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Fine structure of the vitellogenic ovarian follicles of *Pseudoxenos iwatai* (Strepsiptera: Insecta)

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In Strepsiptera, the ultrastructures of their ovarian follicles and oogenesis are known only in *Xenos moutoni* (Kathirithamby *et al.*, 1990) and *Elenchus tenuicornis* (Büning, 1994, 1998). According to these studies, Strepsiptera have a number of single polytrophic meroistic follicles, approximately the same in developmental stage, which are not organized in discrete ovarioles. In this study, we observed the ultrastructural details of the vitellogenic ovarian follicles in a strepsipteran, *Pseudoxenos iwatai*.

Materials and Methods

To obtain immature stages of *Pseudoxenos iwatai*, trap nests (bamboo tubes) were set in Iriomote Island, southernmost Japan in September 12, 1996 (Takahashi *et al.*, 1997). The trap nests were withdrawn in middle April, 1997. Hibernated prepupae of *Anterhynchium flavomarinatum umenoi* were incubated at 26℃ until their eclosion. The fifth instar larvae of female stylopids, prior to protrusion from host metasomal targa, were dissected out of hosts and fixed in 4% glutaraldehyde buffered with 0.1 M sodium cacodylate. Then they were prepared by standard methods for electron microscopy and observed under a transmission electron microscope JEOL JEM–1010 at 80 kV.

Results and Discussion

As shown in Figure 1, the vitellogenic ovarian follicles of *Pseudoxenos iwatai* are oval in shape and measure about 116×80 μm in size. The oocyte volume is almost equal to that of the nurse chamber. The outer surface of a follicle is surrounded by monolayered follicular epithelial cells which are 5 μm in maximum height and squamous in shape. The nurse chamber consists of many irregularly arranged cells with a spherical or subspherical nucleus (about 7×6 μm in size). The number of nurse cells in one ovarian follicle could not be precisely determined, but it seems that the total number of nurse cells is close to 255 (2^8–1), as observed in *Elenchus* (Büning, 1998; Gu *et al.*, 1992).

The cytoplasm of the nurse cells contains many ribosomes and spherical or subspherical mitochondria without or with a few cristae (*ca.* 0.3 μm in diameter), which are randomly scattered in the cytoplasm and are exactly similar to those in the oocyte, but it contains very little endoplasmic reticulum and few Golgi bodies. In addition, bacteria-like structures (*ca.* 1.5×0.7 μm in maximum size) can be seen in the cytoplasm of some nurse cells. The nurse cells are directly or indirectly connected with each other by the ring canals or intercellular bridges (*ca.* 1 μm in diameter). Cell membranes of several nurse cells are found to be degenerate; it leads to the formation of large syncytial cytoplasm (Fig. 2), as observed in *Elenchus* by Büning (1998).

As observed in Figure 1, the anterior pole of the oocyte is bordered by flat cell membranes with several

