

TRANSACTIONS
OF THE
ROYAL SOCIETY OF NEW ZEALAND

ZOOLOGY

Vol. 7

No. 10

19 JANUARY 1966

Note on the Relationship Between Kenozoecia and Avicularia
In Some Cribrilinidae (Polyzoa)

By N. A. POWELL

[Received by the Editor, 29 April 1965.]

Abstract

THE formation of avicularia from kenozoecia is a fairly common phenomenon among certain Cribrilinidae. Further instances of this relationship are documented for *Membraniporella distans* MacGillivray and *Figularia spinea* Brown. From these examples it is concluded that avicularia, kenozoecia and zoecia intergrade in structure and are interchangeable in regeneration in some Anasca and primitive Ascophora. A greater degree of precision in the use of certain morphological terminology is desirable.

INTRODUCTION

KENOZOOECIA are highly polymorphic Polyzoan individuals without a polypide or orifice. They commonly occur in some Recent genera of Cribrilinidae, notably *Membraniporella*, *Reginella* and *Figularia*, in the form of small rounded chambers with central apertures, covered by a thin chitinous membrane. In the Anascan genus *Retevirgula* (Brown, 1952, p. 74) and the primitive Ascophoran genus *Chorizopora* (Waters, 1925, p. 346; Harmer, 1957, p. 948) such structures are often replaced by avicularia. A similar relationship between kenozoecia and avicularia obtains in the Cribrilinidae, but requires further documentation.

Membraniporella distans MacGillivray, a Recent Australian (Peronian) species, often has kenozoecia scattered throughout the zoaria. MacGillivray (1883, p. 30) made no mention of these chambers in his original description, and examination of the holotype (National Museum Victoria Cat. No. 62846) confirms their absence in that specimen. They occur, however, in two Victorian specimens examined (Australian Museum Cat. No. G.4653, N.M.V. Cat. No. 63758). The former specimen (Pl. 1, fig. 1) is of particular interest because in one or two instances the central pore is larger, the tapered portion of the opesia being slightly recessed within the peripheral gymnocyst in a manner reminiscent of the rostral palate of normal avicularia. The writer hesitates to interpret such chambers as true avicularia as found for example, in *Membraniporella agassizi* Smitt, because mandibles and condyles are not developed.

Vicarious avicularia encountered in *Figularia spinea* Brown (Pl. 1, figs. 2, 3), an indigenous New Zealand species, always form from kenozoecia. The avicularia in Brown's species are normally situated at the bifurcation of the zooid rows

Published by the Royal Society of New Zealand, c/o Victoria University of
Wellington, P.O. Box 196, Wellington.

(Fig. 3), the spatulate rostrum of the functional avicularium being developed on the distal region of the kenozoecium. The prominent opesia, formed by the enlargement of the central aperture, is divided by a pair of projecting spinose condyles into a distal sub-triangular region and a proximal semi-circular area (Fig. 2). The avicularian opesia now developed, is restricted distally by the recessed rostral palate and proximally by the gymnocyst (i.e., the frontal wall of the kenozoecium).

Kenozoecia in *F. spinea* Brown may be formed also as regenerative structures within zooecia as shown by a Stewart Island specimen (Fig. 3). One zooecium in this particular colony is readily distinguished from the others by its orifice, which is sealed off by a calcareous occlusion. Removal of the frontal shield revealed the oval chamber of a kenozoecium emplaced within the zooecial chamber.

Levinson (1907, fig. 11) encountered a very similar regenerative process in *Membranipora fossata* Levinson, a species which he (p. 155) cited as evidence of "double regeneration". In that instance, a zooecium has regenerated another within its zooecial cavity. This in turn has regenerated a vicarious avicularium. The feature of immediate importance, however, concerns the kenozoecium situated within an adjacent zooecium, the significance of which Levinson overlooked. This could be interpreted (like the Stewart Island material) as a regenerative phase, perhaps intermediate between the zooecium and the functional avicularium. These processes clearly emphasise the high degree of polymorphism exhibited by certain Anascan and primitive Ascophoran species.

