

8. CONCLUSION AND DELIVERABLES

- The three main tea growing regions of India are Darjeeling, Assam and Nilgiri. Tea is the main agro-industry of North-East India including the Dooars, Terai and Darjeeling foothill region.
- The tea was first used in China as a medicinal drink and later became a popular stimulating beverage. Nowadays, it has gained popularity world-wide.
- Tea plantation suffer largely from, pest attack. There are approximately, 300 species of insects, mites and nematodes infesting tea, out of which about 25 arthropod species have been recognized as serious pests in North East India.
- To overcome the crop loss, the tea pests are mostly managed conventionally by using synthetic insecticides. Many synthetic insecticides are non-biodegradable, others degrade very slowly and persist in the environment. Insecticides cause pollution of soil and ground water and have harmful effects on a wide range of non-target organisms (beneficial insects, mammals and human).
- Continuous exposures to insecticides, result in development of resistant strains of insect, management of which require increased doses of insecticides or introduction of new insecticides. Different chemical pesticides (organophosphates and synthetic pyrethroids) have been found to be less effective against defoliators in recent time.
- In view of this and also due to a greater acceptance of organic tea (as compared to synthetic chemically managed conventional tea) by health conscious consumers, the future protection and production of tea appear to depend largely on non-conventional control methods.

- One of the ecofriendly approaches of biological control is conservation of the microbial bio-agents or application of some of the effective bacterial control agents of the pest.
- Report of development of insect resistance to commercially available *Btk* has stimulated new research to find additional local *Bt* strains and other microbes that have specific activity spectrum against certain insect pests.
- For knowing the natural occurrence of the entomopathogenic bacteria, population sampling of the host insects (*A. submarginata*, *A. bipunctata* and *O. postica*) was done from the tea plantations of Darjeeling foothill region and the adjoining plains (Terai and the Dooars).
- Numerous *Bacillus thuringiensis* subspecies had been isolated from dead and dying insect larvae and in most cases the isolate had toxic activity to the insect from which it had been isolated.
- In this research study of entomopathogenic microbials such as bacteria that naturally infect and kill the pests were surveyed, isolated, and characterized then to determine their efficacy, so that in future, potential microbial pesticides may be developed.
- The entomopathogenic bacteria obtained from larval cadavers of sporadic tea pests, *Arctornis submarginata*, *Andraca bipunctata* and *Orgyia postica* were isolated and tested following a standard procedure and Koch's postulate.
- After characterization, the bacteria were bioassayed on 2nd instar of their respective insect host. The percentage mortality, LC₅₀ and LT₅₀ values were determined. After bioassay cross-infectivity to the beneficial insect, silkworm was tested.

- Three bacterial strains of *Bacillus* Arc01, Arc02, Arc03 from *A. submarginata*; four strains Ab01, Ab02, Ab03 and Ab04 from *A. bipunctata* and two strains Org2A and Org6A from *O. postica* were selected for study.
- All the newly isolated *Bacillus* strains were found to be different from each other and also from commercial strain of *Bacillus thuringiensis kurstaki* in respect of characteristics and toxicity.
- Molecular characterization of these isolates confirmed that they were indeed strains of *Bacillus*.
- After comparing all the data it may be said that the bacterial strains (*Bacillus* sp. Arc03, Ab04 and Org6A) might be developed in future as potential microbial biopesticides having similar or greater efficacy than *Btk* which is already being used for controlling different lepidopteran tea pests.