Chelicerate-like Oogenesis in Endeis nodosa (Pycnogonida; Endeidae)

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Several tens of juvenile and adult specimens of the pycnogonid, *Endeis nodosa* Hilton, were collected from the floating baskets for rearing some colonial ascidians, at the Shimoda Marine Research Center, University of Tsukuba, at Nabeta Bay, Shimoda, Izu, Central Japan. Adult females were fixed with the seawater-Bouin's solution or 70% ethanol and made up into serial paraffin sections, 5-7 μ m thick, stained with Delafield's hematoxylin and eosin (H.-E.), Heidenhain's azan, or Masson's trichrome staining method.

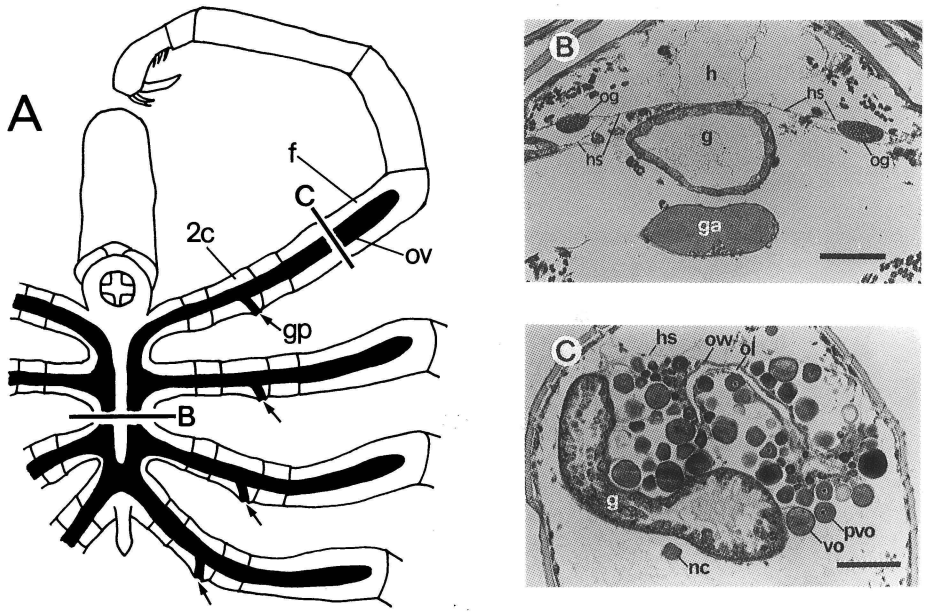

Fig. 1 Adult ovary of *Endeis nodosa*. A. shape of ovary (dorsal view). B and C corresponding to photographs B and C. B. cross section of trunk ovary. Azan. Scale = 100 μ m. C. Cross section of pedal ovary in femoral segment. H.-E. Scale = 100 μ m. f: femoral segment, g: gut, ga: ganglion, gp: genital pore (arrows), h: heart, hs: horizontal septum, nc: nerve cord, og: oogonium, ol: ovarian lumen, ov: ovary, ow: ovarian wall, pvo: previtellogenic oocyte, 2c: second coxal segment, vo: vitellogenic oocyte.

The adult ovary was U-shaped in the cephalothorax, and extended branches into four pairs of the walking legs up to the 4th (the femoral) segments (Fig. 1A). The U-shaped trunk region and proximal regions of the branches were not tubular, but cord-shaped, and filled only with oogonia (Fig. 1B). In the pedal region, mostly in the femoral segment, the tubular ovary included oocytes in various oogenetic stages and mature eggs, but no oogonia (Fig. 1C).

A number of previtellogenic and vitellogenic oocytes and mature eggs protruded outward from the ovarian wall with cellular stalks connecting these egg cells with the ovary (Figs. 1C, 2). No follicle cells were seen around these egg cells. Very young oocytes remained in the ovarian wall, aggregated into some cord-shaped germ zones running longitudinally through the pedal ovary. (Fig. 3). The young oocytes beginning to grow must leave the germ zone, migrate outward, and protrude from the ovarian surface, raising the basement membrane of the ovarian epithelium and accompanied by some young epithelial cells to form their stalks. A direct connection between the ovarian lumen and the genital pore through the oviduct in each walking legs (Fig. 4) was found for the first time among the pycnogonids. At present, we can presume that mature eggs are ovulated into the ovarian lumen through the cavities of their stalks, not into the space surrounding the ovary as having asserted in *E. spinosa* by Sanchez (1959), and then transported to the genital

pore through the oviduct.

