

*BRYORACHIS* (PHIDOLOPORIDAE) AND *RETELEPRALIA* (CHEILOPORINIDAE):  
TWO NEW GENERA OF INDO-PACIFIC BRYOZOA

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Two new genera of ascophorine Cheilostomatida are recognised from northeastern Australia and the Norfolk Ridge. *Bryorachis* (family Phidoloporidae), with erect, unbranching or scarcely branching stems, has a colony form somewhat intermediate between that of *Reteporellina* and *Chevron*. Two species, both new, are ascribed to *Bryorachis*. *Retelepralia*, with a sole included species, also occurs in Mauritius. Provisionally included in the Cheiloporinidae, it is characterised by relatively large, ventricose zooids interconnected by short tubular processes. There is also a striated median gymnocystal strip frontally. □ *Bryozoa, Bryorachis, Retelepralia, taxonomy, deep-sea.*

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In the course of the authors' respective studies on the bryozoan faunas of the Norfolk Ridge and NE Australia, recent collections from deeper water have yielded new taxa common to both areas. These comprise two new species representing a new genus of the lace-coral family Phidoloporidae, and a third species, previously known only from Mauritius, representing a new genus of Cheiloporinidae.

The new phidoloporid genus is only the second in the family occurring on soft sediments and appears significant in its unique colonial morphology as transitional between a shelf/slope genus of rigid-erect species and a deep-sea genus whose species are found on terrigenous-foraminiferal oozes. The new cheiloporinid is unusual in the family, and among lepralioid ascophorines generally, in having encrusting zooids linked by tubular connections.

The purpose of this paper is to describe the new taxa, and assess their taxonomic and biogeographic affinities.

#### MATERIALS AND METHODS

Material was collected in the course of various oceanic cruises. Specimens from the Norfolk Ridge were collected during cruises of New Zealand Oceanographic Institute (NIWA) research vessels Taranui and Tangaroa. Specimens from the Coral Sea were collected during three *Cidaris* expedition cruises of R.V. Franklin.

Selected specimens were soaked in domestic bleach (hypochlorite solution) to remove organic tissues from the zooidal skeletons. These were

washed thoroughly in water and dried prior to carbon or gold coating for scanning electron microscopy.

Dimensions were calculated from the scale bars in SEM photographs and checked by calibration against graticule measurements using light microscopy.

#### SYSTEMATICS

Class GYMNOLEPIDA Allman, 1856  
Order CHEILOSTOMATIDA Busk, 1852  
Family PHIDOLOPORIDAE Gabb & Horn, 1862

#### *Bryorachis* gen. nov.

ETYMOLOGY. The generic name is derived partly from the phylum name Bryozoa, and *rachis*, a Greek feminine noun meaning backbone, alluding to the appearance of the stems.

TYPE SPECIES. *Bryorachis pichoni* sp. nov.

DIAGNOSIS. Colony erect, rod-like and unbranched, or with limited branching basally and laterally, with distinct frontal and abfrontal surfaces. Stems 3-5-serial, the axial and adjacent longitudinal series of zooids opening frontally, additional series originating abfrontally but directed laterally. Zooidal peristomes projecting, the paired lateral ones giving the stems the appearance of vertebral columns; peristomial orifices lack spines but may be denticulate. Primary orifices suborbicular with a broad shallow sinus, the distal arch beaded. Autozooids with a depressed granular-tubercular area frontally in which a pair of areolar pores are recessed proximally. Avicularia absent from the axial row of zooids, present adventitiously on most of the

others except at proximal ends of stems, with short rounded or triangular rostrum. Ovicells cucullate, smooth and imperforate, widely open frontally and non-labellate. Abfrontal kenozooids small, disposed at regular intervals adjacent to the dorsal walls of the lateral zooids and often bearing small avicularia.

***Bryorachis pichoni* sp. nov.**  
(Figs 1, 2A,B)

ETYMOLOGY. For the chief scientist on the Cidaris expeditions, Professor Michel Pichon (École Pratique des Hautes Études, Université de Perpignan, France).