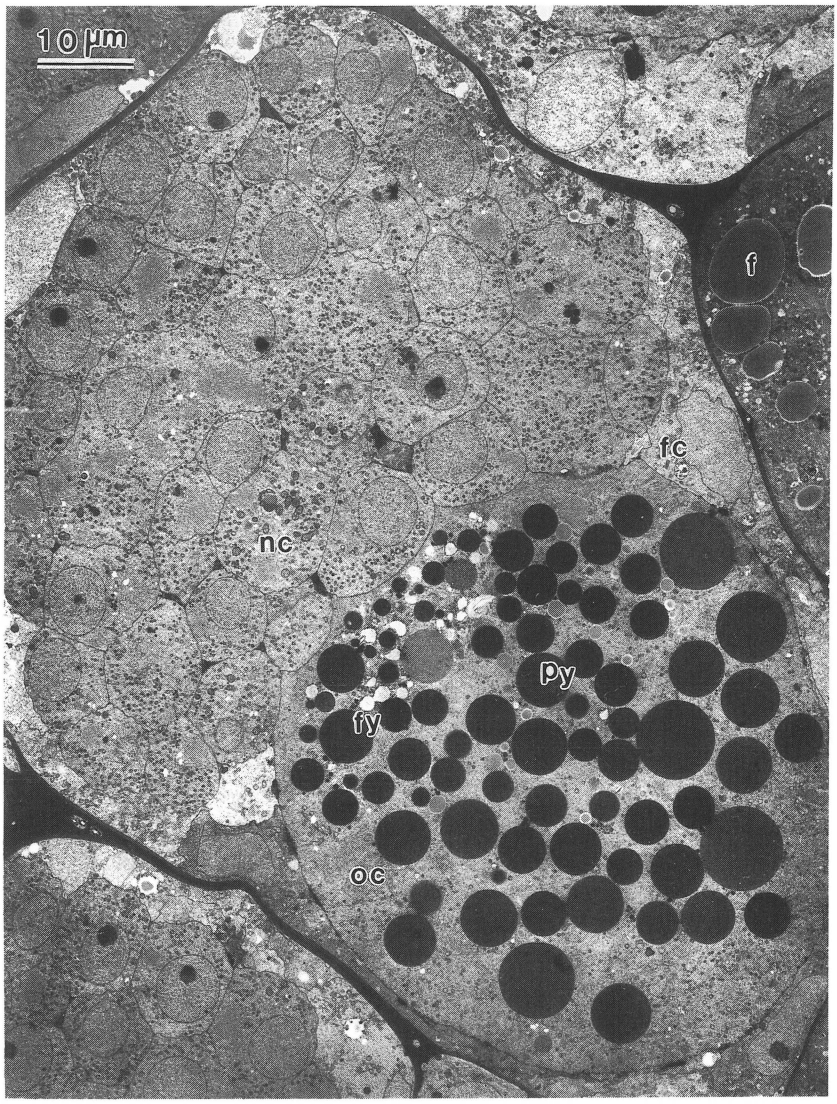

Fig. 1 Low electron micrograph of a sagittal section through middle vitellogenic ovarian follicle in *Pseudoxenos iwatai*. f: fat body, fc: follicular cell, fy: fatty yolk, nc: nurse cells, oc: oocyte, py: proteid yolk.

nurse cells. Although the intercellular bridges between oocyte and nurse cells were very difficult to observe, only one bridge (*ca.* 1 μm in diameter) could be detected by careful observation of many ultrathin sections (Fig. 3).

The nucleus of oocyte is larger (*ca.* 15×10 μm in size) than those of nurse cells, and located near the posterior pole of the cortical or subcortical ooplasm. The proteid yolk spheres are of various sizes, depending on the period of their growth. The smaller spheres are situated at the anterior cortical ooplasm adjacent to the nurse chamber, whereas the larger ones are located at the cortical or subcortical ooplasm beneath the follicular cells. The micropinocytotic invaginations or pinosomes can be scarcely recognized, although the microvilli can be found in some spaces between the oocyte and the follicle cells. The incorporation of yolk precursors by the micropinocytosis may be not so active as in other insects. With the progressive vitellogenesis, lipid droplets in a small amount appear among the proteid yolks.

At the late stage of the vitellogenesis, the follicular cells begin to accumulate the precursor materials

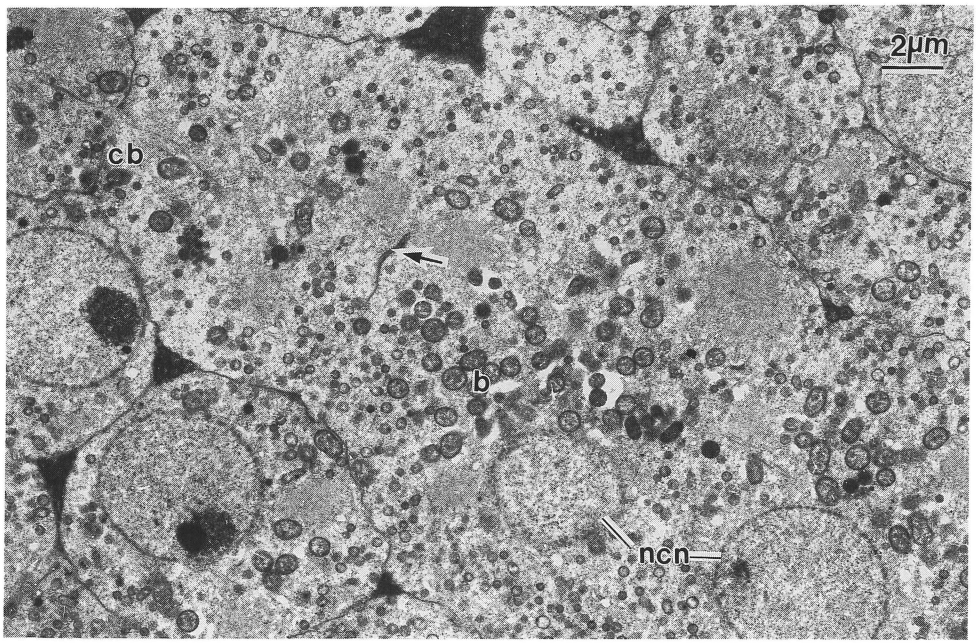

Fig. 2 Ultrastructure of the syncytial nurse cell. Note the residual cell membrane (arrow). b: bacteria-like structure, cb: intercellular bridge, ncn: nurse cell nuclei.

of the vitelline membrane on the oocyte surface. Subsequently the follicular cells begin to degenerate.

Our ultrastructural observation on the vitellogenic ovarian follicles for *Pseudoxenos* is, in all respects, coincident with the previous works for the other strepsipterans *Xenos* (Kathirithamby *et al.*, 1990) and *Elenchus* (Büning, 1994, 1998). Our study supports the conclusion addressed in these works that the strepsipteran ovarian follicle is categorized into a polytrophic meroistic type.

