

CHAPTER 5

5.0 DISCUSSION

The research study shows that the insecticides if at all used, must be delivered in an effective rotation pattern based on their respective mode of actions. Though this is difficult to make the farmer understand, it proves to be helpful to the scientists and agriculture professionals worldwide. They can slowly educate the farmer by showing the long-term effects of such insecticides used in extensive and haphazard manner. The best alternative to this is switch to organic farming or using bio-pesticides which are having less adverse effect on environment and more positive and healthy effects on plants. The researchers Rupela & Humayun (2006), Gupta & Dikshit (2010), Srinivasan Ramasamy (2012), all recommend the use of biopesticides. These include bio-fungicides (*Trichoderma*), bioherbicides (*Phytophthora*) and bioinsecticides (*Bacillus thuringiensis*). Other biological methods like recycling plant biomass, use of vermicompost must be adopted instead of the toxic insecticides which are not only bad for environment but also for human health.

The study accounts to discover the long-term effects of using the same insecticides on destructive pest like *Spodoptera litura*. It slowly shows onset of resistance in laboratory-maintained culture from generation to generation. The usage of insecticides must be slowly declined, conferring less stability. Otherwise it will even cause more problems than providing right solution. This research does not include mixing of insecticides belonging to two different groups. But the background study states that they could be mixed, in a careful manner. This is supported by research work of Ahmad, Sayyed, Saleem, & Ahmad, 2008 from Behruddin Zakkaria University of Pakistan, Multan and from Department of Biochemistry, University of Sussex United Kingdom in *Spodoptera litura*. They reported that Chlorpyrifos, Profenofos and Fipronil could be used in mixtures to restore the susceptibility caused by Cypermethrin and Deltamethrin. Information regarding the correct application of pesticides and the use of advanced technologies for target delivery of pesticide, as well as

intensive training on selective application of the correct pesticides at the correct time for the correct pests, should be disseminated to the user group.

The current studies showed onset of resistance which may be considered as an alarming situation. At the same time, due to its less toxicity and biological properties. Spinosad being a bio pesticide may prove to be useful by keeping it one of the insecticides in rotation. It would help in reducing environmental impact and in avoiding development of resistance in insects. Kaur, P and Kang (2015), from Punjab Agricultural University stated the Spinosad 20 ppm was least toxic against third instar larvae of *Spodoptera litura*. In another studies, Saleem et al. (2016) from Department of Entomology, Faisalabad, Pakistan states that Spinosad (Tracer® 480 SC) has moderate toxicity against third instar larvae of *S.litura* at 960 ppm.

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The current studies showed onset of resistance which may be considered as an alarming situation. At the same time, due to its less toxicity and biological properties, bio insecticide can be used in the rotation of insecticide programmes. These were the results of resistance monitoring against two insecticides i.e. Cypermethrin 25 EC and Chlorpyrifos 20 EC. The other two insecticides were Spinosad 45 SC and Coragen 20SC. Repeated use of the same class of pesticides to control a pest can cause undesirable changes in the gene pool of a pest leading to a form of selection pesticide resistance.

Studies on development of resistance in *Spodoptera litura*, showed onset of resistance in the fifth generation. This was observed for the insecticide Coragen® 20SC, indicated by the mortality value of 36.67% at 1ppm in contrast to 40.00% in the fourth generation at same concentration. There was an onset of resistance developed in *S.litura* , when exposed to Chlorpyrifos @ 0.05 ppm. In the fifth generation, there was a decrement in the values of mortality for the same concentration i.e 0.05 ppm. Thus, there was moderate amount of resistance developed against Chlorpyrifos in third instar larvae in fifth generation. When the pest was exposed to Cypermethrin, it indicated the development of resistance from the fourth generation itself.

Despite of various agricultural practices like Integrated Pest management programs, Insecticide Resistance Monitoring programs, the sustainable agriculture needs to be re-established and it is still a complex problem. This problem requires perpetual efforts by all the scientist's fraternity in unification with the farming community. Along with all queries in my mind, we have been able to answer some of the important questions of resistance development in pests, onset of resistance and its relationship with generation turn-over. Hence the sustainable agriculture not just includes agricultural practices, but also the deep studies of development of resistance development in agriculturally important pests. The industrialization is the backbone of any country's growth on the economy facet. But what are we giving back to nature in response to the money earned?

Residues of pesticides? Is this really what we call progress, or just a hallucination?