MATERIAL. HOLOTYPE: QMG21274, J-shaped colony, Cidaris 3 Stn 6.4, 11 Nov. 1992, 10°00.82'S, 145°00.15'E, 1777m, Calypso dredge, coll. M. Pichon, R.A. Birtles, P.W. Arnold, in alcohol. PARATYPES: QMG21275, L-shaped colony, same locality as holotype, mounted on SEM stub; QMG21276, 4 additional fragments, in alcohol. ADDITIONAL MATERIAL: Cidaris 1 Stn 20.3, 10 May 1986, 17°46.5'S, 147°48.8'E, 1223–1224m, Ockelmann epibenthic sledge, coll. M. Pichon, R.A. Birtles, P.W. Arnold, 1 specimen in alcohol (QMG21277), 1 mounted on SEM stub (QM21278). Cidaris 1 Stn 35.1E, 13 May 1986, 16°50.7'S, 147°08.1'E, 1604m, Smith-MacIntyre grab, coll. M. Riddle, D. Alongi, 1 specimen in alcohol (QM21279). Cidaris 3 Stn 6.3, 11 Feb. 1992, 10°01.2'S, 145°01.5'E, 1777–1779m, Ockelmann epibenthic sledge, coll. M. Pichon, R.A. Birtles, P.W. Arnold, 1 specimen mounted on SEM stub (QM21280).

DESCRIPTION. Colony (known only from fragments) erect, rod-like, maximum length 8.0mm, generally unbranched but limited branching basally can create roughly L- or J-shaped colonies; 1 colony has a short lateral branch. Stems 3–5-serial, 0.54–0.69mm wide between peristomial projections, 1.9–2.5mm at peristomial projections.

Zooids in the axial longitudinal row 0.89–0.98mm long and 0.33–0.52mm wide. Frontal shield in these zooids with an extensive granular-tubercular depressed area, 0.38–0.53mm long and 0.21–0.33mm wide, at the proximal end of which is a pair of recessed areolar pores, 0.06–0.09mm wide, best seen in oblique view. Peristomes sub-tubular, projecting, especially in lateral zooids, the secondary orifice 0.23–0.27mm diameter with an irregular rim; with labial pore (spiramen) and

median suture inset in a groove. Primary orifice suborbicular, the distal arch of the anter beaded, with broad sinusoid poster; no condyles. Autozooids flanking axial series of zooids similar to them but the granular-tubercular area not significantly depressed and lacking areolar pores, the orifices facing about 40° away from main axis; both these zooids and the axial ones bear ovicells. Most lateral autozooids originate abfrontally at an oblique angle but the peristomes on each side are directed laterally in opposite pairs; labial pore and groove visible frontally, but also with a distinct groove and pore abfrontally; not seen to bear ovicells.

Ovicells recumbent, cucullate, 0.25–0.35mm long and 0.28–0.35mm wide, smooth and imperforate and widely open frontally; no labellum or lateral slits but the sides of the ovicell descending somewhat proximally.

