THE FINE STRUCTURE OF THE SEMINAL BURSA OF *Aedes aegypti* (LINNAEUS)

JACK COLVARD JONES AND HARLEY G. SHEFFIELD

Adult *Aedes* (*Stegomyia*) *aegypti* (Linnaeus) mosquitoes are known to copulate repeatedly in cages (Roth, 1948). During copulation, the aedeagus is inserted only into the upper vagina and engages the dorsal vaginal valve, causing the eversion of the latter (Jones and Wheeler, 1965a). Normally, the male ejaculates accessory gland material and spermatozoa only into a large sac, the seminal bursa, which opens into the upper vagina (Jones and Wheeler, 1965a; Spielman, 1964). Shortly after insemination, the bursal wall thickens. Many spermatozoa rapidly leave the bursa and usually reach two and occasionally all three spermathecae of the female (Jones and Wheeler, 1965b; Spielman, 1964). If the third spermatheca has spermatozoa, it almost always contains relatively few of them. When spermatozoa are present within even one of the spermathecae, the female may then be said to be *impregnated*. This term is particularly useful because it is possible for a mosquito to have spermatozoa in her bursa and none in her spermathecae; for example, in numerous artificial inseminations this

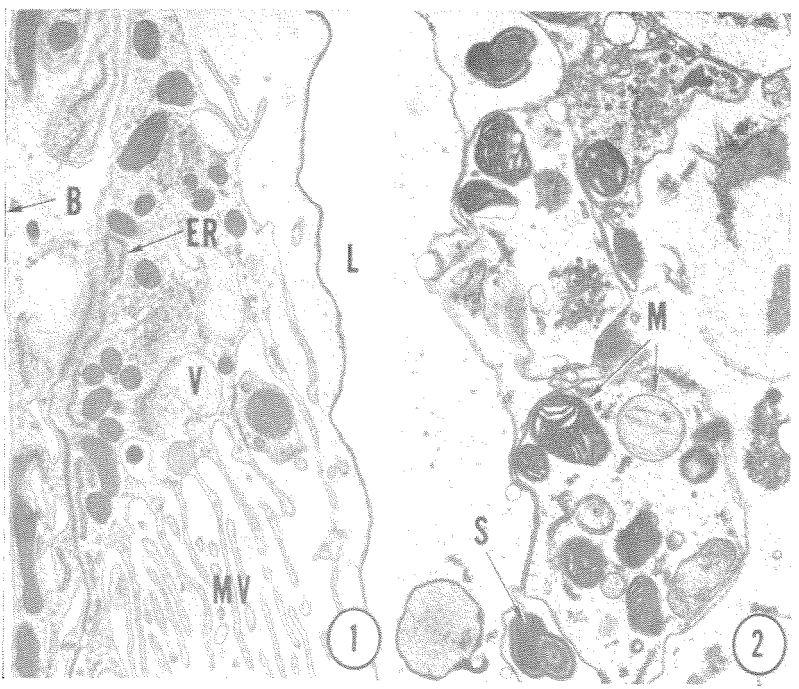

FIG. 1.—An electron micrograph of a portion of a bursal cell. Basement lamina (B), endoplasmic reticulum (ER), lumen (L), microvilli (MV) and vacuole (V) × 13,900.

FIG. 2.—Electron micrograph of a portion of luminal contents of inseminated bursa. Mitochondria (M), spermatozoa (S) × 22,800.

is the case (Jones and Wheeler, 1965c). It is known that seminal material within the bursa is absorbed within two to three days, after which the sac is again clear and empty (Jones and Wheeler, 1965b). Very little is known about the role the bursa plays between insemination and impregnation of mosquitoes. A study of the seminal bursa might lead to clues to some of the factors involved in sperm transfer. This preliminary note describes the fine structure of the

[1] Scientific Article Number A 1576, Contribution number 4290 of the Maryland Agricultural Experiment Station.

[2] Department of Entomology, University of Maryland, College Park, Maryland 20742. Supported by N.I.H. Career Development Award GM 21,529 and N.I.H. grants GM 6021 and Ai 08477.

[3] Laboratory of Parasitic Diseases, National Institutes of Health, Bethesda, Maryland 20014.

seminal bursa at insemination and during impregnation of the Bangkok strain of *A. aegypti*.

After being force mated with males, the terminalia of the females were dissected into cold saline before, during and shortly after sperm transfer to the spermathecae. The terminalia were placed in 2.5 percent glutaraldehyde and the material was then postfixed in 2 percent osmium tetroxide and dehydrated in ethanol and finally embedded in Epon.