Waters (1887, Pl. 7, fig. 18) depicted a kenozoecium in the fossil material he identified as *Membraniporella nitida* Johnston var. (= *F. spinea* Brown, 1952, p. 181) from Waipukurau, New Zealand (Pliocene), but made no comment on the structure in his description. The writer cannot decide whether it is interzooecial, or whether it occupies the cavity of an old zooecium and thus vicarious, therefore constituting a regenerative condition similar to that encountered in the Stewart Island material. Waters' figure is rather ambiguous on this point. Avicularia were not found in any of the New Zealand fossil material Brown (1952, p. 183) assigned to this species, although Waters (1887, p. 52) did record a large spatulate avicularium in a Recent specimen. A specimen from Weka Pass (Middle Miocene) however, which Brown (1952, p. 183) attributed to *Figularia huttoni* Brown (the writer in manuscript, considers this species to be conspecific with *F. spinea* Brown) appears to agree with the Recent material as regards the mode of origin of avicularia. The rostral opesia in the fossil specimen is depicted (Brown: text-fig. 127) as a rounded pore, suggesting that it has been retained intact from the central pore of a kenozoecium. Normally, the rostral opesia becomes expanded into a large sub-triangular aperture (Fig. 3).

DISCUSSION

The morphological significance of kenozoecia in the Cheilostomata is not fully understood. Norman (1903, p. 102) and Hastings (1964, p. 258) have shown that in some Cribrilinidae kenozoecia play an important part in the building of the colony. Brown's (1952, p. 75, text-fig. 27) observations show that in *Retevirgula acuta* (Hincks), the zooecia may be budded off from such structures. Harmer (1957, p. 948) commented on the occurrence of similar chambers in *Chorizopora*. In several cribrilinid and membraniporine genera avicularia replace kenozoecia. A regenerative condition involving a kenozoecium, intermediate between the adult zooecium and the functional avicularium has also been observed in one species of *Figularia* and *Membranipora*.



FIG. 1.—*Membraniporella distans* MacGillivray x 32. A.M. Cat. No. G.4653. Locality, Victoria. Note the kenozoecium and an adjacent heterozoecium (encircled). Two additional heterozoecia are visible at the right and left distal margins of the colony. FIG. 2.—*Figularia spinea* Brown x 32. B.M. Cat. No. 1964.8.12.28A. Terra Nova Station 90. Locality: Off Three Kings Islands, North New Zealand, 100 fathoms. Interzooecial kenozoecium indicated. A functional avicularium is situated at the right margin. FIG. 3.—*Figularia spinea* Brown x 32. Locality, Stewart Island, New Zealand, 35 fathoms. Universitets Museum, Copenhagen (Mortensen Collection). A kenozoecium, generated from within a zooecium is encircled. Note the two sub-jacent avicularia.

In some circumstances, it is evident that kenozooezia may arise at certain positions in the colony where normal zooecial budding is prevented. For example in Fig. 1 a kenozooezium and an adjacent abortive (?) avicularium are situated at the intersection of two opposing directions of growth, a situation not conducive perhaps to normal zooecial development.

It is clearly evident that avicularia, kenozooezia and zooecia intergrade in structure in certain Anascan and primitive Ascophoran species. All three individuals may also interchange in regeneration. A greater degree of precision in the use of certain morphological nomenclature seems desirable to describe such extreme polymorphism. I refer particularly to the terms zooeciule and kenozooezium on the one hand and vicarious and interzooecial as applied to the avicularium on the other.

Bassler's (1953, p. G. 16) definition of the term zooeciule "as an immature zooecium or kenozooezium occurring sporadically among normal zooecia . . ." is confusing, as it involves two different structures. I apply the term zooeciule strictly to dwarfed zooecia (i.e., small zooecia with an orifice and polypide, as found in *Trypotegea venusta* (Norman)).

The structures Brown (1952, pp. 48, 75) termed zooeciules in *Electra ongleyi* Brown and *Retevirgula acuta* (Hincks) are quite unlike adult zooecia and are more correctly to be interpreted as reduced individuals without a polypide or orifice—i.e., kenozooezia in the sense of the original definition of Levinsen (1909, p. 46).

Vicarious avicularia have usually been defined as avicularia that reach the basal surface of the colony, as opposed to adventitious avicularia budded from the surface of the zooecium. Hastings (1963, p. 181, footnote) applies the term "vicarious" to those avicularia obviously taking the place of zooecia in the budding scheme, calling the remainder of those that reach the basal surface *interzooecial*. As Hastings notes, the two types of heterozooezia intergrade, but confusion sometimes arises as a result of this ambiguity in terminology especially when it is applied to highly polymorphic species. Under generally accepted usage for example, the functional avicularium in Fig. 2 formed from a kenozooezium, is interzooecial, in Fig. 3 however, they may now quite legitimately be termed vicarious—i.e., they fit into a series of zooecia as if they themselves were zooecia.