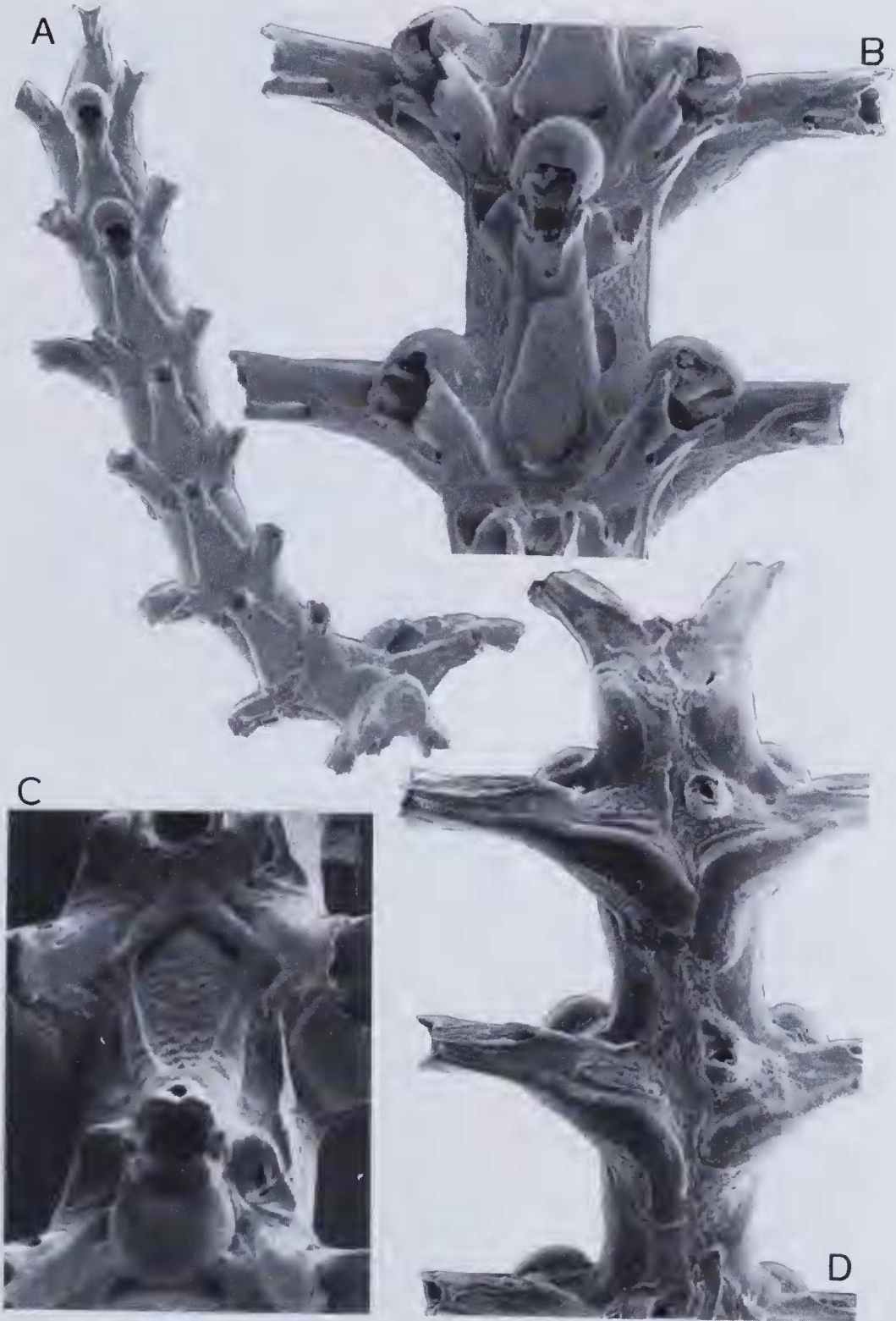
Avicularia adventitious, borne mostly on the zooids flanking the axial series, occasionally on the most lateral zooids, never on the axial ones; somewhat oval in shape with a variable rostrum (rounded-triangular to acute) and complete cross-bar, positioned adjacent to the peristomes of the axial autozooids.

Abfrontal kenozooids roughly triangular, infilling axillary region between dorsal walls of autozooids; surface granular, usually with 2 small pores and occasionally an avicularium like the frontal ones.

Ancestrula with globular base, orientated at right angles to main growth axis. Peristomes of the first 3–5 zooids (including ancestrula) directed to base of colony, with a reversal in orientation of subsequent zooids to form a single growth axis or short branches.

REMARKS. Among the various specimens taken at different stations, the most significant variation is in the form of the avicularia. Specimens from Cidaris 1 Station 20.3 (17°46'S, 1223–1224m) have more acutely triangular mandibles on both frontal and abfrontal surfaces than in specimens from Cidaris 3 Stations 6.3 and 6.4 (c. 10°01'S, 1777–1779m). The opesial region of the avicularium is contained in a more prominently exerted base in specimens from Cidaris 1 Stn 20.3.

FIG. 1. A–D, *Bryorachis pichoni* gen. et sp. nov. (registered material from the Coral Sea). A, frontal view of L-shaped paratype colony (QMG21275),  $\times 23$ . B, central part of stem with ovicelled zooids,  $\times 44$ . C, frontal view, tilted to show the characteristic paired proximofrontal areolar pores,  $\times 63$ . D, abfrontal view of distal end of stem showing arrangement of peristomes and avicularia,  $\times 37$ ; (B–D, QMG21278).



***Bryorachis curiosa* sp. nov.**  
(Fig. 2C,D)

**MATERIAL.** HOLOTYPE. NIWA (N.Z. Oceanographic Institute) registration no. H-671, from NZOI Stn G10, 32°09.5'S, 168°15.0'E (southern part of Norfolk Ridge NE of Wanganella Bank, just inside the Australian EEZ of Norfolk I.), 970m, coll. 29 Sept. 1966 during the Noumea Cruise of R.V. Taranui. Only known specimen, coated frontally for SEM examination.