The bursa is a single-cell-layered sac which has no musculature (Fig. 1). Those portions of the sac which were examined with the electron microscope were neither innervated nor tracheated. All of the cells in the sac are of the same type. The sinuous borders of contiguous cells are connected by multiple septate desmosomes. An extremely thin, finely granular basement lamina separates the bursal cells from the body cavity or hemocoele. The bursal cells possess only a few isolated cisternae of rough-surfaced endoplasmic reticulum, many well-defined mitochondria with densely packed cristae, and large Golgi complexes (Fig. 1). A large flattened nucleus with its nucleolus is located near the basal margin of each cell. Scattered, long microtubules lie parallel to the longitudinal axis of the sac. Extensive invaginations of the outer plasma membrane form clear, highly irregular saccules of extracellular space within the basal portion of the cells. Vacuoles of various sizes which often have a clear center and peripheral finely granular material are seen along the apical surface along with conspicuous, long, thin, widely spaced and irregular microvillar projections (Fig. 1). The bursa is lined with a very thin, dense, non-lamellated cuticular intima (epicuticle?). The area between the latter and the microvilli is filled with a fine flocculent material.

The semen within the bursa of the freshly inseminated female includes some spermatozoa and a large amount of accessory gland material, the latter consisting of some male accessory gland cells or their remnants, including numerous mitochondria (many with dense matrices, others of light density), various membranous cell components and fragments, as well as finely flocculent material (Fig. 2). No membrane was seen around the seminal material within the bursae examined.

The paucity of rough surfaced endoplasmic reticulum in the bursal wall immediately before, during, and shortly after transfer of semen from the bursa to the spermathecae suggests that the cells are not secretory during this critical period. The architecture of the bursal cells suggests absorbing tissue and this is in keeping with the observation that seminal materials remaining after impregnation disappear in a few days.

References

JONES, J. C., and WHEELER, R. E. 1965a. An analytical study of coitus in *Aedes aegypti* (Linnaeus). J. Morph. 117:401–424.

JONES, J. C., and WHEELER, R. E. 1965b. Studies on spermathecal filling in *Aedes aegypti* (Linnaeus). Biol. Bull. 129:134–150.

JONES, J. C., and WHEELER, R. E. 1965c. Studies on spermathecal filling in *Aedes aegypti* (Linnaeus). II. Experimental. Biol. Bull. 129: 532–545.

ROTH, L. M. 1948. A study of mosquito behavior, an experimental laboratory study of the sexual behavior of *Aedes aegypti* (L.). Amer. Midland Nat. 40:265–352.

SPIELMAN, A. 1964. The mechanics of copulation of *Aedes aegypti*. Biol. Bull. 127:324–344.

A GYNANDROMORPH OF *Culex fuscocephalus* THEOBALD FROM EAST PAKISTAN[1]

M. ASLAMKHAN

Pakistan Medical Research Center, Lahore, Pakistan and the Institute of International Medicine, University of Maryland School of Medicine, Baltimore, Maryland, U.S.A.

INTRODUCTION. About 100 described and over 200 undescribed gynandromorphs are known in the family Culicidae. They represent 28 species belonging to 8 genera. More than half the known mosquito gynandromorphs occur in the genus *Culex*. Kitzmiller (1953) has listed five *Culex* species with reported gynandromorphs viz; *C. coronator, C. pipiens* complex, *C. nigripalpus, C. salinarius,* and *C. theileri*. Since then four *Culex* species have been added to the list: *C. tarsalis* (Keh, 1955). *C. erythrothorax* (Blakeslee and Rigby, 1965), *C. tritaeniorhynchus* (Aslamkhan and Baker, 1969), and *C. cinereus* (Van Someren, 1969). This report describes the first gynandromorph in *Culex* (*Culex*) *fuscocephalus* Theobald.

MATERIALS AND RESULTS. During a course of study from August 1968 to July 1969, to establish the mosquito vector of rural bancroftian filariasis in Dinajpur District, East Pakistan (Aslamkhan and Wolfe, 1970), 20,915 mosquitoes belonging to 35 species were collected and identified. Of these 801 were *C. fuscocephalus*: 80 were taken resting in houses, 135 were collected on human bait and 586 were taken in cattle-biting collections. A good number of males was also collected from the houses but their numbers were not recorded. The single gynandromorph herein described was collected in the village of Akcha along with 40 other normal females on January 9, 1969, while feeding on cattle.

The gynandromorph was bipolar, the anterior end being female and the posterior male. The head and the mouth parts were typically female (Fig. 1); the hypopygium was that of a normal male (Fig. 2). Abdominal segments numbers 1

[1] These studies were supported by Public Health Service Grant No. TW 00142 (ICMRT) from the office of International Research, National Institute of Health, Bethesda, Maryland.