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Variability of Ooeciostome Shape and Position in Antarctic Idmidroniform Bryozoans (Bryozoa: Cyclostomatida)

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Abstract. Variability in the shape and position of the ooeciostome in Antarctic idmidroniform cyclostome bryozoans is described in detail. All characters analysed (size and shape of ooeciostome and ooeciopore, ooeciostome position, orientation of ooeciopore) exhibit variability. Therefore, they may be categorized as useful rather than diagnostic taxonomic characters. Recent idmidroniform bryozoans are arranged in a morphoseries reflecting some possible stages in the evolution of the ooeciostome. Possible trends include loss of terminal position, length decrease, increased curvature and flattening. The ooeciostome of *Idmidronea fraudulenta* Ostrovsky & Taylor, 1996 is studied by SEM for the first time.

Key words. *Exidmonea, Idmidronea*, gonozooid, taxonomy, variability, evolution.

1. INTRODUCTION

The use of reproductive skeletal structures (brood chambers and their apertures) is of considerable and, sometimes, critical importance in the taxonomy of cyclostome bryozoans. Many authors have noted a marked stability of the form, position and orientation of these structures. WATERS noted that "the position and nature of the opening of the ovicell is most important, often, in fact more so than the shape of the ovicell" (1889: 276). The opinion of HARMER was "that this structure [ooeciostome] will become increasingly important in the systematic study of the Cyclostomata" (1898: 81). BORG (1926: 347) repeated HARMER's point of view, and OSBURN (1953: 616) agreed with previous authors that "position and form of the gonopores (ooeciopores) and their tubes (ooeciostomes) are ... fairly constant". KLUGE's (1975: 84–85) statement is no less categorical: "the form and location of their oviduct (oeciostome) and its orifice (oeciopore) are permanent and these can serve as dependable criteria". HAYWARD and RYLAND (1985: 32) noted that "the structure of the brood chambers and its ooeciostome are very useful taxanomic characteristics and reference to these will usually allow rapid identification". VISKOVA (1992) followed the verdict of KLUGE.

Only rarely is the variability of cyclostome reproductive structures mentioned. OSBURN (1953: 616), for example, noted in passing that "even here a certain amount of causion is necessary". HILLMER (1968), WALTER (1969) and BROOD (1972: 57) were among the first to note "the great variation in the ovicellar shape" (see also WALTER 1989). As to the ooeciostome, its "grande variabilité" was beautifully illustrated by HARMELIN (1976: 67, pl. I, figs. 6–8, pl. III, fig. 3, etc). Inconstancy of ooeciostome shape was mentioned by OSTROVSKY and TAYLOR (1996).

During the study of erect idmidromiform bryozoans from the Antarctic, many different kinds of ooeciostome morphology and position were encountered. The objective of this paper is to describe these variations and to investigate their possible evolutionary significance.

2. MATERIAL AND METHODS

More than 550 fertile colonies and fragments with ooeciostomes belonging to seven idmidroniform species (*Exidmonea arcuata* Ostrovsky & Taylor, 1996, *Idmidronea hula* Borg, 1944, *I. antarctica* Borg, 1944, *I. pseudocrisina* Borg, 1944, *I. obtecta* Borg, 1944, *I. pellucida* Ostrovsky & Taylor, 1996, and *I. fraudulenta* Ostrovsky & Taylor, 1996) were exam-