**DESCRIPTION.** Colony erect, rod-like, unbranched, the sole fragment 6.0mm long, the proximal end rounded. Stem 5-serial, 0.65-0.71mm wide between peristomial projections, 1.19-1.50mm at peristomial projections.

Autozooids in the axial longitudinal row 0.77-0.94mm long. Frontal shield of these zooids with a conspicuous granular-tubercular depressed area, 0.33-0.39mm long and 0.27-0.36mm wide, at the proximal end of which is a pair of recessed areolar pores each up to 0.09mm wide, visible frontally but especially conspicuous when viewed obliquely. Zooidal peristomes subtubular, scarcely evident on the axial zooids, most developed on the lateral ones, the secondary orifice 0.22-0.24mm wide with a U-shaped pseudosinus that is not further constricted to become a closed labial pore and suture. Primary orifice suborbicular, the distal arch of the anter beaded, with broad sinusoid poster; no condyles. Autozooids flanking axial autozooids similar to them, granular-tubercular over most of the surface but lacking the depressed area and areolar pores; peristomes facing slightly away from main axis.

Ovicells not present. Avicularia adventitious, borne on most autozooids except the axial series, with a very narrow opesial region separated by a complete crossbar from the rounded rostrum; positioned adjacent to the peristomes of the axial autozooids.

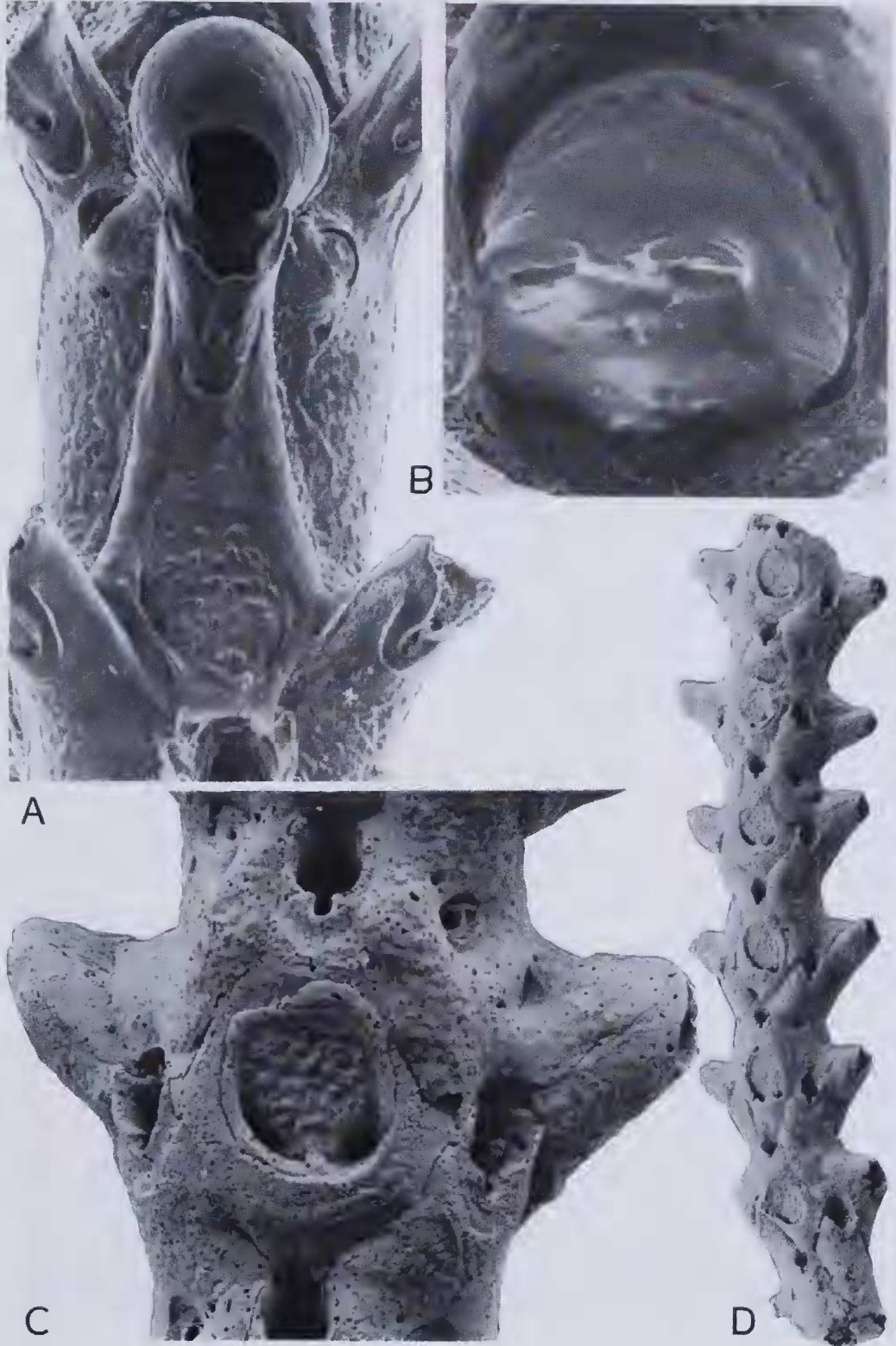
Abfrontal surface granular-tubercular; kenozooids somewhat pyriform to rounded-triangular, situated on the 'backs' of the most lateral zooids, adjacent pairs of kenozooids separated by an irregularly zigzag median groove coursing down the back of the stem. Each kenozooid typically with an avicularium identical to the frontal ones.

