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# Ultrastructure of Oogonia in Germarium of Adult Females of *Allacma fusca* (Collembola)

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## Synopsis

Cystocytes in germarium of *Allacma fusca* are distributed in branching clusters. The cystocytes are morphologically identical and interconnected with cytoplasmic bridges. The ultrastructural data on cystocytes, during their interphase, with special reference to cytoplasmic bridges are presented.

## Introduction

*Allacma fusca* (Collembola, Apterygota) inhabits forests of Europe, North Africa and North America. These insects can be found on tree trunks on roting wooden logs, on stones and occasionally on mushrooms.

The reports on ultrastructure of cystocytes within ovaries of Apterygota are quite scarce (Matsuzaki, 1973; Palévody, 1976; Bitsch, 1980; Biliński, 1983). Cystocytes develope in synchronic mitotic divisions, from cystoblasts. Their number (N) is species dependent. However, in most cases this is equal to: $N = 2^n$, where n = numbers following mitotic divisions.

The known facts about *A. fusca* are that sack like ovaries are of polytrophic type. The germaria placed on top of ovarioles are folded towards lower part of the abdomen (Krzysztofowicz, 1977). The present work is devoted to ultrastructural investigation of cystocytes in germarium of adult females.

## Material and Methods

Females of *Allacma fusca* were collected near Kraków (South of Poland) during

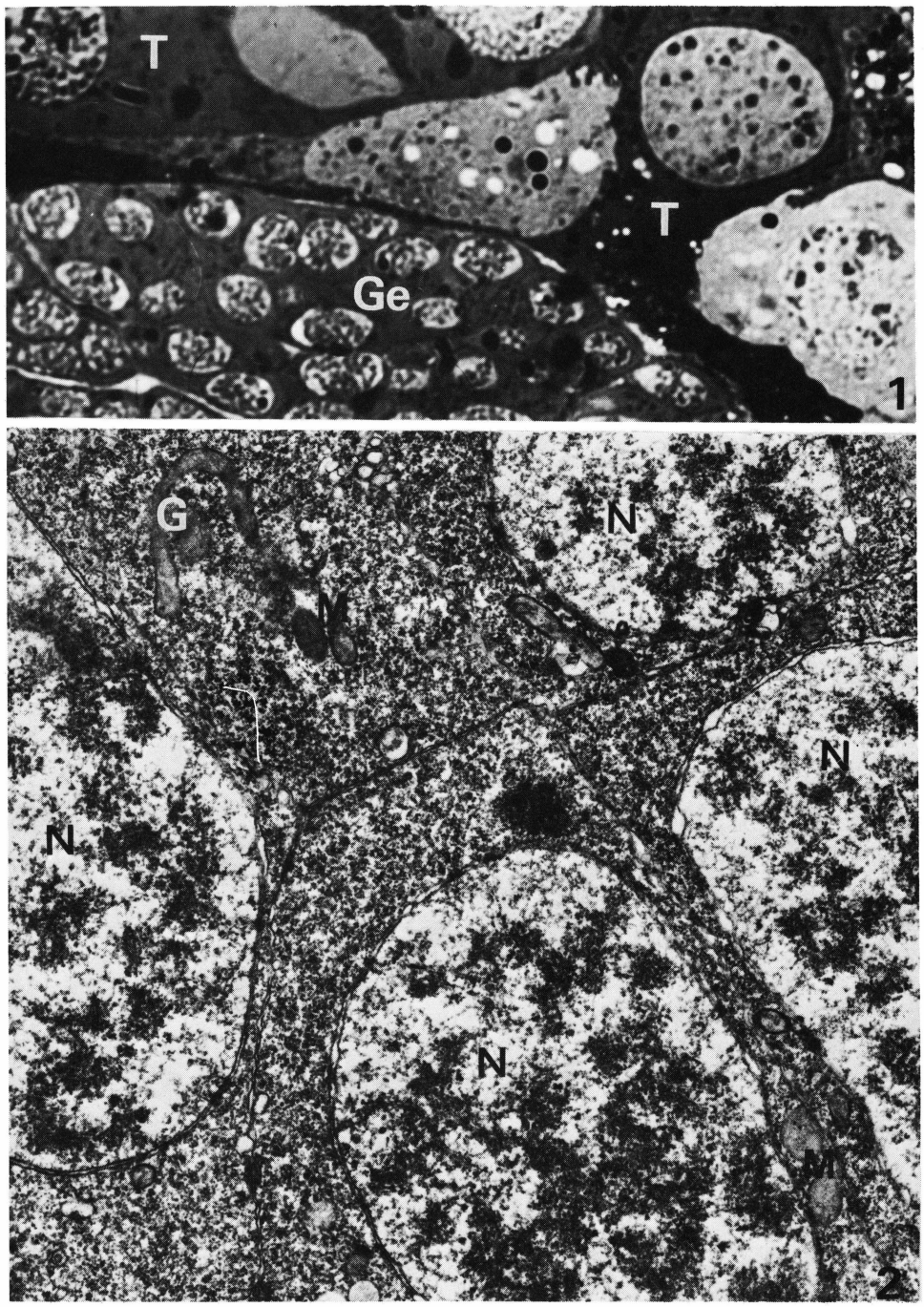


Fig. 1. Photomicrograph of the gonad fragment. G, germarium; T, trophocytes. × 540
Fig. 2. Electron micrograph of the fragment of germarium. G, Golgi apparatus; M, mitochondria; N, nucleus. × 12.000.

early June. They were decapitated and preliminary fixed in 2.5% glutaraldehyde in 0.1 M phosphate buffer, pH 7.4. In all the osmotic pressure was 410 mosmol. After 1.5 hr the fixed specimens were put into 1% tannic acid, in 0.1 M phosphate buffer, pH 7.4 with addition of sucrose (5.8 g in 100 ml of solution) for 24 hr. After this, the material was rinsed several times in the phosphate buffer, then in 1% sodium sulfate and postfixed in 2% $OsO_4$ in 0.1 M phosphate buffer with addition of sucrose (2.56 g of sucrose in 100 ml of the solution).