It is considered that a more precise terminology would call all avicularia that reach the basal surface vicarious, specifying wherever possible the type of structure they replace—namely, kenozooezia or zooecia as in *Figularia spinea* Brown or pore-chambers as in *Microporella coronata* (Audouin) (Hastings, 1963, p. 179).

ACKNOWLEDGMENTS

This study was undertaken during the tenure of a post-graduate scholarship awarded by the Australian National University. I am grateful to Professor D. A. Brown, of the Geology Department, for his supervision and helpful guidance.

My gratitude is also due to the Director of the Universitetets Zoologiske Museum, Copenhagen, who made available a specimen of *Figularia spinea* Brown from the Mortensen Collection of New Zealand Polyzoa (Ascophora); to the Director and Dr J. C. Yaldwyn of the Australian Museum, Sydney, for the loan of a specimen of *Membraniporella distans* MacGillivray; to Miss J. Hope Macpherson, National Museum Victoria, who examined the holotype. I should also like to thank Dr Anna B. Hastings, of the British Museum (Natural History), who kindly forwarded comparative specimens of *F. spinea* Brown for examination and offered valuable comments on the manuscript.

LITERATURE CITED

- BASSLER, R. S., 1953. Treatise on Invertebrate Paleontology. Part G. Bryozoa. *Geol. Soc. America and Univ. Kansas Press.* i-xiii, G1-G.253.
- BROWN, D. A., 1952. The Tertiary Cheilostomatous Polyzoa of New Zealand 1-xii, 1-405. British Museum (Natural History).
- HARMER, S. F., 1957. The Polyzoa of the Siboga Expedition, IV. Cheilostomata Ascophora, II. *Rep. Siboga Exped.*, XXVIII, i-xv, 641-1147, Pls. 42-74. Leiden.
- HASTINGS, A. B., 1963. Notes on Polyzoa (Bryozoa) VI. Some Setiform Heterozoecia. *Ann. Mag. Nat. Hist. London* (6) XIII, 177-89.
- 1964. The Cheilostomatous Polyzoa *Neoeuthyris woosteri* (MacGillivray) and *Reginella doliaris* (Maplestone). *Bull. Brit. Mus. (Nat. Hist.) Zoology* 11, 3, 243-62, Pls. 1-4.
- LEVINSEN, G. M. R., 1907. Sur la Régénération totale des Bryozoaires. *Overs K. Dansk Vidensk. Selsk. Forhandl. Kobenhavn.* 151-59, Pl. 1.
- 1909. Morphological and Systematic Studies on the Cheilostomatous Bryozoa. vii + 431 pp., 24pls. Copenhagen.
- MACGILLIVRAY, P. H., 1833. Descriptions of New or Little Known Polyzoa. I. *Trans. Proc. Roy. Soc. Victoria.* XIX, 130-38, Pls. 1-3.
- NORMAN, A. M., 1903. Notes on the Natural History of East Finmark. *Ann. Mag. Nat. Hist. London* (7) XII, 87-128, Pls. 8, 9.
- POWELL, N. A., 1964. The Morphology, Systematics and Distribution of some Recent Polyzoa (Bryozoa) from North New Zealand. (Unpublished Ph.D. thesis in the Library of the Institute of Advanced Studies, A.N.U., Canberra.)
- WATERS, A. W., 1887. On Tertiary Chilostomatous Bryozoa from New Zealand. *Quart. Journ. Geol. Soc. London*, XLIII, 40-72, Pls. 6-8.
- 1923. Mediterranean and Other Cribriliniidae, together with their relationship to Cretaceous forms. *Ann. Mag. Nat. Hist. London* (9) XII, 545-73, Pls. 17, 18.
- 1925. Ancestrulae of Cheilostomatous Bryozoa, II. *Ann. Mag. Nat. Hist. London* (9) XV, 341-52, Pls. 21, 22.

DR N. A. POWELL,
National Museum of Canada,
Ottawa 4,
Canada.