7. SUMMARY

7.1 Preparation of stage-specific identification keys for the common looper species of tea with description of stages

- *Biston* (=*Buzura*) *suppressaria* and *Hyposidra* spp. could be identified easily based on their body size, general appearance, coloration and wing shape.
- *Biston* (=*Buzura*) *suppressaria* was more robust with larger abdomen, whitish-grey colour and un-fringed posterior wing margins. *Hyposidra* spp. were with smaller abdomen and slaty-dark colouration. Wing margin was either broadly fringed in *H. infixaria* or having a notch at the tip on the inner margin of the meso-thoracic wing in female *H. talaca*.
- Looper stages of the two congeners, *H. talaca* and *H. infixaria* could be distinguished only after they reached 4th larval instar. 3rd abdominal leg in the late instars, cremaster at pupal stage and wing margins in adults bore the most distinguishable and key character states.

7.2 Designing and development of synthetic (artificial) diet for rearing the geometrid (looper) species

- Diet used by Lyon and Brown (1970) could sustain the larval development of *H. talaca* but failed to develop a normal adult. Addition of linoleic acid in the diet was found obligatory for normal development of adult in *H. talaca*.
- Addition of linseed oil along with linoleic acid and vitamin E in the diet was necessary for normal development in *B. suppressaria*.
- Addition of linseed oil in the diet, designed for *H. talaca* rearing, gave a better development results and emergence of normal adults of *H. infixaria*.

- Moisture content in diet and inside of rearing container was kept optimum in order to avoid high larval mortality by sticking to water droplets on one hand and to avoid fast drying of diet cubes on the other. An optimum relative humidity around 75% was necessary for normal pupation and adult emergence.

7.3 Developmental Traits and Food utilization efficiencies on Natural host plants (Tea and Needlewood)

- Development period was found to be significantly higher on tea than on needlewood due to difference in their larval duration, however there was no significant difference in pupal period. The fecundity was significantly higher on tea-reared *B. suppressaria*. There was no significant difference in pupal and adult weight on the two natural hosts.
- *H. talaca* showed no significant difference in development period on the two hosts whereas *H. infixaria* developed faster on needlewood than on tea.
- In both the congeners, pupae and adults were found to be heavier when reared on tea than on needlewood.
- More or less same trend of nutritional indices were observed in all three species on two of the natural hosts.
- Higher Efficiency of Conversion of Ingested food (ECI), Efficiency of Conversion of Digested food (ECD), Production Index (PI) and lower Maintenance Cost (MC) on tea than that on needlewood were indicators of more suitability of the former host (tea) than the latter.

7.4 Developmental Traits and Food utilization efficiencies on Synthetic diet and Natural host (tea)

- All the three species performed and survived better on synthetic diets than on its natural host, tea.
- In general, the development period was faster on synthetic diet, however with no significant difference in pupal and adult weight of *Hyposidra* spp. Nevertheless, in *B. suppressaria* Pupal and adult weights were significantly higher when reared on synthetic diet. Hence, it can be stated that geometrids took less time to attain the same or higher weight on artificial diet than that on their preferred host plant, tea.
- Better performance of all the three species on synthetic diet can also be confirmed by their nutritional indices. In general, higher ECI, ECD, AD, PI and lower RCR, MC values were recorded in synthetic diet-reared specimen than the one reared on tea.

7.5 Principal Hydrolases and Defense enzymes of loopers reared on tea, needlewood and synthetic diet

- *Hyposidra* spp. showed no significant difference in amylase activity on the three food regimes (tea, needlewood and synthetic diet) whereas *B. suppressaria* showed significantly higher amylase activity on synthetic diet.
- A significantly less invertase activity was observed in congeners of *Hyposidra* reared on synthetic diet than that on natural host plants. This indicated that these species may uptake fructose (in form of its isomeric form, 'dextrose') directly instead of sucrose to meet its requirement of carbohydrate. However no significant difference in invertase activity was noted in *B. suppressaria* on the three food regimes. This may imply greater

dependence of *B. suppressaria* on sucrose from food source for their development.

- Protease activity was significantly higher on synthetic diets in the congeners and marginally higher in *B. suppressaria* than that on natural diets.
- Lipase was marginally higher on synthetic diet in *B. suppressaria* and *H. talaca* whereas it was significantly higher in *H. infixaria*.
- The three detoxifying enzymes showed similar trends in all three species. Generally a lower activity of these enzymes were recorded on synthetic diet.
- Based on the activity recorded of the principal hydrolysing enzymes in the geometrid species, it can be inferred that the essential components of the synthetic diets are optimally utilized for normal development of the three species. At the same time synthetic diet is with less anti-nutritive components (allelochemicals), as reflected in low activity of defence enzymes.

7.6 Standardization of laboratory culture technique for the geometrid (looper) species on synthetic diets

- The most essential care needed while rearing the neonates was removal of the accumulated water droplets in the rearing container. Covering the mouth of the rearing container had to be done in a balanced way to reduce fast drying of diet cubes and prevent accumulation of excess moisture inside the rearing container as well. At the same time rearing containers were wrapped with the opaque paper to avoid phototactic movement of neonates.
- Dispensing the diet cube on toothpick was an important step in reducing the larval mortality by sticking. The toothpicks as support inside the container

not only provided opportunities for free movement of the loopers, it also provided a natural twig like support to which loopers could cling.

- Sterilization of rearing room, containers and equipment was done regularly to prevent microbial contamination.
- While comparing cost (financial/ maintenance/ labour/ time/ hygiene) of laboratory rearing, and the risks involved both synthetic diet and natural diet appeared to be by and large same.
- However, large scale disease-free culture of the geometrid species under study at technical and industrial level appeared to be more promising on synthetic diets than on natural diet.