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Full Length Research Article

ULTRASTRUCTURAL CHANGES IN THE ADULT MALE ACCESSORY REPRODUCTIVE GLANDS OF *CHRYSOCORIS PURPUREUS* (WESTW.) (HEMIPTERA:PENTATOMIDAE) IN RELATION TO MATING

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ABSTRACT

Electron microscopic studies on the adult male accessory reproductive glands of *Chrysocoris purpureus* insects have revealed presence of a single layer of columnar epithelium, characterized by the multi shaped endoplasmic reticulum, polymorphic golgi bodies and vesicles. The male accessory reproductive gland before mating indicates its apocrine mode of secretion and its relative quantity of secretion appears to be higher than that of the glands after mating. A significance changes in the structure of the glands has been observed and it indicates the presence of numerous rough endoplasmic reticulum with cisternae which are considerably distended and induce fine granular products. The lumen of this gland reveals the presence of granular secretary materials identical to the rough endoplasmic inclusions and electron dense substance which are identical to golgi vesicles. The gland, further exhibits the mitochondria with numerous microvilli, swollen nucleus and secretary vesicles with multi vesicular bodies. The gland of the insects after mating reveals the occurrence of the degenerative epithelium, shrunken nucleus and large number of smooth endoplasmic reticulum. It shows the absence of multi vesicular bodies indicating its less secretary activity. Based on the observations, it may be inferred that this gland involves itself in apocrine mode of secretion during reproductive cycle and this secretion seems to facilitates the transport of spermatozoa into female through seminal fluid and may contribute rich materials for the maturity and physiological activity of spermatozoa.

INTRODUCTION

In insects, the male accessory reproductive gland vary in number, size, shape and location (Leopold, 1976 and Ranganathan, 1982). In *Chrysocoris purpureus* the male accessory reproductive gland lies at the postero median end of the abdominal ganglion and below the rectum. It consists of a bunch of fine tubules closely apposed together. In a just emerged adult, the tubules are not much developed. After that, the tubules show little change but only after mating the tubules are distinguished from each other. It consists of seven long, thick and thin, filamentous, highly coiled, whitish, mesodermal tubules situated just posterior to the junction of vasa deferentia and ejaculatory duct. (Gregory, 1965). The MARG's of their position length and appearance of the tubule ie; median-ventral (unpaired), antero-ventral (paired), median-ventral (paired) and postero-ventral-lateral (paired). The male accessory reproductive glands of insects, in most cases, the gland exhibits a single layered glandular epithelium surrounded by basement membrane and muscular wall (Bonhag and wick, 1953). They may be ectodermal in origin are known as ectadenia and in this case they open into the ejaculatory duct, occur in Coleopteran and possibly other groups. Glands of mesodermal origin, mesadenia are found in Orthroptera and in some cases Tenbrio for instance both ectadenia and mesadenia are present (Chapman, 1972). Apocrine secretion involves autolysis of the contents of the apical ends of the cells the merocrine secretion seem to occur mostly along the sides of the cells below the junctures of the terminal bars. In *C.purpureus* both the apocrine and merocrine mode of secretion is seen in mated males and only apocrine is reported in virgin males. (Gregory, 1965, Odbiambo, 1969, and Tenebriomolitor 1984). The primary function of these secretion is to facilitate sperm transfer, but they may also act as barriers to further insemination, either physically (or) by altering the behaviouer of the female. In some cases the secretion may have some nutritional value for the females (or) they may accelerate oocyte maturation (Leopold, 1976). The secretion of the male accessory reproductive gland contains proteinaceous components which has a wide verity of

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functions (Hinton, 1974; Leopold, 1976; Chen, 1984 and Happ, 1984). One of the major functions is in the assembly of spermatophore, a structure which serves as the vehicle for the transfer of sperm from male to female. The development and synthetic activity of the glands associates with the reproductive system of the male are regulated hormonally in several insect species (Szollosi and Landureau, 1977; Szopa and Happ, 1982; Szopa *et al*., 1985). The ultra structural studies of MARG's are scanty in insects especially in Hemiptera. Hence this study has aimed to find out the ultrastructual changes in the MARG's of *Chrysocoris purpureus* with special reference to mating.