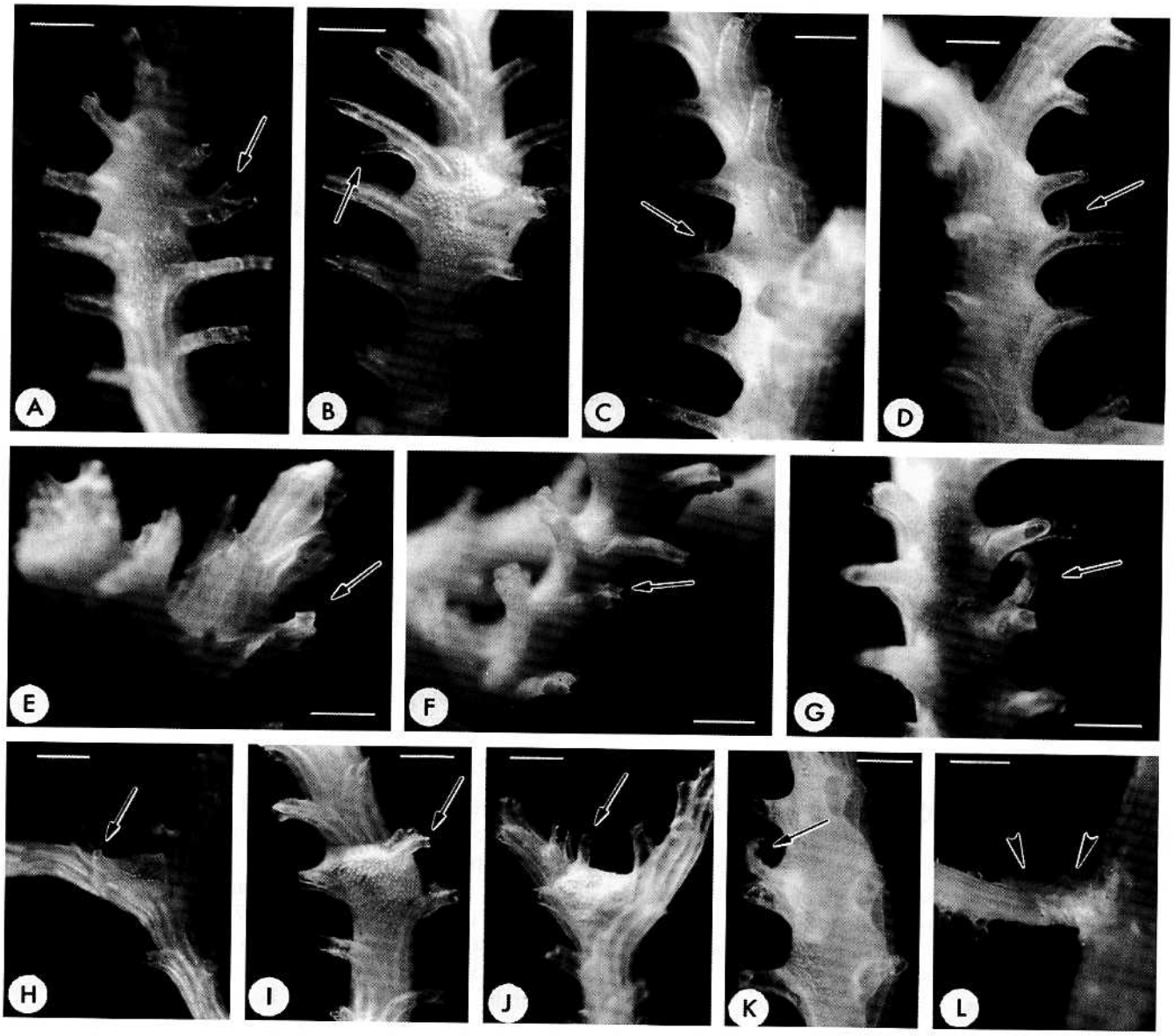

Fig. 1. Ooeciostomes (arrowed) of: A–B, *Exidmonea arcuata;* C–D, *Idmidronea hula*; E–F, *I. antarctica*; G, *I. fraudulenta*; H–J, *I. pellucida*, K, *I. pseudocrisina*, L, colony of *I. hula* with dorsal kenozooids (arrowheads). Scale bars: 500 μm.

Table 1. Measurements in μm of the ooeciostomes and ooeciopores of some Antarctic idmidroniform bryozoans.

	OSL	OSD	OPD
Exidmonea arcuata	201–314	56–70 × 84–140	42–49 × 56–126
Idmidronea hula	51–157	70–91 × 112–170	61–84 × 91–133
I. antarctica	27–109	105–126 × 142–163	84–112 × 98–142
I. pellucida	87–229	42–56 × 126–163	28–42 × 70–142
I. fraudulenta	221–444	70–112 × 142–170	56–98 × 128–156
I. pseudocrisina	200–298	63–85 × 226–246	56–78 × 205–299
I. obtecta	114–233	131–355 × 313–369	104–285 × 226–299

OSL: ooeciostome length, **OSD:** ooeciostome diameter, **OPD:** ooeciopore diameter.

ined. Specimens were collected in different parts of the Antarctic during the 34th and 36th Soviet (Russian) Antarctic Expeditions (see OSTROVSKY & TAYLOR (1996) for locality details) and preserved in alcohol. Some colonies were coated with gold for SEM study.

