International Journal of Research in Engineering and Applied Sciences(IJREAS)
Available online at http://euroasiapub.org/journals.php
Vol. 13 Issue 02, February- 2023
ISSN(O): 2249-3905, ISSN(P) : 2349-6525 | Impact Factor: 8.202 |
Thomson Reuters ID: L-5236-2015

Insecticides and survival of Giant Honey Bee (*Apis dorsata* F.)

Dr Nirmala Rathee, Assoc. Professor,
Govt. College Hisar, drnirmalrathee@gmail.com

Abstract: Insects are important pollinators of crops. The spectacular Giant honey bee (*Apis dosta* F.) is found in massive hives inhabiting high rise building or trees. It is a natural pollinator of many crops apart from providing large amount of honey and wax. Use of pesticides severely affect the crop-bee integration system. Insecticides especially organophosphtes and cabamates when come in contact with honey bee affect the nervous system severely by affecting acetylcholinesterase enzyme at synapse. Now we need to formulate the indispensable insecticides in such a way that they affect the pest particularly not the non-target organisma like human being and honey bees.

Keywords:-Giant Honey bee, Acetylcholinesterase, organophosphates, Carbamates, Pesticides, Insecticides

Introduction: Insecticides are widely and commonly used to increase crop production to meet the increasing demand of food due to exponential growth of human population. In this blind array of pesticides many non-target organisms like Humans and insects are directly or indirectly affected. One such important insect is honey bee which not only plays important role in crop production but also improve crop variety by heterosis. Honey bees like Giant honey bee (*Apis dorsata* F.) is commonly seen inhabiting high trees or large buildings. Insecticides when sprayed on crops accidently gets in contact with bees either by touch or alongwith nectar. This causes large-scale mortality in bees affecting crop production in turn. It is the need of the hour to design insecticides in such a way that they affect pest only and not non target organisms.

According to estimates, plants that are pollinated by insects make up a third of the entire human diet in developed nations. Because they are crucial pollinators for a number of entomophilous crops, honey bees are highly prized by farmers and agriculturalists for their ability to make honey. Bees are worth 10–20 times more in crop pollination than in honey and wax production. Bees help the plant by increasing seed production and, through heterosis, by raising crop quality. Even though it is unintentional, there is such a close interaction between plants and insects that some plant species can only reproduce when pollinated by insects. Without bees many biological balances would be upset (Jean-Prost, 1987; Sihag and Singh, 1999).

The most impressive species of honey bees is the giant honey bee (*Apis dorsata* F.), which inhabits wide spaces in massive colonies. This fiercest stinging insect on Earth (Morse and Liago, 1969) may adapt to live in close proximity to people by constructing its nest on the outside of buildings in big cities or on trees in gardens. The total honey collected by them is in large quantity. One comb gives honey from 50-100 Kg which perhaps no other bees can give. Above all it is a natural pollinator of several entomophilous crops.

In the wake of intensive agriculture, insect and disease issues that frequently manifest in epidemic proportions have come to light. According to the Food and Agriculture Organization, pests and illnesses are responsible for up to one-third of all food losses globally. Despite the correct emphasis on alternative means of control, it is a known truth that significant losses due to pests and illnesses occur in our production and storage despite estimates regarding losses varying. It is unthinkable that we can avoid using a certain amount of pesticides at the current stage of our agriculture's development.

For cost-effective crop production, pest control is just as crucial as using high-quality seed, getting enough rain or other high-quality water, using fertilizers wisely, and cultivating the land properly. Almost all crops are susceptible to illnesses and pest insects or weeds, which have a substantial impact on their growth and yield percentage. The demand for an increasing amount of food and fiber has necessitated enlarging the size of farm, utilizing more acres of land for growing crops and accelerating the mechanization of agriculture. The increased acreage in crops and the larger fields of a single crop favors the development of insect mite and disease problems. This in turn necessitates extensive use of pesticides (Atkins 1979).The integrity of the plant bee system has been seriously challenged by the indiscriminate use of pesticides for plant protection in contemporary agriculture, to the point of confirmed crop failures and financial losses. This is due to the fact that most pesticides are harmful to bees.

Worldwide agricultural crop economic returns are being seriously impacted by the extensive use of insecticides, which is killing out natural and controllable bee pollinators on a vast scale (Crane and Walker, 1983).

In several developing nations, where agricultural programs frequently involve the spraying of insecticides while disregarding or being unaware of the necessity of bees, honey bees are still at extremely high risk. Insecticides, acaricides, fungicides, and toxicants are examples of pesticides that are used to control a variety of other pests. Insecticides used on crops are the primary cause of the vast majority of bee mortality (Crane, 1990).