MATERIALS AND METHODS

The male accessory reproductive gland (before and after mating) was dissected and separated. The tissue was fixed in 3% glutaraldehyde, 0.1M cacodylate and 0.025% calcium chloride buffer (ph 7.4) for 3h at 4^0C. After washing the tissue thoroughly in the same buffer, it was post fixed in 1% aqueous osmium tetra oxide (OSO_4) for 2-3h. The tissue was washed again thoroughly in the same buffer and was dehydrated through a graded series and embedded in flat silocinemould for one hour. Thin sections were cut in LKB_U-Ultra microtome. Thin sections were double stained with uranyl acetate asd lead citrate for 5minutes. They were viewed under Philip's (Zoo) Holland transmission microscope (TEM) and electron photomicrographs were taken.

RESULTS AND DISCUSSION

The MARG's of insects after eclosion appear white and transparent. As it gain more secretary materials and receives sperm from the testis via vas deference, the gland appear full, grayish and opaque. The wall of mesadenes consists of tall, columnar epithelium with thin basement membrane and delicate muscle bands around the gland. An intricate network of intercellular spaces which can be considerably distended surrounds the basal parts of the cells. During maturation, it becomes more and more pronounced and extends further towards the apical to the blister like dilations extended septate desmosomes furnish the mechanical coherence of the epithelium (fig. 6).

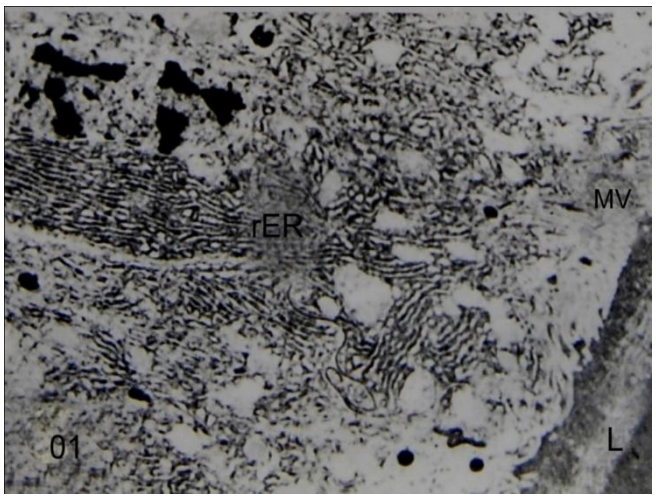

Fig.1. Ultrastructure of MARG's- before mating (MV)- microvilli (L)- lumen (rER)- rough endoplasmic reticulam

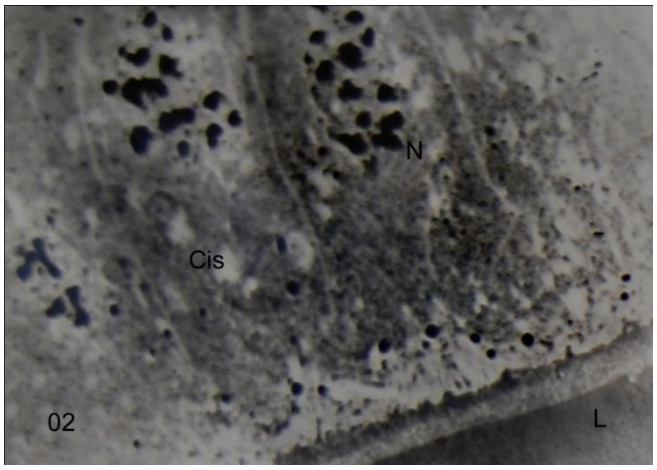

Fig. 2. Ultrastructure of MARG's – before mating (Cis) – Cisternae (N) – nucleus (L) - lumen