3. RESULTS

In the most of the Antarctic idmidroniforms studied, the ooeciostome is a straight or a curved tube, flattened to a greater or lesser degree, and located in the distal or middle portion of the gonozooid. The ooeciostome was located proximally in only one example of *I. pseudocrisina*. As a rule, the ooeciostome has the appearance of a continuation of a small lobe of the gonozooid, adhering to the peristome base of the innermost autozooid of a series from above (Figs. 1A, C–G, K; 2B, J–K; 4C–F). Morphometric characters of ooeciostomes and ooeciopores of the studied species are given in Table 1.

Exidmonea arcuata Ostrovsky & Taylor, 1996
(Figs. 1A–B; 2A–F)

Number of ooeciostomes examined: 157. In most cases the ooeciostome is a flattened, extended tube, narrowing slightly towards the aperture (Figs. 1A-B; 2A). The oval, elliptical or, sometimes, almost slit-like, ooeciopore is directed laterally and upwards, from the surface of colony (Fig. 2A–D).

Variability. About ten colonies were found with the ooeciostomes adherent to the innermost zooids of a series on their undersides (Fig. 1B; 2C). Sometimes, the ooeciostome is located on the outermost autozooid in a series (Fig. 2A, D). In this case, the ooeciopore may face almost basally (Fig. 2D). Two vertical ooeciostomes were found in the material examined: one of them was cylindrical with a circular ooeciopore (Fig. 2E), the other was terminal, conical and not adherent to any of the peristomes (Fig. 2F).

Idmidronea hula Borg, 1944 (Figs. 1C–D, L; 3)

Number of ooeciostomes examined: 201. Usually the ooeciostome has the appearance of a short, moderately curved cylindrical tube (Figs. 1C–D; 3A). However, the tube in reality is rather flattened. The oval ooeciopore (Fig. 3C–D) is directed towards the lateral surface of the colony and, at the same time, upwards.

Variability. As in *E. arcuata*, the ooeciostome sometimes adheres to the autozooids on their undersides (Fig. 3E). In one colony a frontal ooeciostome was found (Fig. 3F). The shape of the ooeciostome varies significantly: often ooeciostomes are dilated basally (Fig. 3G); the curvature of the tube may be so strong that the ooeciopore is directed almost horizontally (Fig. 3H–I); in some cases only the tip of the ooeciostome is curved (Fig. 3J) whereas in others curvature is lacking (Fig. 3K, N); sometimes, the ooeciostome is markedly tilted (Fig. 3L); the tube may be expanded distally (Fig. 3K, M) or, on the contrary, tapered (Fig. 3N). Some circular ooeciopores were found, one of which faced frontally (Fig. 3O).

Remarks. OSTROVSKY and TAYLOR (1996) referred this species to *Exidmonea* David, Mongereau & Pouyet, 1972, because of the absence of dorsal kenozooids. In the course of the present study, however, these polymorphs were found in two young colonies (Fig. 1L) among a sample of almost 2500. Therefore, although generic division based on the presence or absence of the kenozooids is most probably artificial, it is necessary to return this species to the genus *Idmidronea* Canu, 1920 (see also a remark in OSTROVSKY 1997).

Idmidronea antarctica Borg, 1944
(Figs. 1E–F; 2G–O)

Number of ooeciostomes examined: 103. As a rule the ooeciostome is a short, slightly flattened cylindrical tube (Fig. 1E–F). The oval ooeciopore (Fig. 2I) is directed upwards almost in all cases.

Variability. In one case an ooeciostome curved outwards (Fig. 2N). Occasionally, ooeciostomes may be very short (see Fig. 2J and Table 1). The tube is often expanded distally (Fig. 2H, K–L) and has funnel-like or bowl-like shape. Sometimes, a narrow ring is formed around an ooeciopore (Fig. 2I). In two colonies the ooeciostomes were found to be similar to the ooeciostomes of *I. hula*, curved and with ooeciopores directed towards the lateral surface of the colony (Fig. 2K–L). There was one frontal ooeciostome in the material examined (Fig. 2M), and an unusual horizontal ooeciostome was found in one colony (Fig. 2O).

Idmidronea pellucida Ostrovsky & Taylor, 1996
(Figs. 1H–J; 4A–B)

Number of ooeciostomes examined: 46. In the most cases the ooeciostome has an appearance of a flattened tube, curved at the end (Fig. 1H). It is located on the frontal side of the colony, adhering to the base of the peristome of one of the innermost autozooids. The oval ooeciopore (Fig. 4A) usually faces frontally.