One of the most significant insecticide groups that is commonly employed in agriculture is the chlorinated hydrocarbons (DDT, BHC, Chlordane, and dieldrin), which are the nerve poisons. DDT essentially induces the nerve fiber to discharge repeatedly in response to a single stimulus. The most widely used pesticides with anticholinesterase properties are organophosphates and carbamates. The presynaptic membrane becomes depolarized and more permeable to calcium ions when an impulse reaches the synaptic knob of the axon. Acetylcholine, a neurotransmitter, is released from tiny synaptic vesicles located there into the synaptic cleft by exocytosis via the presynaptic membrane in response to the entry of Ca+ ions from the synaptic cleft into the synaptic knob. The next neuron's dendritic membrane contains specific chemical sites called cholinergic receptors, to which acetylcholine connects after diffusing across the synaptic cleft. The ionic passage through the channels is enabled by the chemical's interaction with the chemoreceptors already present. Down their concentration gradients, the Na+ ions enter and the K+ ions exit the dendrite. As a result, the post synaptic membrane becomes depolarized and a new action potential begins, starting a wave (new impulse) that travels along the new neuron.

The post-synaptic (dendrite) membrane contains the enzyme acetylcholinesterase (AChE), which deactivates the acetylcholine. The membrane can repolarize because the enzyme hydrolyzes acetylcholine into its component acetic acid and choline. Acetylcholine's components have no functional properties. So, further dendritic stimulation is prevented. By diffusing back to the axon, the ingredients are recombined form acetycholine with the aid of the required synthesizing enzymes (Lummis et al., 1990).Insect growth regulators such as diflubenzuron, triflumuron, teflubenzuron and flufenoxuron inhibit the process of chitin biosynthesis and cause moulting failure and deformities (Chakraborty and Chatterjee, 1997). Neem extracts are the most widely used biopesticide.Neem's antifeedent effect may indirectly lower female fertility, although sterility seems to be predominantly caused by changes in ecdysteroid titres and disruptions of the hormones that control insect reproduction.

Pesticide poisoning may result in the death of many hive bees in addition to foragers, which might result in the population of bees being dramatically reduced to the queen, a few nurse bees, and newly emerging bees within a day or two. The brood cycle frequently breaks when the queen stops producing eggs (Atkins and Kellum, 1986). Many colonies that are not completely eliminated may be reduced to the point where they can no longer produce honey or act as pollinators, nor can they be separated to create more colonies. This kind of economic loss likely outweighs the cost caused by insecticides completely wiping off colonies. The beekeepers suffer a considerable financial loss, but the value of the fruit and seed that are lost due to inadequate pollination is thought to be 50–100 times greater.

Quite a lot of work has been done in the field of general toxicity of insecticide to honey bees and other insects. The acuteness of toxicity generally depends upon the nature, dose level and time of application of the insecticides and it may affect longevity and , at times, temporal division of labour in honey bes and thus the use of biopesticide is on increase.

However, not much work has been done on the relationship of AChE and honeybee poisoning, especially on Asiatic honey bees which are considered to be very good pollinators of several entomophilous crops. Neonicotinoids are highly toxic to bees and also increase AchE activity when exposed to sublethal doses (Bioly Monique et al, 2013). Organophosphates and Carbamates prove to be highly toxic to *Apis dorsata* whereas insect growth regulators and biopesticides are found to be much insect friendly (Rathee, 2015).

Conclusion: Nerve poisons proved to be highly toxic to bees. Concentrations or doses of insecticides to be prepared in such a way that it is strong enough to kill the pest barut doesn't harm any non-target organism.

References

Atkins, E.L. 1979. Injury to honey bees by poisoning. In : Dadant and Sons (ed.). *The hive and the honey bee* by Journal Printing Company, Carthage, Illinois

Boily, M. et al. 2013. Acetylcholinesterase in honeybees (*Apis mellifera*) exposed to neonicotiniods, atrazine and glyphosate: laboratory and field expeiments. *Environ Sci Pollut Res Int*. 2013 Aug; **20** (8):5603-14

Chakraborty, S. and Chatterjee, M.L. 1997. Effect of four benzophenylureas on population of safflower aphid *Dactynotus coathami* HRL and Lady bird predators, *Coccinella septumpunctata* and coccinella sp. *Indian J. Expl. Biol.* **37** (4) : 374-378

Crane, E. 1990. Injury to bees by insecticides and other pesticides. In : Crane. E. (ed.) *Bees and Beekeeping*, Hienemann Newnes. Halley Court, Jerdon Hill, Oxford Oxz 8EJ.

Crane, E. and Walker, P. 1983. *The impact* of pest *management on bees and pollination.* IBRA, England. 107pp, Appendices

Jean – Prost, P. 1987. *Apiculture*, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, India

Lummis, S.C.R; Galione, A. and Taylor, C.W. 1990. Transmembrane signaling in insects *A. Rev. Ent.* **35;** 345-377

Morse, R.A. and Laigo, F.M. 1969. *Apis dorsata* in the Philippines. *Monogr. Philipp. Ass. Ent***. I**; 1-96

Sanchez-Bayo, F, Goka K 2016. Impacts of Pesticides on Honey Bees, Ch-4

Rathee, N *et al*. 2015. Effect of some insecticides on Acetylcholinesterase Activity of Giant Honey Bee (Apis dorsata F.) *Annals of Biology* **31** (I) : 113-116

Sihag, R.C. and Kumar, S. 1990. Determining the dose-concentration relationship for the bee toxicity experiments. *Korean J. Apic.* **5**(2): 32-34

Sihag R.C. and Singh, M. 1999. Why should the pollinators be conserved. *Current Science.* **77**(50:626-627).