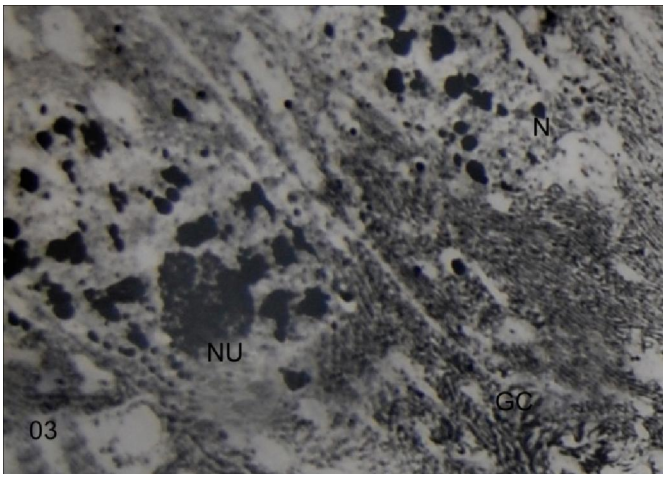

Fig.3. Ultrastructure of MARG's before mating (NU)-nucleolus (N)- nucleus (GC)- golgi complexes

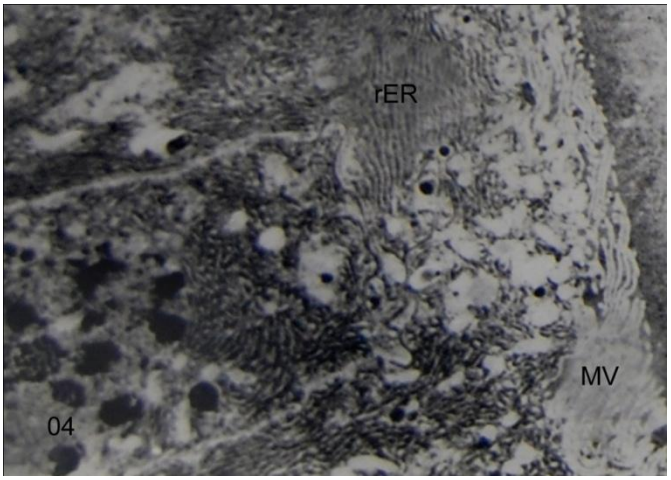

Fig.4. Ultrastructure of MARG's-before mating (MV) microvilli (rER)- rough endoplasmic reticulam

The nuclei are basally located. The nuclei of epithelial cells are large, globular and swollen (fig. 2 &3). The most spectacular changes concern the rough endoplasmic reticulum (fig.1). The rough endoplasmic reticulum increase drastically at the days of maturation and occupies most of the cytoplasmic materials (fig. 5 and 6). The cisternae of rough endoplasmic reticulum are distended and enclosed a fine granulated materials.

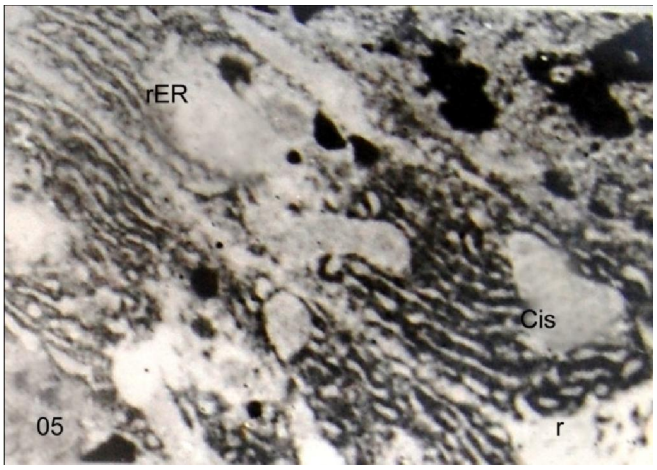

Fig.5. Ultrastructure of MARG's- before mating (rER) – rough endoplasmic reticulam (Cis)- cisternae

