Success story

- The biodiversity studies on light traps, host trees and through soil sampling was carried out at 107 locations covering 12 districts of Himachal Pradesh. Six different light sources viz., UV light trap, mercury light trap, infra-red light trap, sodium bulb trap, ordinary light trap and CFL light trap in different trap designs were tried for collection of beetles. UV light trap was found best showing 5 times higher catch of beetles.
- Till date, 88 species of Scarabaeid beetles have been collected on light trap/host trees from 12 districts of Himachal Pradesh. Melolonthinae comprised 58.97 per cent of total phytophagous scarabaeids, followed by Rutelinae (29.49%), Cetoniinae (7.69%), Dynastinae (2.59%) and Dynamopodinae (1.28%). Among them the most dominant five species are *Brahmina coriacea* (48.4%), *Holotrichia longipennis* (9.70%), *Autoserica phthisica* (5.19%), *Maladera insanabilis* (4.95%) and *Schizonycha* sp. (3.88%) causing economic losses in potato, pea, cabbage, ginger, maize, rajmash, apple, apricot, walnut, peach and pear. Two cutworm species viz. *Agrotis ipsilon* and *Agrotis segetum* were recorded on light traps and in different crops.
- Bioecology and raster pattern of 19 species of white grubs viz. *Brahmina coriacea, Holotrichia longipennis, Holotrichia sikkimensis, Brahmina flavosericea, M. cotesi, Melolontha cuprescens, Melolontha indica Melolontha furcicauda, Polyphylla sikkimensis, Lepidiota stigma, Autoserica phthisica, Schizonycha* sp., *Anomala dimidiata, Anomala polita, Anomala lineatopennis, Anomala varicolor, P. dionysius, Maladera thomsoni, Maladera insanabilis*. In different crops, like potato, ginger, rice and maize, infestation of white grubs ranged from 0.5 to 28.5 per cent.
- The biology of *A. ipsilon* and *A. segetum* has been studied at Palampur, *A. ipsilon* completed 02 generations, whereas *A. segetum* completed 04 generations in a year. The total duration of life cycle was 46-65 and 38-40 days for *A. ipsilon* and *A. segetum*, respectively.
- DNA sequencing of *Holotrichia longipennis*, *H. sikkimensis*, *H. consanguinea* and *H. serrata* was done. Amplified PCR products were cloned in pGEM®-TEASY vector. The BLAST N results showed that *H. longipennis* (sequence A_1) had 99% indentity to *Cox 1* from *H. consanguinea* (A_3). Similarly *H. sikkimensis* (sequence A_2) showed 80% identity to *Cox 1* from *Jekelius brullei*. *H. longipennis* (sequence A_3) showed 99% identity to *Cox 1* from *H. serrata*. *H. serrata* (sequence A_4) showed 98% identity to *Cox 1* from *H. nagpurensis*. On the other hand, sequence B_1 (*H. longipennis*) and B_4 (*H. serrata*) showed similarity to *28S rRNA* from *Hoplochelus piliger* with identity of 98 and 99%, respectively, whereas both sequences B_2 (*H. sikkimensis*) and B_3 (*H. consanguinea*) showed 99% identity to *28S rRNA* for *Haplidia transversa*.

- Two species of entomopathogenic fungi i.e. *Beauveria brongniartii* and *Entomophthora* sp. and one species of predator, *Tiphia* sp. has been reported from the state infecting the white grubs under natural conditions. *Beauveria brongniartii* isolates from different parts of Himachal Pradesh have been isolated and Shillaroo strain has been found highly virulent against grubs of *B. coriacea*. Maize grains have been found best for mass multiplication of *B. brongniartii*.
- Standardized the time of insecticide application for effective management of whitegrubs in potato in north western Himalaya. Earlier recommendations advocated the use of phorate 10 G at the time of sowing in April. Our new recommendation is to apply insecticides in 2nd week of June which coincide with peak emergence of beetles in Shimla hills covering about 3000 ha area and about 15000 potato farmers were benefited. New chemicals *i.e.* clothianidin 50 WDG @ 120-150 g a.i./ ha and acephate 50% + imidacloprid 1.8% @ 1.25 kg/ ha have been found highly effective. A total of 1500 ha area was covered and around 10000 farmers were benefited.
- Interaction studies of entomopathogens viz. *Heterorhabditis indica, Steinernema carpocapsae* (EPNs), *Beauveria bassiana, Metarhizium anisopliae* (EPF) and *Bacillus cereus* (EPB) with the commonly used synthetic insecticides viz. imidacloprid 17.8SL, chlopyriphos20EC and clothianidin 50WDG against the major species of white grubs has been conducted under laboratory. Among all the tested combinations, *H. indica, S. carpocapsae, B. bassiana* and *M. anisopliae* showed synergistic interaction effects with all the tested insects, whereas, *B. cereus* showed additive effect with imidacloprid 17.8SL and chlorpyriphos 20EC and antagonistic effect with clothianidin 50WDG. Under laboratory conditions, combination of *H. indica* with imidacloprid showed higher efficacy as compared to other evaluated enotomopathogens, both against *H. longipennis* and *B. coriacea* white grubs. Therefore, this combination was further evaluated under field conditions to study its effectiveness under field conditions and resulted in significant results.
- Under field conditions, clothianidin 50WDG @125 (g a.i./ha) and acephate 50 % + imidacloprid 1.8 % @ 1250 (g ai /ha) has been found most effective among chemicals whereas among biopesticides, *Heterorhabditis indica*, *Steinernema carpocapsae* and *Beauveria bassiana* has been proved effective against white grubs in potato crop. Against cutworm, clothianidin 50WDG @125 (g a.i./ ha) and imidacloprid 17.8 SL @ 60(g a.i./ha) were found effective in cabbage crop as pre-sown treatment. For the management of termites, fipronil 40% + imidacloprid 40% WG applied @ 3 g/ kg seed and clothianidin 50 WDG applied @ 1.5 ml/ kg seed were found most effective as seed treatment.