

THE RELATIVE STUDIES OF NEUROSECRETION IN CORPORA CARDIACA OF *Chrysocoris stoll* (HETEROPTERA).

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Key words : Neurosecretion, *Corpora cardiaca*, *Chrysocoris stoll*, Heteroptera.

Chrysocoris stoll has well developed neuroendocrine system, which consists in neurosecretory cells (NSC), *corpora cardiaca* (CC), *corpora allata* (CA) and prothoracic glands (PTG). *Corpora cardiaca* are important neuroendocrine glands of *C. stoll*. On the basis of the distribution of neurosecretory material (NSM), the histomorphology of the *corpora cardiaca* in *C. stoll* is described. The corpus cardiacum clearly consists of anterior storage lobes and posterior secretory lobes. Posterior storage part is made up of chromophobe cells and anterior secretory part is made up of chromophil cells. The storage parts of CC are connected to the brain neurosecretory cells by nervicorporis cardiaci I & II and secretory parts of CC are also connected with *corpora allata* (CA) by nervicorporis allati.

INTRODUCTION

Chrysocoris stoll is a common pest of *Croton sparsiflorus* plant. The corpora cardiaca are principal neurohaemal organs of *Chrysocoris stoll*. They are elongated paired bodies lying behind the brain and closely associated to the aorta. The brain neurosecretory cells produce neurohormone and reach the storage lobe or corpora cardiaca by NCC I and NCC II. The paired *corpora cardiaca* are fused in some insects (Geldiay, 1967 and Awasthi, 1976). Each *corpus cardiacum* is clearly differentiated into two parts, anterior storage part which receives the neurosecretory materials (NSM) from neurosecretory cells (NSC) and other posterior secretory parts which secrete their own hormones. (Dogra and Ewen, 1970; Saini, 1971 and Ruscoe, 1978).

Khan and Fraser (1976) have described very briefly the neuroendocrine system of the later stages of cockroach (*Periplaneta americana*) and also briefly described the *corpora cardiaca* with their nervous connections. Studies on the neuroendocrine system of the Grasshopper have been made by Raziuddin *et al.*, 1978; Mendes, 1978; Odhiambo, 1979 and Krishnandam & Rammurthy, 1980. The neurosecretory materials present in CC and their nervous connection NCC 1 & NCC II have been described in *S. gregaria* by Adiyodi (1984), Gabe (1986) and Manson (1993). The histological structure of CC in Heteropteran bugs have been described by Naveed *et al.*, (2008) and neurosecretory material present in central region of this insect by Dhingra (2009).

MATERIALS AND METHOD

The adult males and females of *Chrysocoris stoll* were collected from the plants of *Croton sparsiflorus* and reared in the laboratory under room temperature. The female *C. stoll* lays eggs after mating. The nymphs were hatched out from eggs and developed in cage. The freshly moulted individuals (both sexes) were selected for experiments, i.e., solitary condition (one male & one female) and crowded condition (50 males and 50 females) and reared in experimental cages. The adult individuals of different ages were dissected in insect ringer solution under binocular dissecting microscope. The

brain alongwith the extracerebral neuroendocrine complex were fixed in 10% formaline solution and were stained with Performic Acid Victoria blue (PA VB) stain (Dogra and Tandan, 1964) for histomorphological studies of the *corpora cardiaca*. The neuroendocrine complex were fixed in aqueous Bouins fluid for 24 hrs and embedded in paraffin wax (m.p.62°C). Serial sections of materials were cut at the thickness of 8µ to 10µ and were stained by Paraldehyde fuchsin (PF), Chrom-Haematoxylin phloxine (CHP) stains.

RESULTS AND DISCUSSIONS

The corpus cardiacum is an elongated glandular structure situated behind the brain above the foregut of *C. stoll*. The corpora cardiaca are paired symmetrical glands and clearly differentiated into anterior storage parts and posterior secretory parts. The anterior storage part of the gland stores and reaches the brain, neurosecretory hormones.

The posterior secretory parts are consisting into many intrinsic cells which secreted their own hormone in *C. stoll*. The anterior part of the CC is connected with neurosecretory cells (NSC) of brain by NCC I, NCC II and NCC III. The neurosecretory storage part of the CC contains abundant A-type neurosecretory material which is stained dark purple with PF, blue lack with CHP and deep blue green with PAVB staining methods. The CC are composed of two lobes which are closely associated with the wall of aorta. The posterior lobes of the CC are larger than the anterior lobes and the intrinsic cells of posterior lobes, secrete own materials which stains dark purple with Paraldehyde Fuchsin (PF) and deep blue green with PAVB.

A similar conclusion has been seen in *S. gregaria* by Highnam (1961), Mordue (1965) and Awasthi (1976). The secretory posterior lobe of CC are connected with corpus allatum by nervicorporis allati I (NCAI).

The amount of NSM in corpora cardiaca (cc) in the females of solitary condition and crowded condition has been discussed.