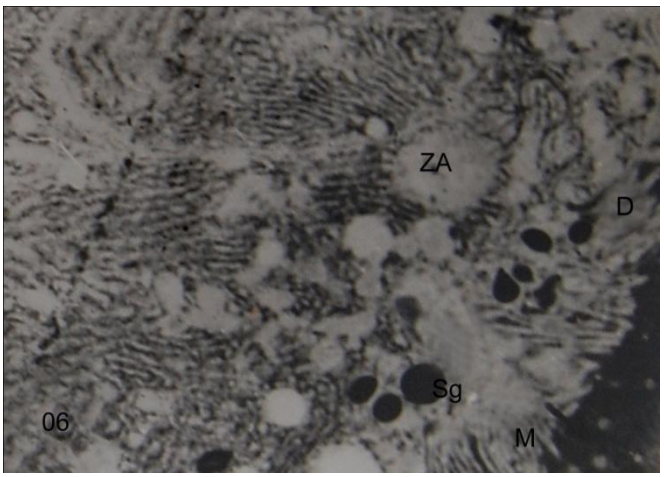

Fig.6. Ultrastructure of MARG's – before mating (D)- desmosomes (M)- merocrine secrection (ZA)- zonulae of adherence (SG)- secretory globule

The lumen of the gland has transparent and opaque secretion (fig. 7 & 8) which synthesis the secretary granules having an electron dense in the centre and electron less core in the pheriphery (fig.8). The protein synthesized at the rER as represented by the swollen cisternae was directly transported to the adjacent golgi vesicles where in the golgi vesicles themselves transformed into membrane limited granules. Tongue *et al*. (1972); and Craig, (1967) observed in the glands of the male *Culex pipens*, three types of granules and four types of secretary cells. The mode of secretion was mesocrine in unmated insects and both mesocrine and apocrine in mated insects. Apocrine was the most frequent mode of secretion various form of rER polymorphic golgi apparatus, many lysosomes, cored vesicles, numerous dense granules, microtubules were all in abundance in the process of secretion. Thibout, (1971); Kaulenas, (1976); Roth and Duteo, (1964). Pinocytotic vesicles and phagosomes are numerous endocytosis of phagosomes and exocytosis of pinocytic vesicles are evident (Riemann and Thorson, 1976a). All these indicated the high secretary activity in the mesadene of 2-3 days old virgin male. Further, the occurrence of disintegration of the epithelial cell of the gland concomitant with high secretary activity showing the flow of granules and clear globules towards the free cell surface in *C.purpureus*, strongly suggest that the mesadenia is highly secretary in nature releasing their contents through apocrine and mesocrine mode of secretary activity. The protein content of the gland decreases significantly during mating it appears that the secretion of the gland is involved in the transference of sperms to the female and perhaps in initiating the oviposition behavior. The secretion could play a role in sperm concentration and/or nourishing (Dorn, 1986). The mitochondria are fewer in number (fig. 9 & 10).

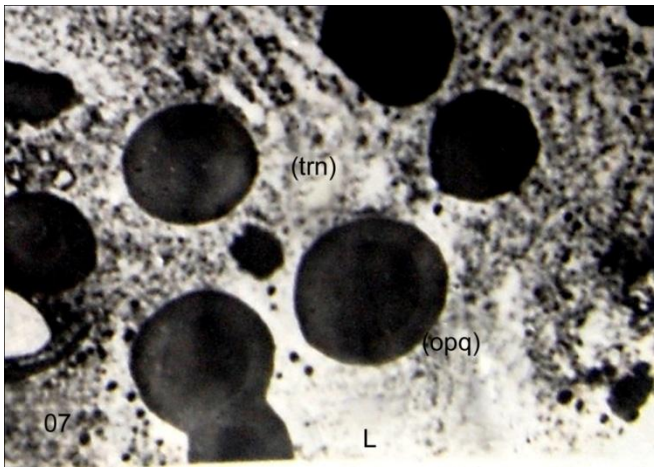

Fig.7. Ultrastructure of MARG's before mating (L)- lumen (opq)- opaque (trn)- transparent.