Following that the material was dried in graded series of alcohol and acetone and embedded in Epon 812. Ultrathin sections were treated with uranyl acetate and lead citrate and examined in Tesla BS 500 electron microscope. Semithin sections were stained with 1% solution of methylene blue in borax.

## Results

Oogenesis in ovaries of *A. fusca* is a synchronic process. In germarium the germ cells undergo mitotic divisions resulting in the clusters of cystocytes (Fig. 1). In each cystocyte cluster about 16 morphologically identical cells occur. They are interconnected with cytoplasmic bridges (Fig. 3). The cystocytes in interphase have very large nucleus and little of cytoplasm (Fig. 2). In the nucleus distinct heterochromatine aggregations and in the cytoplasm ribosomes, polyribosomes, a few mitochondria and dictyosomes can be seen (Figs. 2, 3). Finally, one should mention centrioles which can also be seen in the cytoplasm. The centrioles are often surrounded by a "halo" of mitochondria (Fig. 3 a). Cytoplasmic bridges are built up like those described in another Apterygota. The bridge rims are slightly dilated and lined up with a filamentous electron-dense material. In the bridge an irregular network composed of medium density material occurs (Fig. 3). This is particularly evident on sections parallel to plane of the bridge. However, the network examined on sections with different spatial orientation appears as loosely distributed collection of plate-like structures with no apparent interconnections.

Through the empty spaces of the network there pass microtubules, being probably the remnants of the mitotic spindle. Very often, the bridges are distributed in a particular arrangement — one perpendicular to another (see Discussion).

## Discussion

Like in the case of another apterygotan insects, with the ovaries of polytrophic type, also in *A. fusca* the observed cystocyte clusters were interconnected with cytoplasmic bridges. The cytoplasmic bridges belonging to a single cystocyte can be mutually perpendicular one to another. Such the arrangement is typical for branching cystocyte clusters of Pterygota (King and Büning, 1985). Thus it seems that the cystocyte clusters in *A. fusca* can be a branched-like structures; the first such a case reported for Apterygota. Up to now only linear clusters of cystocytes were known in apterygotan insects (Matsuzaki, 1973; Palévody, 1976; Biliński, 1983).

