COMPARATIVE SEM STUDY BETWEEN LATERAL OVIDUCT AND COMMON OVIDUCT OF A GRASSHOPPER, *Poekilocerus pictus* FABRICIUS (ORTHOPTERA: ACRIDOIDEA)

Dr. Somenath Dey

Abstract

This study has undertaken to compare the morphology of lateral oviduct with the common oviduct of *Poekilocerus pictus* Fabricius under scanning electron microscope. SEM study has revealed distinct longitudinal ridges over the outer surface of lateral oviduct; where as, the outer surface of common oviduct bears transverse folds. Inner surface of the lateral oviduct has provided with secretory warts, apertures, secretory droplets and more surface convolutions; on the other hand, over the inner surface of common oviduct the secretory warts, apertures and secretory droplets are absent and surface convolution pattern is different from that of lateral oviduct.

Key words : *Poekilocerus pictus*, *Lateral oviduct, Common oviduct, SEM, Surface ridges, Secretory droplets*

INTRODUCTION

Poekilocerus pictus, commonly known as Aak or painted grasshopper and are found throughout the planes of India (Raziuddin and Anwar, 1997). The primary host plant of this insect is Aak plant (*Calotropis procera*) but in the absence of its main host plants it feeds upon a number of alternative host plants, many of which are of economic value (Pruthi and Nigam, 1939; Pruthi, 1954; Parihar, 1974; Khurana, 1975; Raziuddin *et al*., 1991).

Like other acridids in this grasshopper the ovary are consisting of many ovarioles (Wigglesworth, 1965; Chapman, 2000; Tembhare, 2006). Each ovariole connected with lateral oviduct by means of pedicel. The lateral oviducts are long tubular structures of mostly uniform diameter. Each lateral oviduct proceeds posteriorly below the alimentary cannel and beneath the nerve cord between the 7^{th}. and 8^{th}. ventral chain ganglia. Generally, two lateral oviducts join a median or common oviduct as found in *Poekilocerus pictus,* however, the *Ephemeroptera* are exceptional in having the lateral oviducts opening separately, each with its own gonopore (Chapman, 2000).

The median or common oviduct is short duct and the posterior most part of this duct modifies into a sac, the genital chamber. The median oviduct opens with the gonopore. The genital chamber in some insects produces a tubular extension,

called the vagina or vulva, which opens at exterior as gonopore. The vagina may not be distinguishable in structure from the median or common oviduct, but its anterior end, and the position of the true gonopore marked by the insertion of the spermatheca (Snodgrass, 1935).

The present paper deals with comparative morphology of both the internal and external surface between lateral and common oviducts of an orthopteran insect, *Poekilocerus pictus,* as revealed under scanning electron microscopy.

MATERIALS AND METHODS

Live *Poekilocerus pictus* has collected from wild fields of Purulia district and reared in insect rearing cage at Department of Zoology, Durgapur Government College. Mature females dissected in orthopteran saline (Clayton *et al*., 1958) under a stereoscopic binocular microscope and lateral oviducts and common oviducts have obtained.

For SEM (Scanning Electron Microscopy) studies, both types of the oviducts of mature female *P. pictus* fixed in 2.5 % gluteraldehyde, prepared in 0.1 M phosphate buffer at p^H 7.4 at 4^oC for 2.5 hours followed by two washing in phosphate buffer at 4^o C. Then both the lateral and common oviducts were dehydrated in ascending grades of ethyl alcohol, i.e. 30%, 50%, 70%, 90% and absolute alcohol at 4^oC for two hours in each grade (two changes of one-hour duration).

In absolute alcohol, specimens dehydrated at 4^oC for one hour and at room temperature for another one hour. Then the specimens immersed in a mixture of alcohol and acetone of different grades (3:1, 2:1, 1:1, 1:2). Two changes of one-hour duration have given in each grade at room temperature. Then dehydrated in acetone for one hour and finally in anhydrous acetone at room temperature and proceeded for critical point drying (CPD). For CPD, the specimens placed over the grid and then placed inside the sputter both for critical point drying and for gold coating (30 minutes). Then this has viewed under scanning electron microscope (JEOL JSM 6700 F) at IACS (Indian Association for the Cultivation of Science, Jadavpur, Kolkata).

RESULTS

In scanning electron micrograph, longitudinal ridges have clearly seen over outer surface of lateral oviduct (Fig. 1), however, the outer surface of common or median oviduct appears to contain transverse ridges (Fig. 2).