Variability. Occasionally, the tube is almost straight. Sometimes, the ooeciostome is located on the colony surface free of the autozooidal peristomes (Fig. 1J; 4A). Ooeciopores quite often have a lateral orientation (Fig. 1I). In one case the ooeciostome was found to be on the reverse side of the colony. It had a funnel-like shape and a circular ooeciopore which faced basally (Fig. 4B).

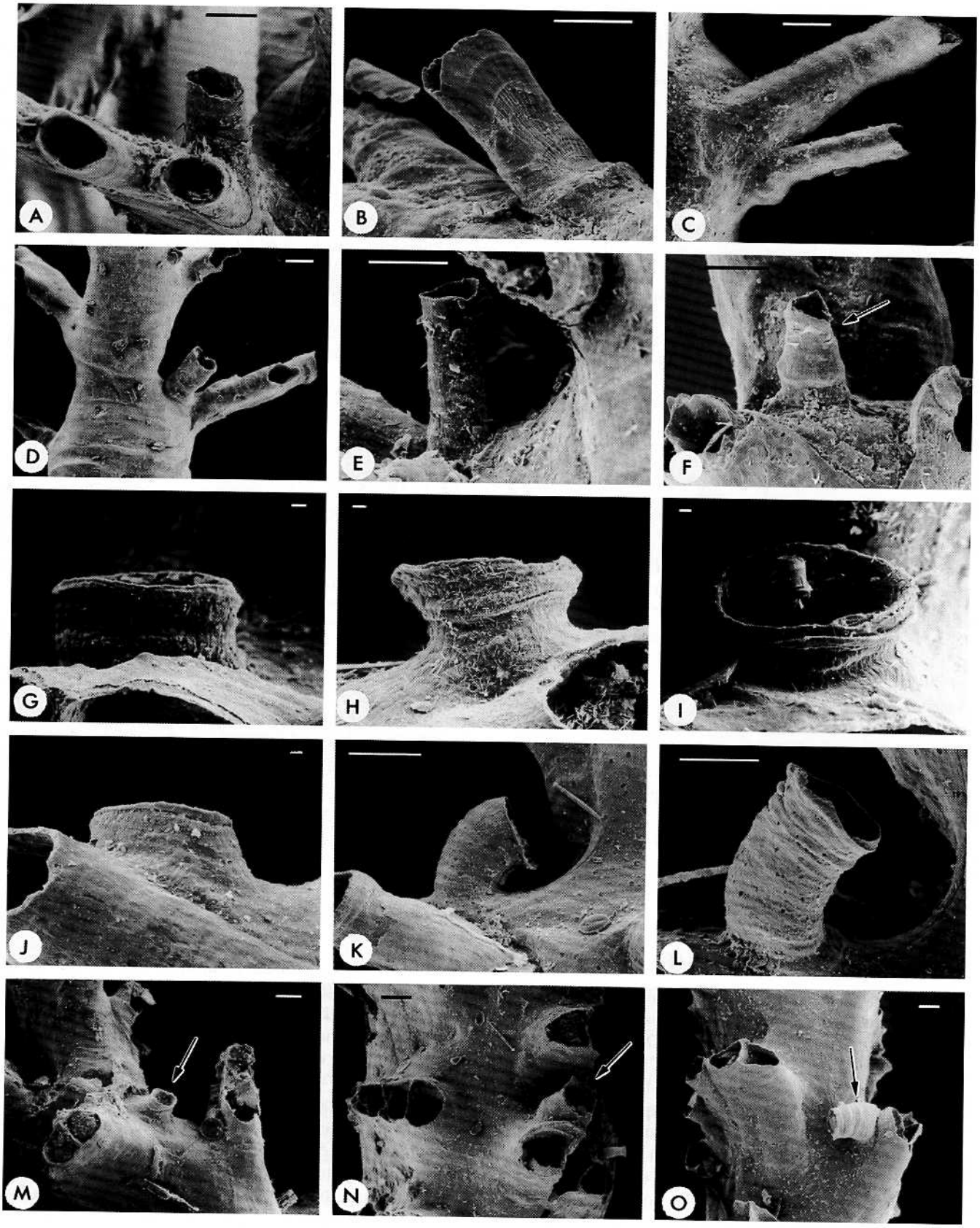

Fig. 2. Ooeciostomes of: A–F, *Exidmonea arcuata*; G–O, *Idmidronea antarctica*. Scale bars: A–F, K–O –100 μm, G–J –10 μm.