References

Büning, J. (1994) *The Insect Ovary*. Chapman & Hall, London.
Büning, J. (1998) *Int. J. Insect Morphol. Embryol.*, **27**, 3–8.
Gu, X., Y. Bei. and C. Gao (1992) *Proc. XIX Int. Congr. Entomol. (Beijing, China, 1992)*, 81.
Kathirithamby, J., M. Carcupino and M. Mazzini (1990) *Frust. Entomol., NS*, **13**, 1–8.
Takahashi, K., Y. Maeta and K. Goukon (1997) *Chugoku Kontyu*, (11), 31–37. (in Japanese with English summary).

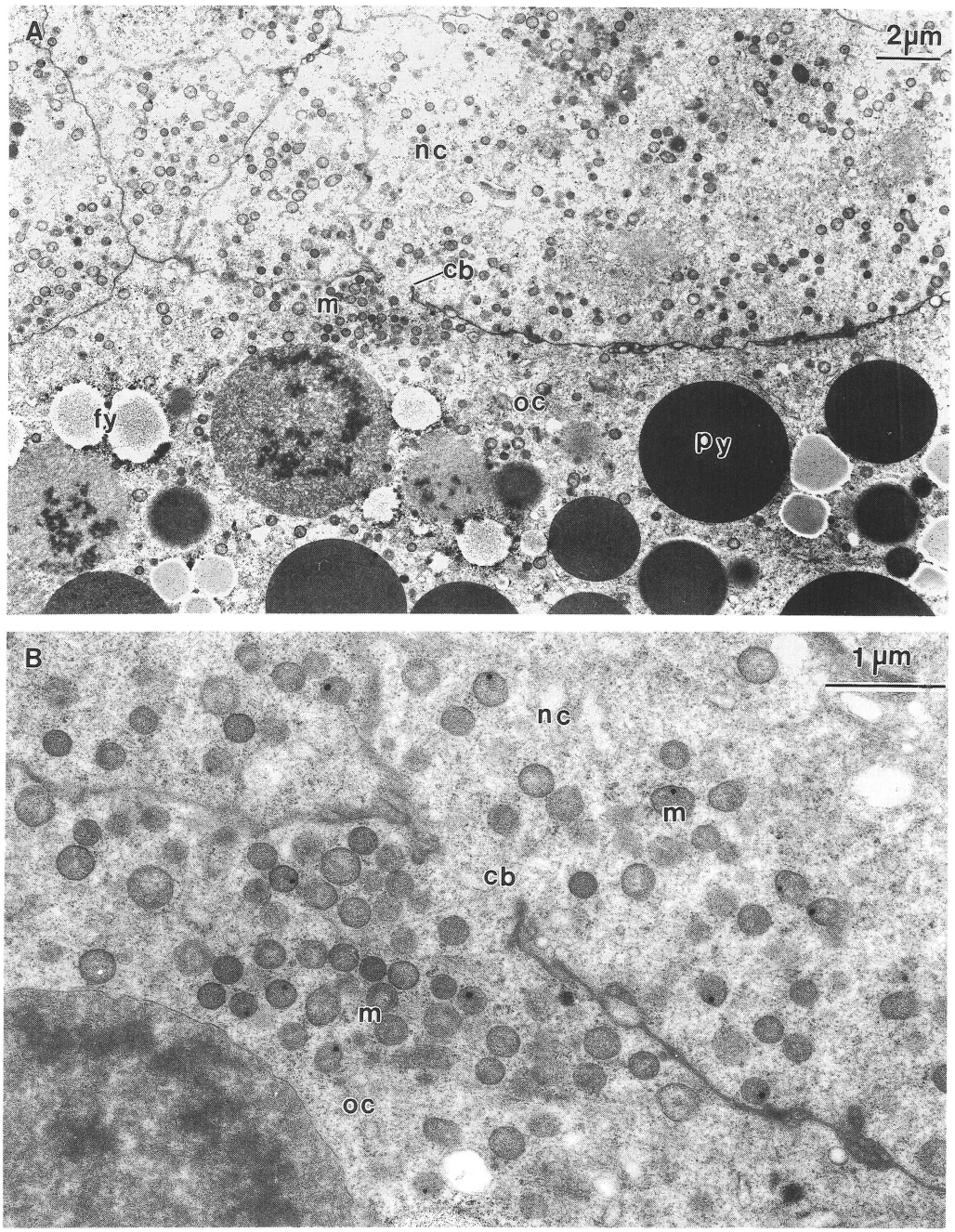

Fig. 3 Ultrastructure of the boundary area of oocyte and nurse chamber. A. Posterior part of nurse chamber (nc) and anterior part of oocyte (oc). B. Enlargement. cb; intercellular bridge between oocyte and nurse cell, fy; fatty yolk, m; mitochondria, py; proteid yolk.