia taylori							
Botrylloides magnicoecum							
Cnemidocarpa novaezelandiae							
Pyura carnea							
Synoicum hypurgon							
Synoicum haurakiensis							
Aplidium phortax							
Aplidium orthium							
Aplidium novaezealandiae							
Aplidium powelli							
Aplidium thomasi							
Homoeodistoma arenosum							
Pseudodistoma novaezelandiae							
?Didemnum chilense							
Polysyncraton paradoxum							
Lissoclinum notti							
Leptoclinides sparsus							

TABLE 1 *continued*, 3

SPECIES	GEOGRAPHICAL ZONES						
	FN	CN	CS	SI & ST	CH	C & A	M
Leptoclinides sluiteri							
Perophora annectens							
Styela plicata							
Microcosmus australis							
Pyura spinosissima							
Aplidium benhami							
Molgula sluiteri							
Aplidium mernooensis							
Aplidium foliaceum							
Pyura pachydermatina							
Distaplia knoxi							
Aplidium stelliferum							
Aplidiopsis discoveryi							
Cnemidocarpa stewartensis							
Didemnum studeri							
Polyclinum sluiteri							
Synoicum stewartense							
Didemnum lithostrotum							
Didemnum mortenseni							
Polycarpa zeteta							
Clavelina michaelseni							
Distaplia marplesi							
Synoicum otagoensis							
Synoicum occidentalis							
Aplidum chthamalum							
Aplidium gilvum							
Aplidium maritimum							
Aplidum oamaruensis							
Aplidium adamsi							
Polyclinum novaezelandiae							
Dumus areniferus							
Pseudodistoma cereum							
Pharyngodictyon elongatum							
Ritterella sigillinoides							
Leptoclinides novaezelandiae							
Leptoclinides duminus							
Tridemnum cerebriforme							

TABLE 1 *continued*, 4

SPECIES	GEOGRAPHICAL ZONES						
	FN	CN	CS	SI & ST	CH	C & A	M
Trididemnum sluiteri				—			
Ascidia lagena				—			
Ascidia stewartensis				—			
Ascidia macropapilla				—			
Ascidiella aspersa				—			
Perophora boltenina				—			
Ciona intestinalis				—			
Botryllus stewartensis				—			
Berrillia boltenioides				—			
Theodorella arenosa				—			
Theodorella stewartensis				—			
Cnemidocarpa otagoensis				—			
Polycarpa pegasis				—			
Styela gracilocarpa				- - - - -			
Pyura picta				—			
Eugyra novaezealandiae				—			
Eugyra munida				—			
Molgula herdmani				—			
Molgula bathamae				—			
Molgula novaeselandiae				—			
Adagnesia antarctica					—		—
Synoicum herdmani					—		
Aplidium amphibolum					—		
Aplidium constrictum					—		
Aplidium knoxi					—		
Aplidium siphonum					—		
Polyclinum michaelseni					—		
Leptoclinides marmoreus					—		
Leptoclinides auranticus					—		
Amphicarpa michaelseni					—		
Amphicarpa schauinslandi					—		
Microcosmus hirsutus					—		
Pyura lutea					—		
?Molguloides ?vitreus		- - - - -			—		
Polyzoa reticulata						—	—
Synoicum pererratum						- - - - -	
Polyzoa opuntia						—	

TABLE 1 *continued*, 5

SPECIES	GEOGRAPHICAL ZONES						
	FN	CN	CS	SI & ST	CH	C & A	M
Alloeocarpa affinis						———	
Molgula amokurae						———	
Aplidium quadriversum							———
Aplidium pseudoradiatum							———
Oligocarpa megalorchis							———
Cnemidocarpa rectofissura							———
Pyura pilosa							———
Molgula longivascula							———
Molgula pulchra							———
Molgula macquariensis							———
Pareugyrioides macquariensis							———

– – – – – = deep water. FN = northern North Island; CN = central North Island; CS = Cook Strait; SI & ST = South Island and Stewart Island; CH = Chatham Islands and Chatham Rise; C & A = Campbell and Auckland Islands; M = Macquarie Island.

recorded also from warm, more northerly areas such as Australia and Indonesia but only 4% of South Island species are known to occur in cool more southerly areas.

Taking the whole of the North Island as a unit conceals the fact that its endemic ascidian fauna consists entirely of species taken from only the area north of approximately the latitude of Auckland. Similarly, species endemic to the South Island and Stewart Island are all from the area south of about latitude 42°S.

The Chatham Islands and Chatham Rise have about half the number of species recorded from either the North or South Island, and one quarter of the total for the whole area studied. More than one quarter of them are unknown outside the Chatham area. The greatest faunistic affinity appears to be with the South Island, 60% of Chatham's species occurring there also, compared with 42% known also from the North Island, and 15% each from the Campbell Island—Auckland Island area and the Macquarie Island area.

Of the 13 species recognised from the Campbell and Auckland Islands, about one sixth are endemic, one third occur also at Macquarie Island and about half are known from the South Island or Stewart Island. Nearly half of the species are shared with the Chatham area and, surprisingly, about the same proportion with the North Island.

Seventeen species are listed from Macquarie Island, of which about one third are unknown elsewhere and nearly half are known from the cool, more southerly waters of the Subantarctic.

I believe that, because of the taxonomic difficulties surrounding many of the species, these figures can provide no more than a rough indication of faunistic relationships. Future more refined taxonomic studies may resolve some of the problems, bringing species here described as new into synonymy with old species, and correcting mistaken identifications. It is perhaps unlikely, however, that taxonomic revision will lead to a radically different view of the faunistic relationships.

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