Morphometric Differences in Midgut Epithelial Cells between Strains of Female *Aedes aegypti* (L.)

(Insecta, Diptera)

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Summary. Midgut epithelial cells of female *Aedes aegypti* deriving from 2 different mosquito strains were compared morphometrically. One of the 2 strains was recently isolated from nature (East Africa). The other strain is an old laboratory strain, reared under laboratory conditions for about 30 years.

The quantitative morphological comparison demonstrates, that the ultrastructural composition of the midgut epithelial cells corresponds generally in both strains. It can be shown, however, that in the old strain, compared to the new strain, the organelle amount of midgut epithelial cells is significantly reduced during the first 53 days of the mosquito’s life. Parallel to decreased relative volumes of organelles and reduced surface densities of membrane systems an increase in lysosome-like structures is observed. These observations are interpreted as deterioration processes, possibly due to the long rearing in the laboratory. Therefore, care should be taken in the selection of an *A.e.egypti* strain for any quantitative morphological or physiological investigation.

Key words: *Aedes aegypti* — Midgut epithelium — Cytology — Strain differences — Morphometry.


Introduction

By means of morphometry (Weibel, 1969) the midgut epithelium of female *Aedes aegypti* of a newly isolated mosquito strain was previously analyzed under various physiological conditions (Hecker et al., 1974). After emergence during

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imaginal differentiation the cells of the anterior (A) and posterior (P) part of the midgut diverge in their ultrastructural composition. The differences found, led the authors to attribute special functions to the A and P-part respectively. It was assumed that the A-part is strongly responsible for absorption, whereas in the P-part proteins as e.g. digestive enzymes are preferentially synthetized. This agrees with the “secretion—absorption—model” of Berridge (1970). During blood digestion a measurable enlargement of the cells and organelles suggested that the functional capacity of the midgut is then increased. In aging mosquitoes, 53 days old, having undergone 7 gonotrophic or feeding cycles, no notable structural differences were found, compared with younger animals. This last finding was somewhat in opposition to qualitatively observed deterioration processeses in midgut cells of even younger A. aegypti (24 days old) of an old laboratory strain (Hecker et al., 1971). In this context changes in several organelles and especially in residual bodies content were described. The question arose whether these differences are strain dependent, because one strain was newly isolated from nature the other an old imbred laboratory strain. In the present paper the two mosquito strains were compared morphometrically to investigate if quantitative differences between the two strains are found; for which cellular parameters and under which physiological conditions. Therefore, the midgut epithelial cells of the old laboratory strain were investigated under the same physiological conditions as previously the newly isolated strain (Hecker et al. 1974).

Material and Methods

Morphometric results for the ultrastructural composition of midgut epithelial cells are available for the Aedes aegypti strain isolated in 1970 in East Africa (Hecker et al., 1974). This strain was named “Sege” (S-strain) after the locality of its origin (Segemaganga, Tanzania; Briegel and Kaiser, 1973).

The strain we want to compare to Sege is called “Lab. strain” (L-strain); it was originally derived from Congo (Kinshasa) and has been bred for about 30 years in our laboratories (Hecker et al., 1971; Briegel and Kaiser, 1973). As it was done previously for the S-strain (Hecker et al., 1974), the anterior (A) and the posterior (P) part of the midgut of L-strain females were examined under various physiological conditions of the mosquitoes:

Stage 1: 0–2 hours after emergence (a.e.) from pupa, unfed = immature.
Stage 2: 3 days a.e. = ready for 1st blood meal (b.m.).
Stage 3: 4 days a.e., 1 day after 1st b.m. = digestion of b.m.
Stage 4: 10 days a.e., 7 days after 1st b.m. = digestion and gonotrophic cycle completed, ready for 2nd b.m.
Stage 5: 53 days a.e., 7 days after 7th b.m. = aging.

The quantitative ultrastructural composition of the epithelial cells was investigated by means of morphometry (Weibel, 1969). Volume ratios, the relative volumes (= volume densities) of organelles expressed as fractions of the cytoplasmic volume and the surface densities of membrane systems (=μ² membrane/μ² cytoplasm) were evaluated. In addition absolute values for the cell volume and for the volumes and surfaces of cellular compartments as well as secondary parameters (e.g. surface to volume ratios) could be calculated. For a complete description of the sampling procedure, preparation for electron microscopy and morphometry cf. Hecker et al. (1974).

Results (Tables 1 and 2, Figs. 1–5)

Comparing the ultrastructural composition of midgut epithelial cells of the S- and of the L-strain, we find good agreement for many parameters investigated.