

CHAPTER V

SUMMARY & CONCLUSION

1. *Platynotus belli* is a black stout ground beetles belongs to family tenebrionidae, order coleoptera & commonly called as 'Pengul'. It is a stored grain pest, abundantly found in stores & granaries. The life cycle of *P. belli* complete with 4 stages of development i.e. egg, larva, pupa and adult. Both the larval and adult forms are harmful & destroys the stored grains.
2. The alimentary canal of adult *P. belli* is typical coleopteran type. & it is divided into foregut, midgut & hindgut. The length of the alimentary canal is 2-2.5 folds that of body length as it measures about 58-60 mm. long. Foregut occupies 3.3% the midgut 58.33% & the hindgut 38.33% of the total length of alimentary canal.
3. Foregut is very short & consists of 3 regions preoral cavity, pharynx & oesophagus. Crop is absent in *P. belli*. Histologically foregut shows outer circular & inner longitudinal muscle layers, epithelial cells & indistinct basement membrane. Intima shows well developed spiny processes. Cardiac/stomodaeal valve is present at the posterior end of stomodaeal wall projecting into midgut
4. Midgut is the longest division of the alimentary canal comprising 58.33% of total length of the digestive gut. Histologically midgut shows tall columnar epithelium with distinct cell membrane & centrally placed nuclei. Epithelium is supported by basement membrane. Holocrine secretion is observed in the midgut epithelium. Food content is enclosed by peritrophic membrane.
5. Hindgut is divisible into anterior ileum, colon & posterior rectum. Histologically the epithelium of ileum consists of very small cuboidal

cells supported by prominent basement membrane. The intima is thin, chitinous and is provided with small spines. Colon consists of epithelium made up of cuboidal cells with very long oval prominent nuclei, with well defined cell boundaries & chitinous intima. Rectum consists of epithelium with six broad folds with large cuboidal cell with prominent nuclei. Anal canal is present at the end of hindgut in the form of narrow passage connecting the rectum with anus. The epithelium is very much folded and is made up of small cuboidal cells with round nuclei. It is supported by a basement membrane. Thick intima is present internally.

6. There are in all six malpighian tubules divided in to three groups, each group containing two of them. Histologically malpighian tubule consist of single layer of cuboidal epithelium. The cells of the proximal region are larger, where as distal region are flattened.

7. For studying the physiology of digestion, digestive enzymes like amylase, invertase, trehalase, lipase and protease are practically characterized. pH optimum of amylase is PH 5.4, Invertase 5.6, Trehalase 5.2, lipase 8.2 & protease 10.2.

8. The temperature optimum activity is obtained at 40⁰C for invertase, amylase, lipase, and protease and 50⁰C for trehalase, showing that the enzyme is stable at higher temperature.

9. The midgut amylase requires 10 minutes for maximum activity which is very short period for process of digestion. Maximum activity is 20 minutes for inverters lipase & protease for trehalase the period of linear activity is 30 min which is longer than other enzyme indicating its slow acting property, than other four enzymes.

10. The theoretical duration of high temperature treatment at 60⁰C for 50 % loss of activity is found to be at 5 minutes, 4 minutes, and 6 minutes

for amylase, lipase & protease respectively. The highest, temperature treatment at 65^o c for 50 % loss of activity is found at 6 min for trehalase and high temperature treatment at 55^oC for 50% loss of activity is found to be 9 min. The results above indicates that the enzymes shows stability even at higher temperature between 55^oC - 65^oC.

11. Michalie's constant (km) were obtained by plotting reciprocals of substrate concentration (1/s) and velocity (1/v) by line weaver's Burk's plot. The km value obtained for amylase 0.4% & protease 0.0185% which is very less this shows that these enzymes are efficient in their action. A km value for invertase is $5.842 \times 10^{-3} \text{M}$, lipase is 3.52×10^{-4} and trehalase is $5.286 \times 10^{-3} \text{M}$. indicating less efficiency of these three enzymes.

12. The Endocrine system conducted in adults *P.belli*. Typical coleopteran pattern is seen in this beetle. Endocrine system consist of cephalic endocrine system and ventral ganglia. Anatomically, cephalic endocrine system consist of brain, paired corpora cardiaca and paired corpora allata. On the basis of their staining properties towards the PF & CHP stain 3 types of neurosecretary cells are observed viz. A, B & C cell types in different NSC groups. There are in all 3 pairs of NSC groups present as paired MNC, paired LNC, paired PNC. A cells are present in all the cell groups except in PNC. B & C cells are present in all the three NSC groups of brain in *P.belli*. The axons of MNC form MNSP the axons of LNC form LNSP and axon of PNC from PNSP. The MNSP emerge out of the brain as NCC-I. The PNSP run towards neuropilar region and joins the LNSP and emerge out of the brain as NCC-II. Both the nerves innervate the CC of their own side.

13. The two neurohaemal organ are present CC & CA, The CC are paired lobe consist of PF positive secretory chromophilic cells PF-ve

chromophobic cells. The corpora allata CA are paired oval bodies lying on either sides of oesophagus & connecting to the distal end of the CC of their respective side. Each lobule is made up from the cells with indistinct cell boundaries & the nuclei of various sizes.

14. The ventral nerve cord of *P.belli* consists of sub oesophageal ganglion (SOG), three thoracic and five abdominal ganglia. The SOG is a large oblong structure located in the ventral region of the head capsule. The prothoracic ganglion is located in prothoracic region. Mesothoracic & metathoracic ganglia are located in the mesothorax & metathorax region respectively. Abdominal ganglia are present in the series in the abdominal region on the basis of staining affinity.

15. Histologically ventral ganglia, consist of neurosecretory cells A, B & C organize in to definite groups. The SOG has in all 4 groups of NSC viz, anterior neurosecretory cells (ANC), a pair of posterior neurosecretory cells (PNC) a, pair of posterolateral neurosecretory cells (PLNC) & a pair of anterolateral neurosecretory cells (ALNC).

In pro, meso and meta thoracic ganglia NSC are present in 4 groups viz – ANC, pair of ALNC, pair of PLNC & PNC are observed. Abdominal ganglia consist of a pair of LNC groups only bordering the entire lateral margin of the abdominal ganglionic part. Neurolemma of all the ganglia stain deeply with PF stain suggesting its connective tissue nature. The last abdominal ganglion consists of only a pair of LNC group. Each LNC group has 'B' & 'C' cells.

The anatomy and physiology of the digestive and neuroendocrine system have significance in the establishment and confirmation of basic knowledge in the coleopteran insects. This knowledge would be utilized in the population management strategies of this species and other related species.

Particularly manipulation in the endocrine system upset the hormonal balance during any stage of development resulting into imbalance in physiological and developmental events which could lead to the formation of individuals which are unfit for survival or reproduction.

Hence, hormonal pest management could be visualized, likewise other physiological aspects may be utilized in the management of this stored grain pest and other related species.