**REMARKS.** The sole colony fragment of *B. curiosa* is somewhat worn, and lacked membranes and soft tissue when collected. It may have been transported; the peristomes of all the zooids are eroded distally, although it appears that the peristomes of the axial series of autozooids did not project as far in life as those of the marginal zooids. Despite the condition of the specimen, it is clearly congeneric with *B. pichoni*. Both species share the following characteristics: same colony morphology, i.e., having the appearance of a vertebral column; the axial series of autozooids lack avicularia and have a depressed frontal area with two proximal areolar pores; regularly disposed abfrontal kenozooids with adventitious avicularia; same shape of primary orifice.

*Bryorachis curiosa* differs from the type species in having a rounder, more conspicuous depressed area frontally, in some zooids bordered by an inner rim; one zooid has two depressed areas in one and it appears that this and the bordering rims in other zooids are the product of some kind of frontal budding, although for what purpose is unclear. It is conceivable that 1-2 rhizoids could issue from the areolar pores, descend basally, and anchor the colony to the substratum, but we have no evidence of rhizoids in either species. Other differences between the two species include the lack of a closed labial pore in *B. curiosa* and rounder avicularian rostra.

**ECOLOGY.** *B. curiosa* is known from only one station, at 970m depth on the southern part of the Norfolk Ridge NE of Wanganella Bank. The sole specimen was taken in a 10-min pipe-dredge sampling which yielded a meagre collection of sand and gravel with pteropod shells, stylasterid hydroids, solitary corals, and bryozoan fragments. Notwithstanding the small size of the collection, the many broken fragments give evidence of an impressive diversity of erect growth forms among the several genera of stylasterids and bryozoans. The latter include *Crassimarginatella vincularia* Gordon (Calloporidae), *Nellia tenella* (Lamarck) (Quadricellariidae), *Bryopastor* sp. (Chaperiidae), *Poricellaria* sp. (Poricellariidae), *Atelestozoum* sp., *Cellaria* spp., *Euginoma* sp., *Syringotrema* sp. (Cellariidae), *Siphonicytara* sp. (Siphonicytaridae), *Raxifabia* sp. (Bifaxariidae).

FIG. 2. A-B. *Bryorachis pichoni* gen. et sp. nov. (registered material from the Coral Sea). A, close-up of ovicelled zooid (QMG21275),  $\times 95$ . B, primary orifice, showing blunted distal beading and the shallow arcuate proximal rim.  $\times 492$ . C-D. *Bryorachis curiosa* gen. et sp. nov. (registered material from NIWA Stn G10, Norfolk Ridge). C, part of transported stem showing arrangement of zooids and the subcircular depressed area of an axial zooid with a secondary rim from apparent frontal budding,  $\times 70$ . D, entire transported stem,  $\times 17$ ; (C-D, NIWA holotype H-671).



dae), *Plagiopora recens* Gordon (Catenicellidae), *Kladapheles gammadeka* Gordon (Lepraliellidae), *Mawatarius inexpectabilis* (Gordon), *Mawatarius* sp. (Mawatariidae), and an undescribed genus of Celleporidae. The only encrusting or nodular bryozoans were species of *Smittina* (Smittinidae) and *Celleporina* (Celleporidae). The diversity of erect forms anchored by rootlets probably reflects the primarily unstable soft-sediment habitat. The few encrusting or nodular species would be limited to small areas provided by gravel particles, pteropod shells, and fragments of corals and bryozoans.