Solitary condition : In one day old female of *C. stoll* has sparse amount of NSM in CC but 12 days old mated females have maximum amount of NSM in CC. In freshly emerged

adults the CC contained a very small amount of neurosecretory material (NSM). However, an increase in the amount of material has been noticed on the 2nd day after fledging of *C. stoll*i. The maximum amount of NSM in the CC was observed during sexually mature or the excitation phase of female *C. stoll*i (Table-1).

The amount of NSM in CC get slowly minimum or sparse amount upto 20 days old oviposited females. Present observation is in agreement with the findings of Highnam (1961) in *Schistocerca*.

Crowded condition : In one day old female has sparse amount of NSM in CC but 10 days old copulated females have maximum amount of NSM in CC of *C. stoll*i. Increased neurosecretory material in CC of increasing age of female *C. stoll*i are upto copulation but the amount of NSM in CC get decreased slowly till 18 days old ovipositing females (Graph-I). The corpora cardiaca of *C. stoll*i have close structural resemblances to those of other grasshoppers (Geldiay 1964 & 1967; Dogra Ewen, 1970 and Raziuddin *et al.*, 1977). In Grasshopper the A-type neurosecretory material (NSM) is exclusively restricted to the anterior storage lobes of the CC. Saini (1971) while discussing the corpora cardiaca of *C. stoll*i described the presence of A-type neurosecretory material in both the anterior and posterior parts. In this regard, Saini (1971) observation on the distribution of neurosecretory material in the CC of *C. stoll*i is quite different from the present findings.

In *S. gregaria*, the posterior part of the CC can be easily separated from the anterior storage lobes by Highnam & Hill (1969). In *C. stoll*i the corpora cardiaca are connected to the brain neurosecretory cells by three pairs of nerves viz a pair of NCC I, NCC II and NCC III. However, in grasshoppers two pair nerves are there, namely NCC I & NCC II which also connect the CC with the brain (Engelmann, 1970 and Raziuddin *et al.*, 1978).

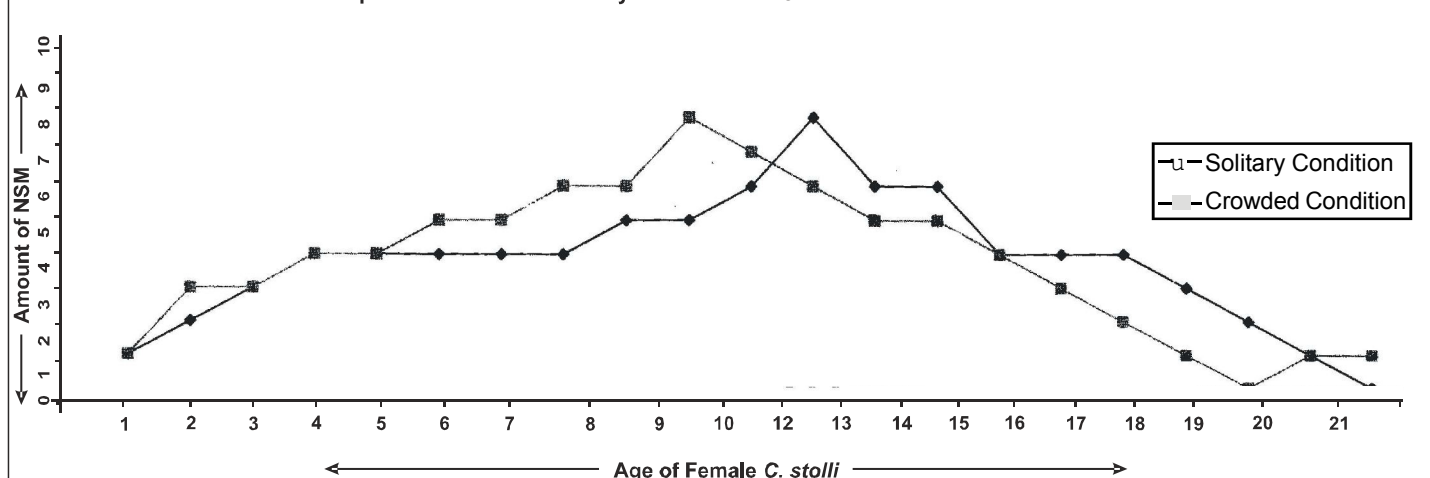
The corpora cardiaca of *C. stoll*i have close histomorphological resemblances with those of the other Heteropteran bugs (Mendes, 1978; Odhiambo, 1979; Krishnam & Ramamurty, 1980 and Naveed *et al.*, 2008).

In some insects the occurrence of NSM has been reported in the CC and their nervous connection (Adiyodi 1984, Gabe 1986). However in *C. stoll*i the CC have stainable neurosecretory material, This finding supports to the present finding. The present investigation on the distribution of neurosecretory material in the CC of *C. stoll*i suggests that the material is mainly stored in the central region of the storage lobe and at times when the stainable material is almost absent in the central region, their presence in abundance along the peripheral region, indicates the material gradually migrates towards the periphery of the glands by Dhingra (2009). The corpra cardiaca are smaller in size during nymphal stage and freshly moulted stage but it get larger in size during copulating phase of female *C. stoll*i. The size of CC also get decreased after oviposition.

