

## **DEVELOPMENT OF ECO-FRIENDLY COW URINE BASED FORMULATIONS FOR HONEY BEE DISEASE MANAGEMENT AND CROP PROTECTION IN UTTARAKHAND**

The work carried out by the PI is of significant importance in organic apiculture practice. She has demonstrated applications of eco-friendly cow urine based formulations in honeybee (*Apis mellifera*) disease management along with pests and disease management of mustard crop (main host crop of honey bees). Different formulations have been prepared to evaluate their efficacy against honeybee disease management and mustard crop protection from insect pests and diseases.

Cow urine of indigenous and Holstein breed at different concentrations found 80-100% effective for management of the bacterial disease [European Foul Brood (EFB)] as compared to 50-55% in case of Terramycin mediated disease management. Cow urine at 25 and 100% concentrations have been found significantly more effective against brood mite infestation with increase in mite fall in honeybee colonies under field conditions with an increase in brood area and honey, pollen stores and strength of bees.

Among the plant products *i.e.* Neem leaf powder and Ajwain powder @ 5g /hive showed the highest reduction in the mite brood infestation, increase in mite fall and sealed worker brood area without affecting the working tendency of worker bees, egg laying capacity of queen bee and newly laid eggs, brood and the bees. It suggests that Ajwain powder and Neem leaf powder can be used in place of chemicals like sulphur, formic acid, thymol for mite disease management in honeybee colonies.

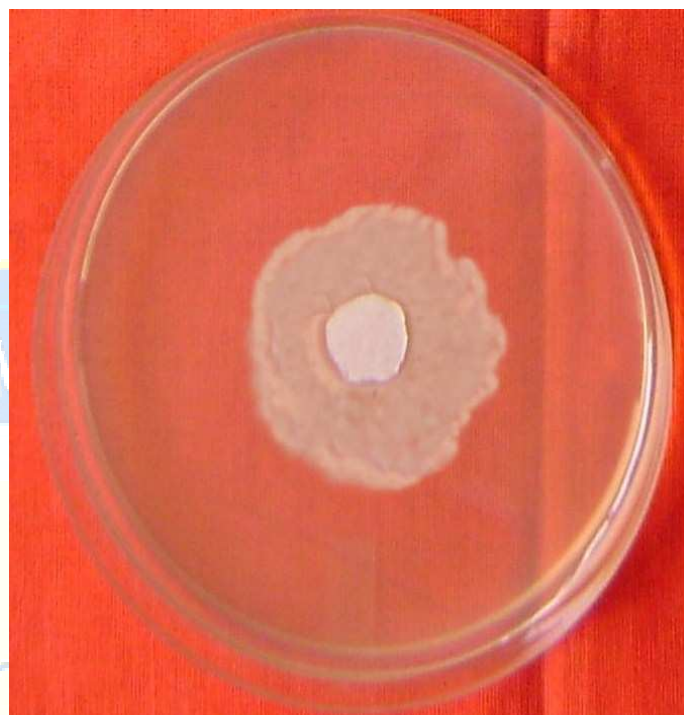
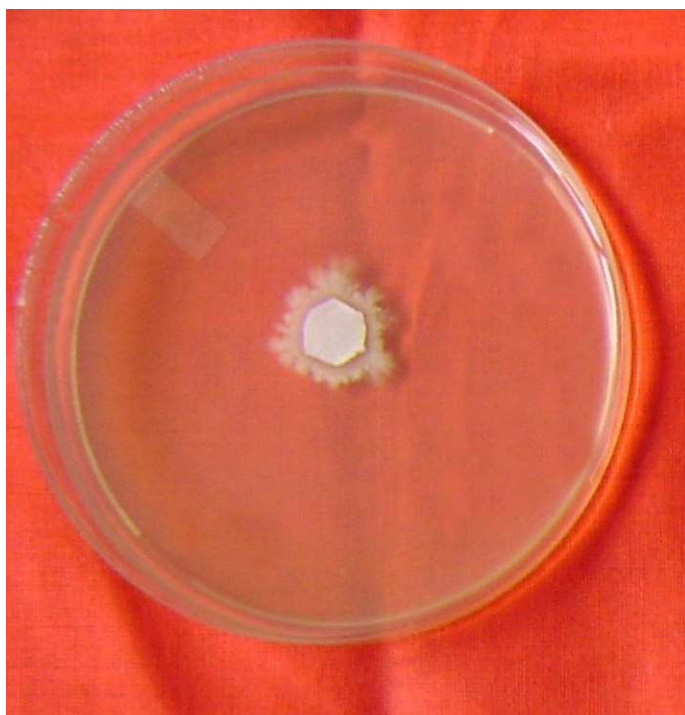
The cow urine at 25% and 100% concentrations and cow urine based formulations prepared with plant products *i.e.* Neem and *Jatropha* @ 2% were found significantly effective against mustard aphid, *Lipaphis erysimi*. In addition, it also facilitates the increase in population of natural enemies of aphids such as parasitoid *Diaeretiella rapae* and *Coccinella septempunctata*. Cow urine and cow urine based plant extracts found 100% effective against pathogenic fungus *Sclerotinia sclerotium* which indicates that eco friendly formulations can be used as cheap and best alternatives in the management of *S. sclerotium*.

The use of plant and animal origin products in the field of apiculture for the honeybee disease management is a novel approach in India and the present studies revealed that the cow urine and cow urine based formulations can serve as a potential eco- friendly measures for management of EFB and mite diseases in honeybee colonies as well as against aphid, *Lipaphis erysimi* and white mold, *Sclerotinia sclerotium* in mustard crop.

## R & D Achievements

Uttarakhand State Council For Science & Technology

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**Growth inhibition of bacteria by cow urine**

**Growth of bacteria without cow urine**

