Oogenesis in a Spongilla Fly, *Sisyla nikkoana* Navás (Neuroptera: Sisylidae)

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The reproductive system of the adult female of a spongilla fly, *Sisyla nikkoana* contains 16–18 polytrophic type ovarioles connected with a lateral oviduct. Each ovariole is approximately 2.0 mm long from the tip of the germarium to the largest ultimate oocyte. The vitellarium of an ovariole is composed of 16 developing egg chambers arranged in a single file (Fig. 1A). The first to tenth egg chambers are at previtellogenic stages, during which the growth is rather slow. The 11th to 13th egg chambers are growing rapidly and at vitellogenic stages. The 14th to 16th egg chambers are in the period of the egg membrane formation or chorionated mature eggs. A mature egg is elongated ovoid and about 420 × 180 μm in size, in which a cone-shaped and micropylar apparatus is observed at a little off center at the anterior end (Fig 1B).

Each of the egg chambers includes an oocyte and 11 to 13 nurse cells. Thus, the number of interconnected sister cells in each egg chamber does not follow the 2^n rule, as in other neuropteran insects, *Chrysopa perla* (Rousset, 1978a, b), *Eumantispa harmandi* (Matsuzaki and Satoh, 1986), two species of Ascalaphidae (Matsuzaki, 1988), and

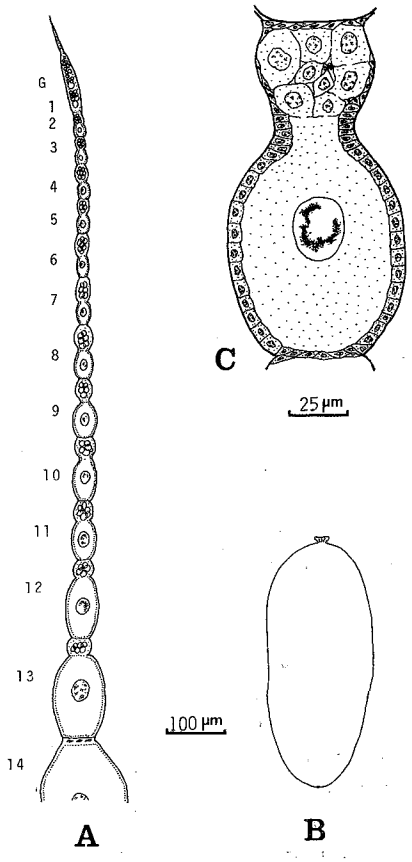


Fig. 1 Ovariole of *Sisyra nikkoana*.

five species of Myrmeleontidae (Matsuzaki, unpublished data). King and Teasley (1980) reported that some fleas with polytrophic ovarioles do not obey the 2^n rule. That is, the number nurse cells per oocyte is between 8 and 13 in two species of *Stenoponia* observed.

The growth curves for developing egg chambers in *Sisyla nikkoana* are shown in Fig. 2. Oocytes grow at a fairly constant rates until at stage 3 when a slight acceleration occurs. Between stages 1 and 6 the oocytes increase their volume by about 1600 times. The oocyte nuclei start to grow at stage 1, and their growth rate is accelerated at stage 3–4, and attain their maximun volume in late vitellogenic stage 6, which nuclei are approximately 460 times as large as the stage 1 nuclei. The nurse chamber grows at a similar rate with the oocyte volume in stage 1–3. In the late previtellogenic stage 3–4, the growth rate of nurse chambers slows down, increase in the volume during which is only about 9 times that of stage 1. Furthermore, in the vitellogenic stages their growth rate levels off and are outdistanced by the volume of the oocyte nucleus. On the other hand, the average volume of each nurse cell nucleus at stage 4 is only about 2.6 times as large as that at stage 1. A similar pattern of growth in egg chamber components has been found in several other neuropteran insects (Matsuzaki, 1987; Matsuzaki and Satoh, 1986).