The SEM of inner surface of lateral oviduct has found to be highly convoluted (Figs. 3, 7 and 9). The inner surface of common oviduct has found very much less convoluted than lateral oviduct (Figs. 4, 6 and 8). The SEM of inner surface of lateral oviduct has been also revealed the presence of secretory warts and apertures of various shapes and sizes (Figs. 5 and 10); however, these types of warts and apertures are totally absent in the inner surface of common oviduct (Figs. 4, 6 and 8). SEM of inner surface of lateral oviduct has also revealed the presence of

secretory droplets (Figs. 11 and 12) of various shapes sizes. This is also observed that in case of common oviduct, folds are of low height (Figs. 4 and 6), where as, in lateral oviducts the folds are with appreciable height (Figs. 3, 7 and 9).

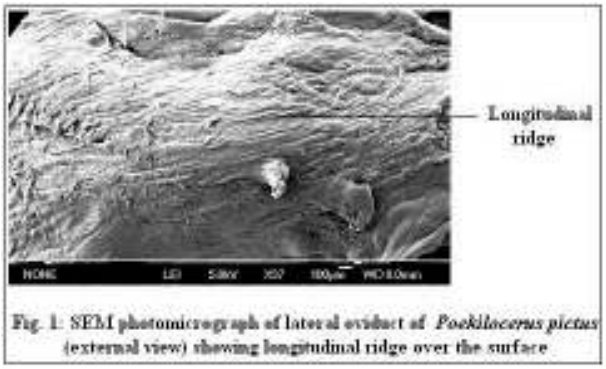

Fig. 1: SEM photomicrograph of lateral oviduct of *Poekilocerus pictus* (external view) showing longitudinal ridge over the surface

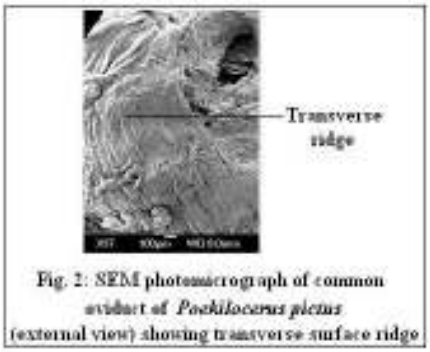

Fig. 2: SEM photomicrograph of common oviduct of *Poekilocerus pictus* (external view) showing transverse surface ridge

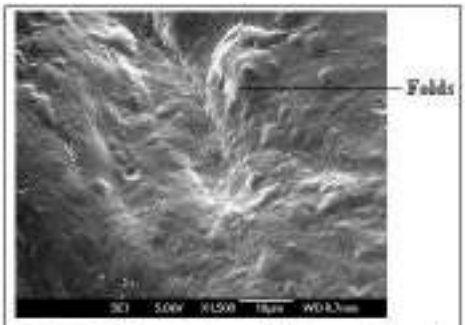

Fig. 3: SEM photomicrograph of internal view of lateral oviduct of *Poekilocerus pictus* showing folding pattern

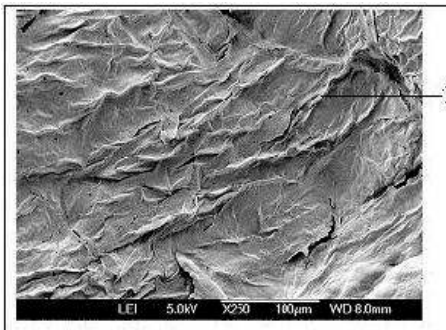

Fig. 4: SEM photomicrograph of internal surface of common oviduct of *Poekilocerus pictus* showing folding pattern

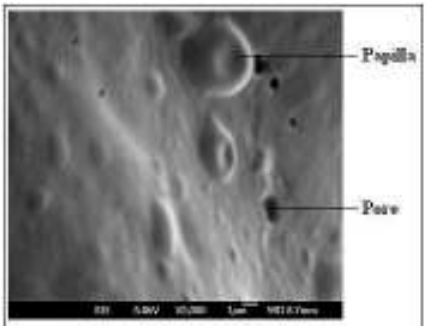

Fig. 5: SEM photomicrograph of internal surface of lateral oviduct of *Poekilocerus pictus* showing the presence of papilla and pore which are absent in case of common oviduct's internal surface

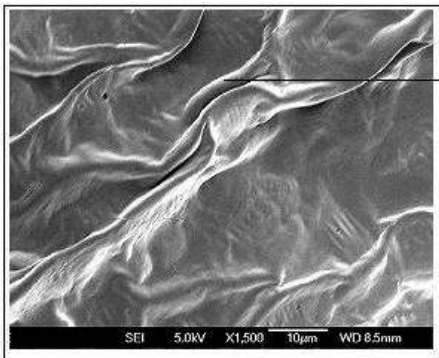

Fig. 6: SEM photomicrograph of internal surface of common oviduct (magnified view) of *Poekilocerus pictus* showing folding pattern