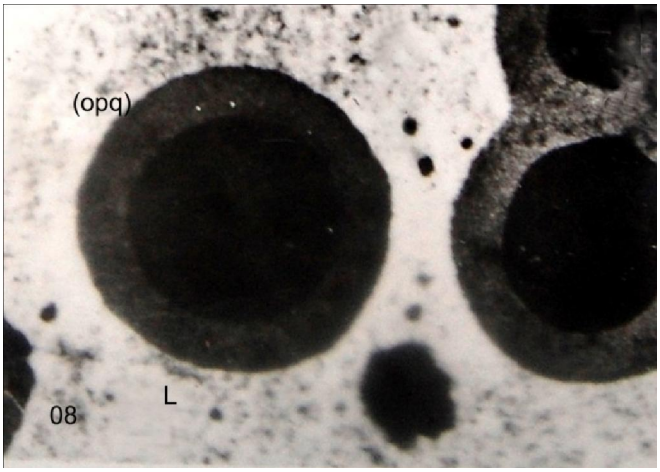

Fig.8. Magnified view of chrysocoris purpures of mating (L)- lumen (opq)- opaque (trn)- transparent

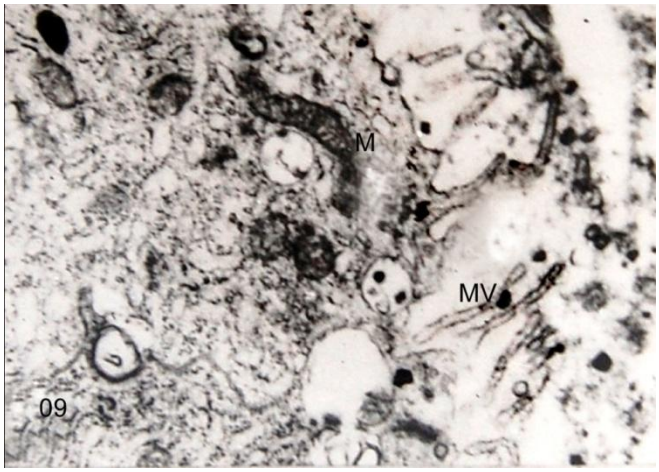

Fig.9. Ultrastructure of MARG's after mating (MV)- microvilli (M)- mitochondria

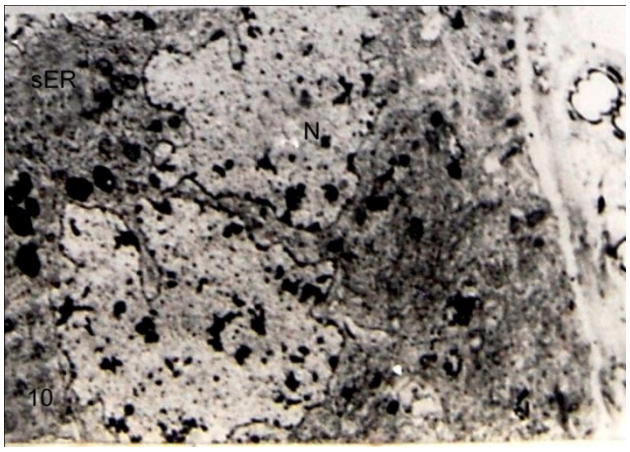

Fig.10. Ultrastructure of MARG's- after mating (N)- nucleus (sER) smooth endoplasmic reticulam

The number and length of the microvilli are less showing that the secretary activity of the cells are evidently less. Golgi complex are few in number with less vesicles (fig. 12). The drastic changes seen in after mating accessory gland is the occurrence of greatly reduced columnar cells due to loss of cytoplasm. The lumen is quite large and contains packets of secretary materials and cytoplasmic (fig. 11 & 13). From these ultra structural findings, it may be inferred that the lumen contains the similar secretary materials of rER and golgi complex, loaded within the lumen by apocrine and mesocrine mode of secretion.