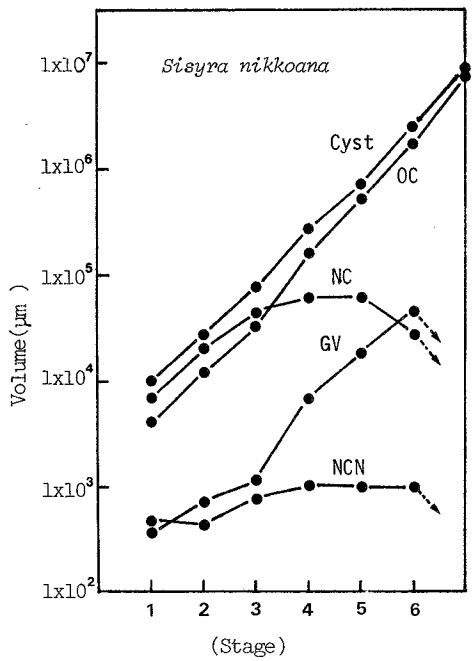
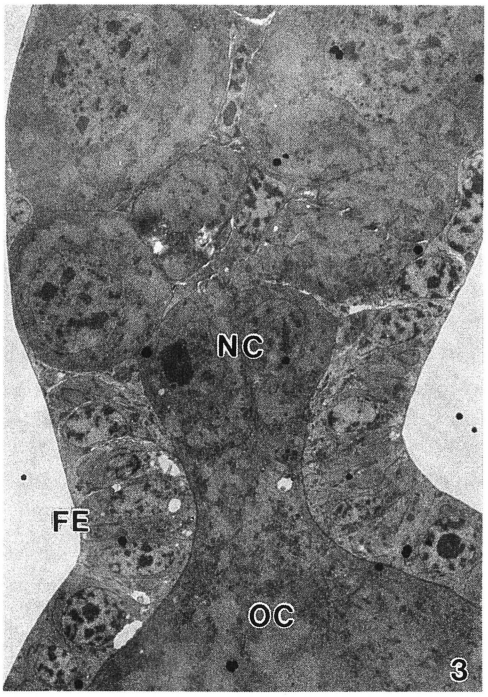


Fig. 2 Change in volume as a function of stage during oogenesis in *Sisyra nikkoana*.

During stages 1–2, the follicular epithelium enclosing the young oocyte-nurse cell complexes is an incompletely formed layer of squamous cells with a thickness of less than 1 μm. Then in the course of previtellogenesis, as the egg chambers grow, the surrounding follicular cells develop slowly. Up to the early stage 3, the thickness of flattened follicular cells surrounding oocyte has increased to 3.5–4.0 μm, and in the late previtellogenic stage 3, it is about 5 μm. Up to the end of this stage, these cells surrounding the oocyte maintain somewhat flattened cuboidal shape. While the nurse chamber is covered by a very thin and flattened follicular cells.

The appearance of the follicular cells is quite different around the anterior region of the oocyte. That is, the follicular cells are elongated to columner in shape, and enclose the anterior region of the oocyte. As the result the anterior of the oocyte is constricted to become a bottle neck like appendix; which is about 10 μm in height and 10–15 μm in diameter (Figs. 1C and 3). However, the boundary between the oocyte and nurse cells is connected by cytoplasmic bridges or ring canals, which are 1.2–1.5 μm in diameter (Fig. 4), as seen in many insects having the polytrophic ovarioles. Cell organelles such as mitochondria and endoplasmic reticulum can pass through the cyto-



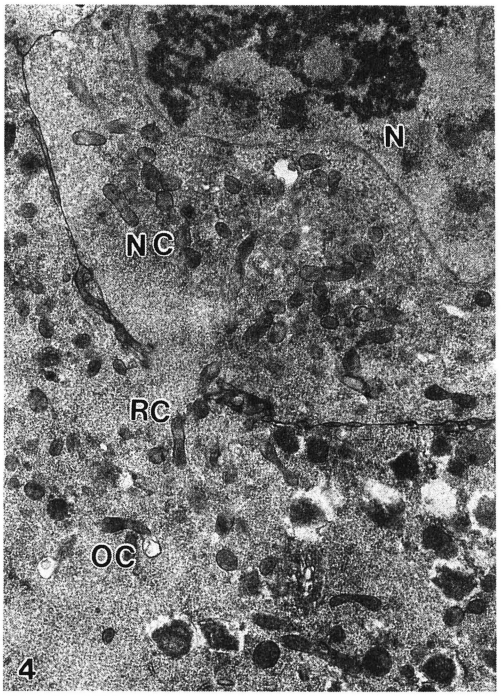


Fig. 3 Portion of the area surrounding the anterior oocyte (OC)-nurse chamber (NC) at same stage with Fig. 1C. ×1600. FE: follicular epithelium.

Fig. 4 Portion of ring canal (RC) between the anterior ooplasm (OC) and nurse cells (NC). ×7500.

plasmic bridge. With the oocyte grows, the bottle neck-like appendix of the oocyte disappears.

References

King, R. C. and M. Teasley (1980) *In* R. Traub and H. Starcke (eds.), Fleas, pp. 337–340, A. A. Balkema, Rotterdam.

Matsuzaki, M. (1987) *Proc. Arthropod. Embryol. Soc. Jpn.*, **(23)**, 23.

Matsuzaki, M. and M. Satoh (1986) *Proc. Arthropod. Embryol. Soc. Jpn.*, **(22)**, 1–3.

Rousset, A. (1978a) *Int. J. Insect Morphol. Embryol.*, **7**, 45–57.

Rousset, A. (1978b) *Int. J. Insect Morphol. Embryol.*, **7**, 59–71.