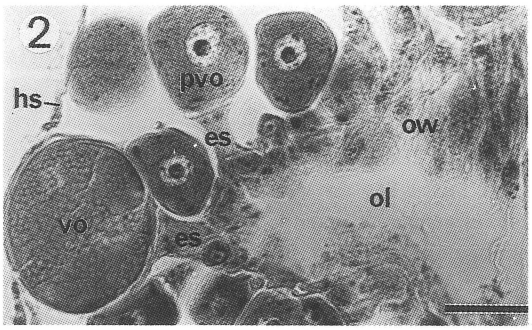

Fig. 2 Sagittal section of pedal ovary in femoral segment of *Endeis nodosa* showing stalked oocytes. Azan. Scale = 25 μ m. es: egg stalk. Other abbreviations same as in Fig. 1.

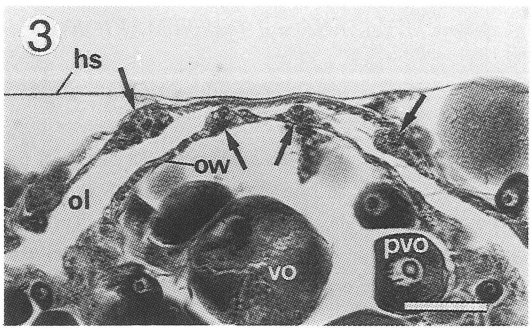

Fig. 3 Cross section of pedal ovary in femoral segment of *Endeis nodosa*. Arrows showing young oocytes in germ zone. H.-E. Scale = 25 μ m. Abbreviations same as in Fig. 1.

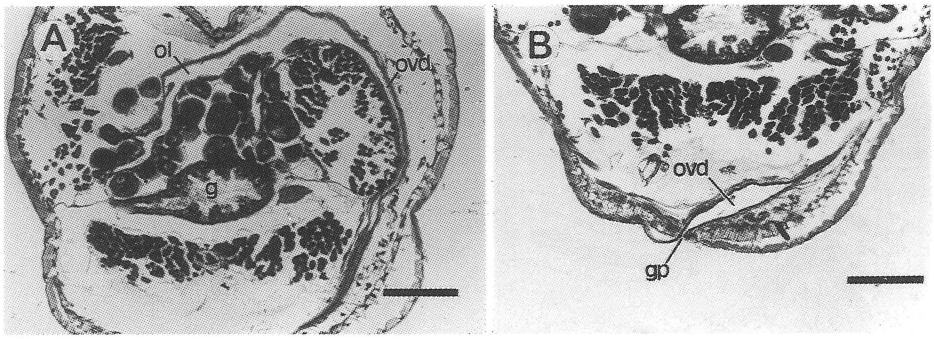

Fig. 4 Oviduct of *Endeis nodosa*. A. Cross section of second coxal segment showing connection between ovary and oviduct. Azan. Scale = 100 μ m. B. Cross section of second coxal segment showing connection between oviduct and genital pore. Azan. Scale = 100 μ m. ovd: oviduct. Other abbreviations same as in Fig. 1.

E. nodosa shows many characteristics in ovarian structure and oogenesis similar to those of many chelicerates, such as the tubular ovary, the cord-shaped germ zone running through the total length of the ovary, and the stalked oocytes and mature eggs protruding outward from the ovary. The route for the ovulation and oviposition is also closely similar to that known in some chelicerates (see Makioka, 1987, 1988).

In some other pycnogonid species, we have also found several chelicerate-like characteristics in ovarian structure and oogenesis (Miyazaki and Makioka, unpublished), but these seem at the present not so typically chelicerate-like as those in *E. nodosa*.

References

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