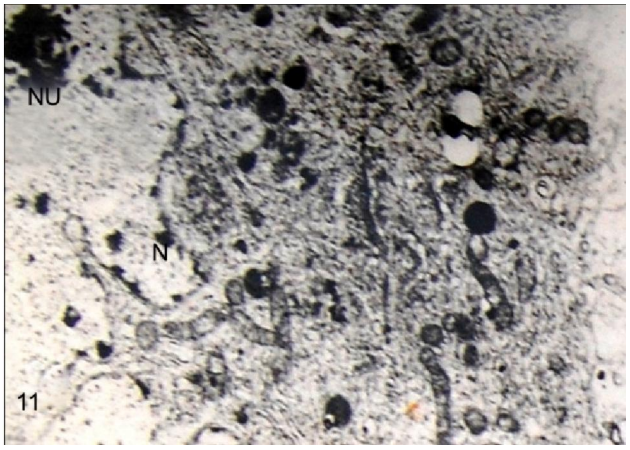

Fig.11. Ultrastructure of MARG's after mating (N)- nucleus (NU)- nucleolus

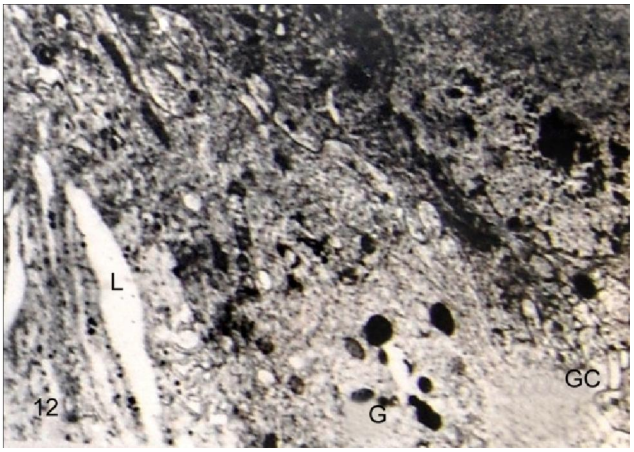

Fig.12. Ultrastructure of MARG's- after mating (GC)- golgi complex (L)- lumen

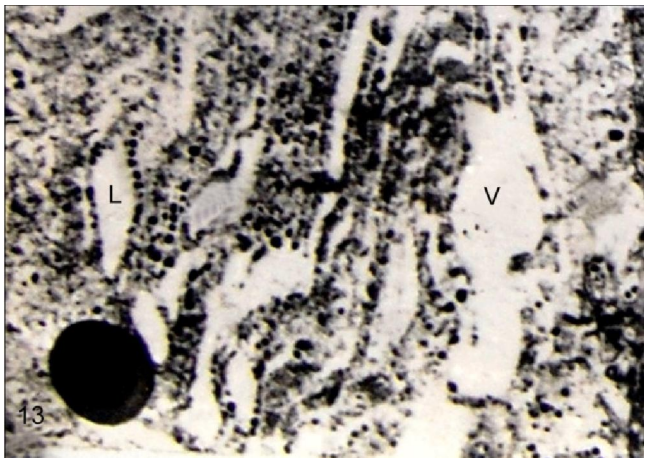

Fig.13. Ultrastructure of MARG's- after mating (V)- vacuole (A)- apocrine secrection (L)- lumen

Further, the lumen of the gland consists of electron dense and electron lucent materials. Probably, the electron dense material consists of an outer transparent core and an inner dense core may be utilized for the formation of spermatophore, which is transferred from male to female during mating and to product the sperms. The transparent secretary material filled in the lumen perhaps rich in before mating period than the after mating period. It may be utilized for the purpose of mating and in turns favours as an energy source for the sperm activation motility and nourishment.

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