TABLE - 1
Neurosecretory material (NSM) showing in Corpora Cardiaca of female *C. Stoll*i.

| Parameters | Amount of stained neurosecretory material in CC of different ages of <i>C. stoll</i> i. | | | | | | | | | | | | | | | | | | | | |
|--------------------|---|-----|-----|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| Solitary Condition | + | ++ | +++ | ++++ | ++++ | ++++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | ++ | + | - |
| Crowded condition | + | +++ | +++ | ++++ | ++++ | ++++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | ++ | + | - | + | + |

1. Graph of NSM in CC of solitary condition and crowded condition of female *C. stoll*i.



References

- Adiyodi, K. G., 1994 : Extracerebral cephalic neuroendocrine complex of the Blattids *P. americana* and *Neostylopyga rhombitolia* (stolli) J. Morph **144** : 469-484.
- Awasthi, V.B., 1976 :Ultra structure of retrocerebral complex of the ear wig, *Euborellia annulipes*J. Insect. Physiol, **22** : 1181-1186.
- Dhingra, S., 2009 : Histology of the corpora cardiaca and neurosecretory cells of Dyteloptera. J. Ent. Res. **64** : 632-635.
- Dogra, G.S. and Tandan B.K. 1964 : Histology of the neurosecretory system and the retrocerebral endocrine glands of the adult migratory grasshopper, *Melanoplus sanguinipes* J. Morph. **130** : 451-466.
- Dogra, G.S. and Ewen A.B., 1970 : Histology of the neurosecretory system and the retrocerebral complex of the adult grasshopper *Melanoplus sanguinipes* (fabr) J. Morph. **130** : 451-466.
- Engelmann, F., 1970 : Studies of nervous connection NCC I & NCC II in brain of Grasshopper Bio, Journ Ent Vol- **22** : 123-131.
- Gabe, M., 1986 : Effect of neurosecretion in development oocyte in bugs. Pergamon Press : 86; 234-240.
- Geldiay, S., 1964 : Morphological and histological studies on the corpora cardiaca in orthoptera conm Fac Sc Ankara Univ **8** : 19-94.
- Geldiay, S., 1967 : Hormonal control of adult reproductive diapause in the Egyptian grasshopper, *Anacridium aegyptium*. L. J. Endorin; **37** : 63-71.
- Highnam K. C., 1961 : The histology of the neurosecretory system of the adult desert Locust *Schinstocerea gregaria*. J. M. Sci. **102** : 27-386.
- Highnam K. C. and Hill. L., 1969 : The Comparative endocrinology of invertebrates. Edward Arnold (Publishers) Ltd. London.
- Khan T. R., and Fraser., 1976 : Neuroendocrine system and neurosecretion in the later stages of cockroach, *Periplanata americana*. Men. Soc. End. **18** : 242-255 .
- Krishnandam, Y. and Ramamurthy P. S., 1980 : A correlative study of the neuroendocrine organs and oocyte maturation in *Pyrilla perpusilla* walker, Zoo1. Anat Forch **84** : 257-285.
- Manson, A.C., 1993 : The brain neuroendocrine complex of the Locust *Sehistoeerea vaga*. Zool Zello : **143** : 199-212.
- Mendes, M.V., 1978 : Histology of the corpora allata & corpora cardiaca of *Melanoplus differentialis*, Biol. Bult Hole. **94** : 194-207.
- Mordue, W., 1965 : Studies on oocyte production and histological changes in the neuroendocrine system of *Tenebrio molita*. L.J. Insect Physiol. **11** : 493-503.
- Naveed A, Dayanand G. Y., & Hosetti B.B., 2008 : Studies on the corpora cardiaca & corpora allata of cotton bugs. Ent. Jorn. **5** : 262-269.
- Odhiambo, T.R., 1979 : Morphometric changes and hormonal activity of the corpora cardiacaca in desert focust. J. insect Physiol. **36** : 255-262.
- Raziuddin, M. and Khan T.R., 1978 : Studies on the neuroendocrine system of the grasshopper, *Poeeloeerus pictus*. Folia Morph. **26** : 16-27 .
- Raziuddin, M., Khan T.R. and Singh, S.B., 1977 : Neuroendocrine activity in relation to mating and oviposition in female grasshopper, *Poeciloceru pictus*. (Fabricius) Vol-1 C.V., India, PP, 319-327 .
- Ruscoe, C.H.E., 1978 : Effect of corpora cardiaca in oocyte development of Heteropteran bug. J. Ins. Sc. **35** : 265-270.
- Saini, R.S., 1971 : Neuroendocrine control of oocyte development *Poeciloceru pictu*. J Zool Loud **165** : 275-283.