#### Family CHEILOPORINIDAE Bassler, 1936

##### *Retelepralia* gen. nov.

ETYMOLOGY. The name is constructed of rete, a Latin neuter noun meaning net or network, and Lepralia, a well-known abandoned genus of cheilostomate bryozoans from which the adjective lepralioid is derived.

TYPE SPECIES. *Lepralia mosaica* Kirkpatrick, 1888.

DIAGNOSIS. Colony encrusting, tending to pluriserial. Autozooids large, linked quincuncially by short tubular processes. Frontal shield lepralioid, highly convex, evenly and densely pseudoporous, with or without a smooth thin ridge in the midline longitudinally. Orifice distinctly divided into anter and poster, the latter broad, straight or barely convex, separated from anter by a pair of stout condyles. No oral spines. No avicularia. Ovicells relatively short, endooecium granular-tubercular and imperforate, ectooecium membranous, the combined orifice larger than that of autozooids and closed by the zooidal operculum.

##### *Retelepralia mosaica* (Kirkpatrick, 1888) (Fig. 3A-D)

*Lepralia mosaica*, Kirkpatrick, 1888: 79, pl. 8, fig. 6.  
*Hippopodina mosaica*, Hayward 1988: 319, fig. 6a,b.

MATERIAL. NIWA: A small infertile colony from NZOI Station 190, 29°25.0'S, 168°05.6'E, Norfolk Ridge SE of Phillip I., 71m depth, coll. 23 July 1975 during the Norfolk Ridge Cruise of R.V. Tangaroa. Museum of Tropical Queensland: QMG21281, a relatively large fertile colony on SEM stub, from RV. James Kirby Stn 1467, 18°57'S, 146°58'E, mid-shelf, central Great Barrier Reef, 24m depth, coll. 9 Aug. 1986 using Ockelmann epibenthic sled by R.A.