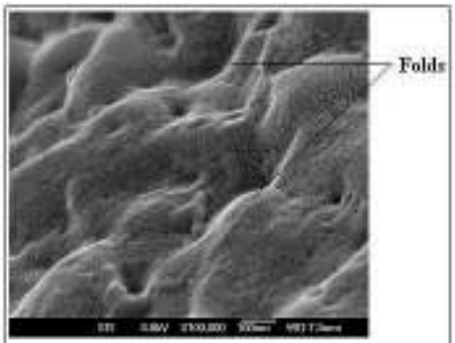

Fig. 7: SEM photomicrograph of internal surface of lateral oviduct of *Poekilocerus pictus* (ultra magnified) to showing folding pattern

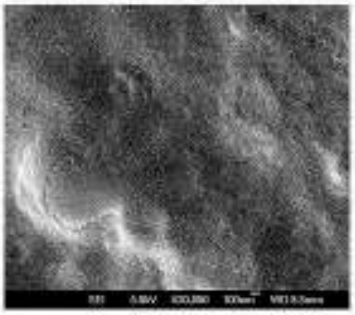

Fig. 8: SEM photomicrograph of internal surface of common oviduct of *Poekilocerus pictus* Note: there are no such pores as found in case of lateral oviduct's internal surface

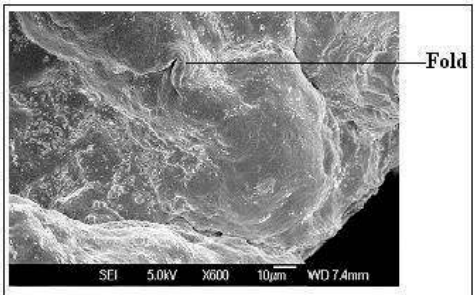

Fig. 9: SEM photomicrograph of internal surface of lateral oviduct of *Poekilocerus pictus* showing surface folding pattern

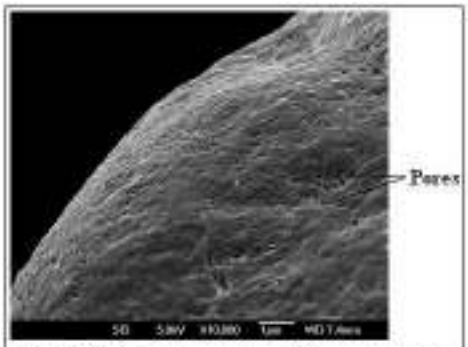

Fig. 10: SEM photomicrograph of internal surface of lateral oviduct of *Poekilocerus pictus* showing porus inner surface texture

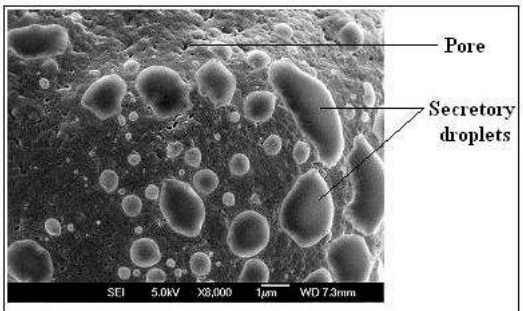

Fig. 11: SEM photomicrograph of internal surface of lateral oviduct of *Poekilocerus pictus* showing pores and the secretory droplets

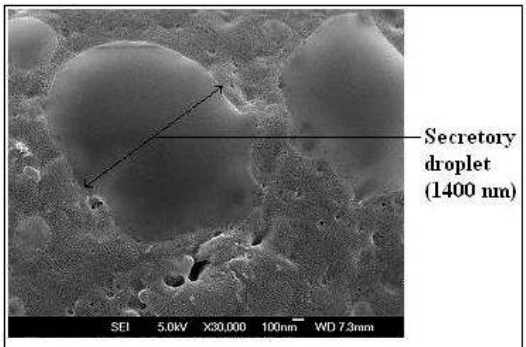

Fig. 12: SEM photomicrograph of inner surface of lateral oviduct of *Poekilocerus pictus* showing pores and secretory droplets (dimension of one such droplet is nearly 1400 nm) [magnified]