It must be stressed out, however, that during the present investigation the prob-

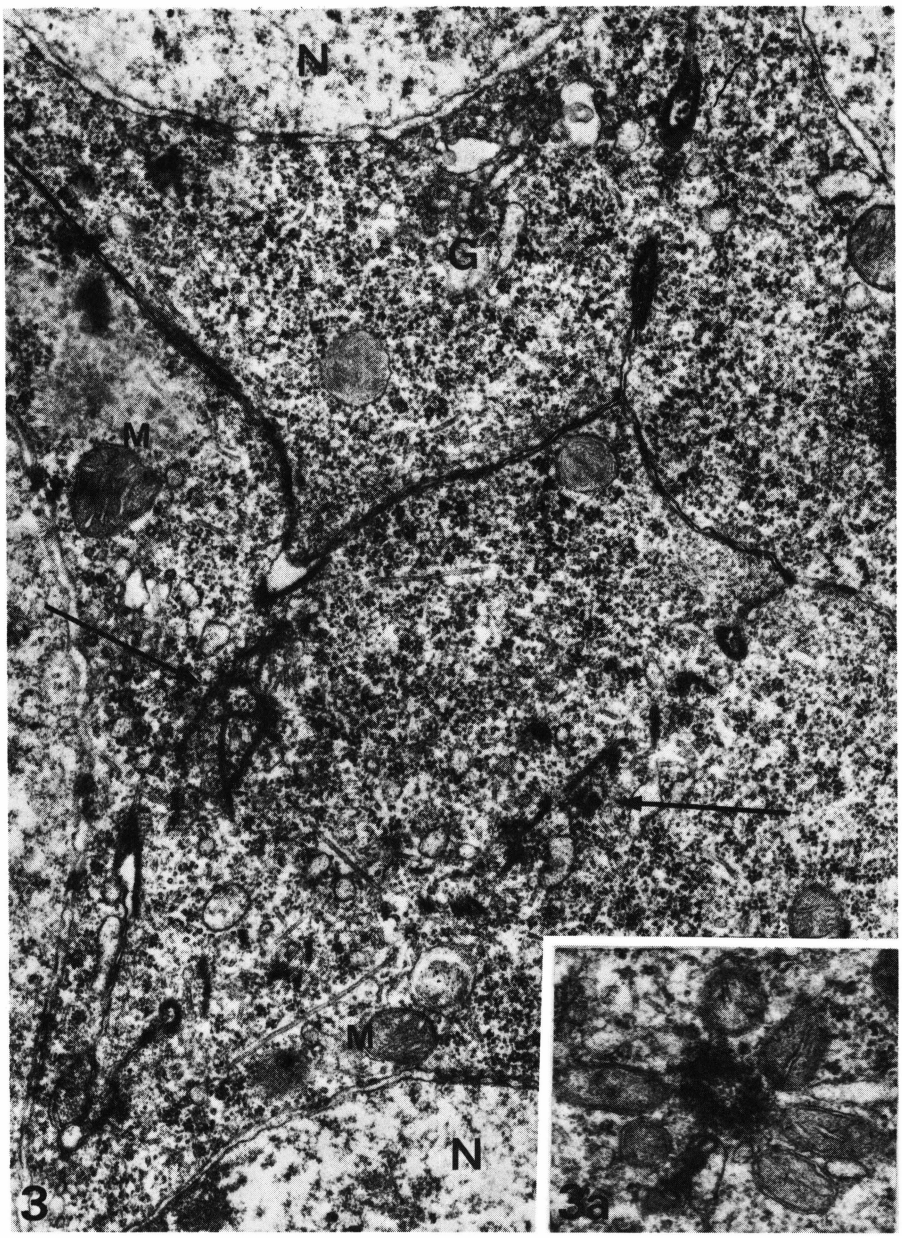


Fig. 3. Electron micrograph of the fragment of germarium. Cytoplasmic bridges can be seen (arrows). G, germarium; M, mitochondria; m, microtubules; N, nucleus. × 22,000.
Fig. 3a. Centriole surrounded with mitochondria. × 37,200.

lem: whether the cystocyte clusters in *A. fusca* are built up, and develop according to the scheme as in Pterygota (King *et al.*, 1983), or if the branchings in the clusters develop in random, remains unsolved.

The final number of cystocytes is close, but not necessarily strictly equal to 16 (*i. e.*, 24). Similar breaking of the rule $N = 2^n$ is known for Campodeidae (*Lepidocampa*, Asaba and Ando, 1978; *Campodea*, Biliński, 1983).

Ultrastructure of cystocytes in *A. fusca* during interphase in similar like that for other Apterygota (Palévody, 1976; Biliński, 1983). In particular the cytoplasmic bridges described in *Isotomurus palustris* (Palévody, 1976) do not differ from these examined in *A. fusca*.

The centrioles in the cystocytes can be attributed to mitotic activity of the cells.

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