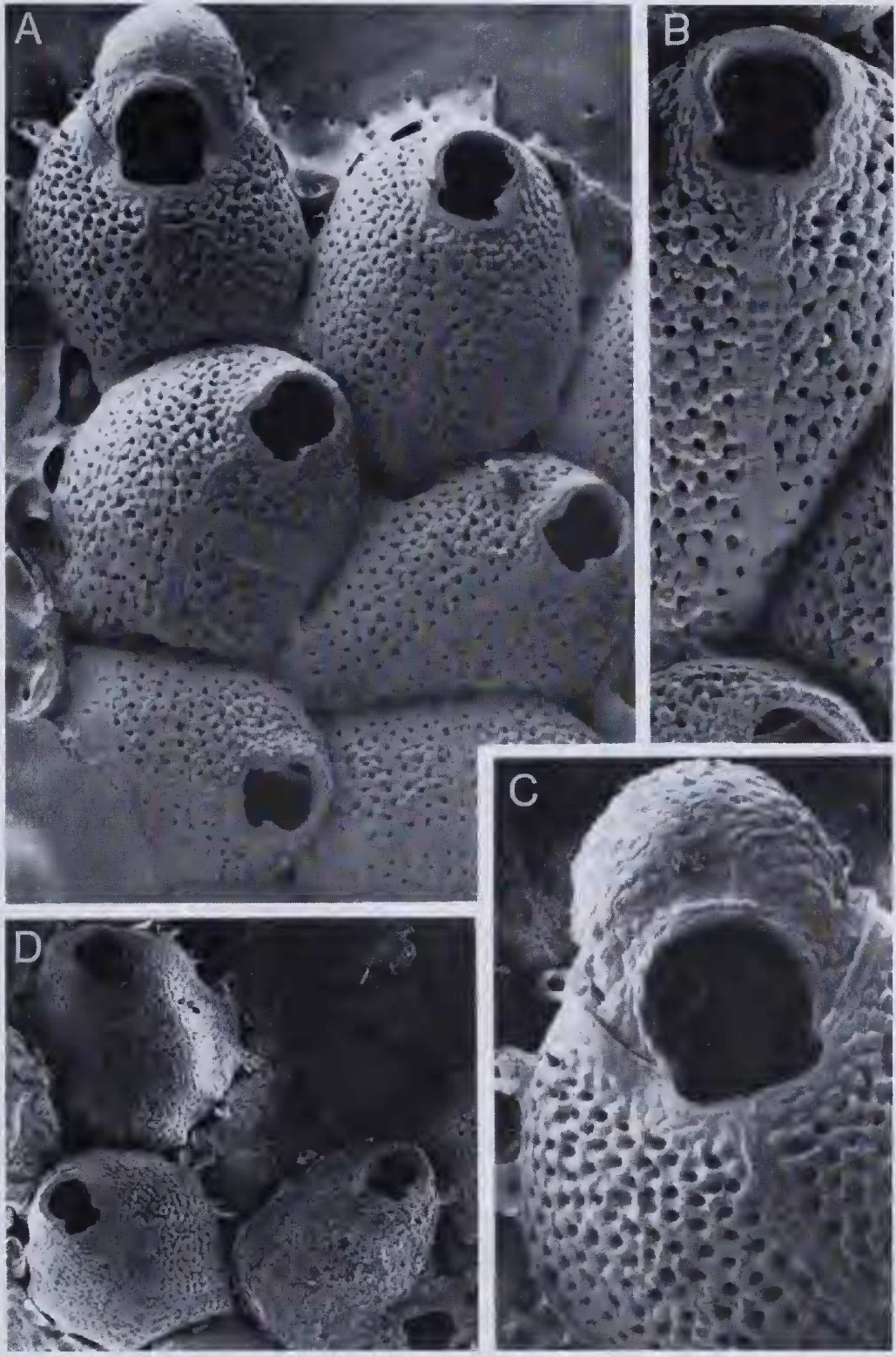
Birtles and P. Arnold. The Natural History Museum, London, BMNH reg. no. 1934.10.6.20, *Lepralia mosaica* Kirkpatrick, 1888, from Mauritius.

DESCRIPTION. Colony encrusting, forming relatively small planar patches less than 1 cm across, the zooids generally arranged quincuncially or, depending on the substratum, somewhat pluriserially. Zooids large, 0.77-0.92mm long and 0.57-0.72mm wide, each connected to its neighbours by c. 5-7 short tubes around the latero-proximal margins basally; these separated by uniporous septula from the parent zooids. Frontal shield lepralioid-cryptocystidean, densely and evenly pseudoporous with small tubercles between the pores; the shield arching convexly from the midline to join the basal wall on each side laterally; at the place where the frontal and basal walls meet may be a slight gymnocystal ridge, representing a thin, upwards extension of the basal wall. This ridge is continuous with a thin median strip of calcification that extends along the midline of each zooid towards the orifice; a series of transversely parallel ridges and grooves may occur along the median strip.

Orifice longer (c. 0.18mm) than wide (c. 0.15mm), with a large, evenly rounded anter separated from a broad poster by a pair of stout condyles, the proximal rim of the poster gently convex or nearly straight. The orificial rim comprises a thin gymnocystal strip that is continuous with the one in the zooidal midline. No oral spines. No avicularia.

Ovicell subglobose, relatively small compared to the overall volume of the autozooid, the endooecium granular-tubercular and imperforate, the ectooecium membranous. The frontal opening of the ovicell larger than autozooidal orifices, widely arching above the anter of the maternal zooid such that its sides extend to the level of the condyles; thus the ovicell is fully sealed when the zooidal operculum is closed. The edge of the opening and the lateral margins of the ovicell are bordered by a thin gymnocystal strip where the membranous ectooecium attaches that parallels another on each side of the orifice coursing distolaterally to the edge of the zooid. The ovicell illustrated (Fig. 3A,C) was raised and free of the substrate on a terminal autozooid so there could

FIG. 3. A-D, *Retelepralia mosaica* (Kirkpatrick). A, several zooids of a colony, including one ovicelled zooid at the colony margin,  $\times 67$ . B, close-up of a zooid showing well-developed striations along the median strip,  $\times 10$ . C, close-up of ovicellular endooecium and fertile orifice,  $\times 123$  (A-C, QMG21281 from mid-shelf, GBR). D, three zooids, one quite worn,  $\times 42$  (unregistered colony from NIWA Stn 190, near Phillip I., Norfolk Ridge).



be no contribution to the frontal shield of the ovicell from a distally placed autozoid.