DISCUSSION

In insects, the lateral oviduct may be either mesodermal or ectodermal in origin. In the former case these develop as extensions of the calyces of the ovaries (Heymons, 1897; Buning, 1994) into which the ovariole open, while in the latter case these develop as out pocketings of the common oviduct (Davey, 1985). However, in many species, upper part of the lateral oviduct is mesodermal while the lower part is ectodermal, the latter developing from the common oviduct, which is always of ectodermal origin (Weber and Weidner, 1974; Davey, 1985). In *Poekilocerus pictus,* the lateral oviducts are mesodermal in origin, hence, without the inner intimal layer (Karim, 1979). With the onset of vitellogenesis in the lumen of the lateral oviduct, secretion began appearing which in females finally filled the lumen completely with mature basal oocytes. It is noteworthy that unlike *Acrida* and *Locusta* (Engelmann, 1970), in *Poekilocerus pictus* accessory glands are absent and the lateral oviduct walls are glandular. In SEM studies of lateral oviducts, the inner surface of the lateral oviduct has found to contain secretory droplets of various sizes. It has further observed that the smaller secretory droplets coalesce to form larger secretory droplets. The nature of secreted material is proteneceous (Karim, 1979).

SEM studies of the lateral oviduct and common oviduct surfaces have revealed an important difference: the former possesses longitudinal surface ridges while the latter has transverse ridges. Further, the inner surfaces of the above two parts also markedly differ as, in the case of common oviducts pore-like openings are totally absent, but these are present in large numbers in the case of lateral oviducts. Still further, in the SEM studies a marked difference in the folding pattern of the two parts has seen. These features revealed by SEM studies have probably reported for the first time in *Poekilocerus pictus.*

ACKNOWLEDGEMENT

The author wish to express his gratitude to the Director, Indian Association for the Cultivation of Science, Jadavpur, Kolkata, India for providing facilities of scanning electron microscopy.

REFERENCES

Buning, J. (1994): The insect ovary- ultrastructure, previtellogenic growth and evolution. *Chapman and Hall, London, UK.*

Chapman, R.F. (2000): The Insects, Structure and Function (4th Edition). *Cambridge University Press*

Davey, K.G. (1985): The female reproductive tract, in *Comprehensive Insect Physiology, Biochemistry and Pharmacology,* (eds G.A. Kerkut and L.I. Gilbert), *Pergamon Press, Oxford,* Vol. **I**, pp 37-82

Engelmann, F. (1970): The physiology of insect reproduction. *Pergamon Press*, Oxford.

Heymons, R. (1897): * Entwicklungsgeschichtliche Untersuchungen an *Lepisma saccharina tZ. Wiss. Zool.* **62**: 583- 63

Karim, S.W. (1979): Studies on the structural and histochemical changes in the reproductive organs during postembryonic development of *Poekilocerus pictis* (Fabr.). *Ph D Thesis. Magadh University, Bodh-Gaya.*

Khurana, A.D. (1975): Alternative host plants of Aak grasshopper, *Poekilocerus pictus* (Fabricius). *Entomologists Newsletter.* **5** (6-7): 34

Parihar, D.R. (1974): Some observations on the life history of Aak grasshopper, *Poekilocerus pictus* (Acridoidea: Pyrgomorphidae) at Jaipur, Rajasthan, India. *J. Zool. Soc. India.* **26**: 89-129

Pruthi, H.S. and Nigam, L.N. (1939): The bionomics, life history and control of the grasshopper, *Poekilocerus pictus* (Fab.) a new pest of cultivated crops in north India. *Indian J. Agric. Sci.***9**: 629-641

Pruthi, H.S. (1954): The Aak grasshopper- *Poekilocerus pictus* (Fabr.) (Acrididae) attacking Citrus in Delhi. *Indian J. Ent.* **16**: 196

Raziuddin, M., Singh, S.B.; Sharma, A.K. and Singh, B.K. (1991): Feeding habits of *Poekilocerus pictus* Fabricius (Acridoidea; Pyrgomorphidae). *Environment and Ecology.* **9** (1): 100-102

Raziuddin, M. and Anwar, M.S. (1997): On the occurrence of a pyrgomorphid grasshopper, *Poekilocerus pictus* Fabricius in India with particular reference to Bihar. *Columban J. Life Sci.* **5** (1-2): 205-211

Snodgrass, R.E. (1935): The abdominal mechanism of grasshoppers. *Smithson.Misc. coll.* **94**: 1-89

Tembhare, D.B. (2006): Modern entomology. *Himalaya Publishing House, Mumbai.*

Weber, H. and Weidner, H. (1974): * *Grundriss der Insektenkunde,* **5**. Aufl. Fischer Verlag, Stuttgart.

Wigglesworth, V.B. (1965): *The principles of insect physiology.* Methuen, London

***** paper not seen in original.