Ancestrula unknown.

REMARKS. Examination of part of Kirkpatrick's Mauritian material of *Lepralia mosaica* demonstrates conspecificity with our specimens. Whereas neither Kirkpatrick (1888) nor Hayward (1988) illustrated or mentioned the median gymnocystal strip on the frontal shield, it is nevertheless present in the loaned Mauritian specimen. In zooids in which the outer epitheca is present, however, it can be difficult to detect, which explains its not having been noticed previously.

ECOLOGY. No information is available on the provenance of Kirkpatrick's material other than that it was collected from Mauritian waters. In the Australasian region, *Retelepralia mosaica* occurs at shallow shelf depths. At NZOI Stn I90 SE of Phillip I., *R. mosaica* was taken at 71m depth by a medium Agassiz trawl from a bottom of biogenic rubble dominated by a species of pectinid bivalve, with octocorals, gastropods and hermit crabs, *Asterodiscus* (Asteroidea), and a variety of echinoids. The sole colony of *R. mosaica* encrusts bryozoans and foraminiferans on a shelly substratum. The Barrier Reef material was collected from soft sediment with calcareous green algae, coralline-algal rhodoliths, seagrass, and extensive biogenic rubble. The site had the greatest species richness and species diversity of molluscs and echinoderms of any along a cross-shelf transect (Birtles & Arnold, 1988). *Retelepralia mosaica* grew on the skeleton of a discoidal foraminiferan *Marginopora vertebralis* de Blainville, which was also overgrown by an unidentified cyclostomate bryozoan and cheilostomate bryozoans of the genera *Trypostega* and *Exechonella*. The similarity of habitats between the GBR and NZ sites, particularly, and the failure to recollect *R. mosaica* on coral reefs of Mauritius (Hayward, 1988) suggest that this species may be characteristic of biogenic rubble on an otherwise soft-sediment seafloor.

#### DISCUSSION

*Bryorachis* is a significant new addition to the family Phidoloporidae inasmuch as it has colonial and zooidal morphologies transitional between *Reteporellina* Harmer, 1933, a genus ranging from the shallow subtidal to shelf and slope depths, and *Chevron* Gordon, 1989, an unusual genus of small V-shaped colonies occurring on deep-sea oozes. *Reteporellina* comprises a number of species of erect, mostly open-branched

bryozoans, some fairly small. The colonies are characteristically fixed to a hard substratum. Among the characteristic features of the genus are the generally projecting subtubular peristome with an irregular rim and an open or closed pseudosinus, as well as the ovicell with conspicuous lateral processes and median labellum. The peristomial characters of *Bryorachis* accord well with those of *Reteporellina*, but not the ovicellular (or indeed colonial) ones. On the other hand, *Bryorachis* has a significant number of characters in common with *Chevron*. These include: similar peristomial features (i.e., either a pseudosinus or closed labial pore and suture) and primary orifice, a frontal granular-tubercular area, similar adventitious avicularia, and, in one of the two *Chevron* species, an identical ovicell. We would argue, based on morphological congruence and geographical distribution, that *Reteporellina* represents the most generalised taxon of the three considered here, with increasing specialisation shown by *Bryorachis* and *Chevron*. It would be useful to know precisely how colonies of the latter two genera are anchored to the substratum. Rootlets seem likely, but we have no evidence for these as yet.

The affinities of *Retelepralia* are not certain. In the absence of ovicells, Hayward (1988) included *Lepralia mosaica* in the genus *Hippopodina* (Hippopodinidae). The absence of avicularia would be unusual in *Hippopodina*, which also has perforated ovicells, and, now that the ovicell is known, the combined characters seem more supportive of a relationship with the genera of Cheiloporinidae. These have a similar orifice and, typically, small or very reduced imperforate ovicells. On the other hand, the tubular connections and median frontal gymnocystal strip in *Retelepralia* are hardly characteristic of the family so the question of affinity remains open.

#### ACKNOWLEDGEMENTS

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