



PRESENT STATUS AND IMPACT OF INSECTICIDE ON HONEY BEES IN INDIA: A REVIEW

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ABSTRACT: This study aimed to evaluate the detrimental effects of pesticide on honeybees. Honeybees play a major economic role in the pollination of agronomic crops, fruits and vegetables. Pollinators like honeybees are accountable for reproduction of approximately 80 to 85% of flowering species and also important in agricultural use and ecosystem health in globally. In farm due to agrochemical use for the safety of crop and their application to crop, infect water and plants around the area. Many times, honeybees expose to agrochemicals like pesticide, insecticide is through gulp of residues found in water and nectar in plants and pollen. Different biological systems of bees affect by sublethal and lethal effect of pesticides. In India, pesticides effects on honeybees increasing day to day, and decreasing of bee product due to increasing of bee colonies damage. Use of pesticide on crop which is detrimental effects on forage resources, performance, toxic condition, pollination process, communication and polluted bee products.

Key words: - Pollination, Agrochemical, Pesticide, Insecticide, Pollen, Nectar.

INTRODUCTION :

In Indian economy, agriculture sector act as a backbone of economy which give 18% share in GDP (Bhardwaj *et al.*, 2013). Honeybees are accountable for reproduction of approximately 80 to 85% of flowering species and also important in agricultural use and ecosystem health in globally. Pollinators give crucial ecosystem favorable to agricultural and natural ecosystem, they help in fruit set development, dispersal and provide reproduction in plants and crops. Nesting and food sources provide by plants. Honeybees and plants have mutualism compatibility bees helps in reproduction of plants and instead of this plant give pollen and nectar to the bees as a food source. With help of pollination process honeybees increases productivity of crops. Due to use of agrochemical like pesticides non targeted species also dying like honeybees and other pollinators (Belzunces *et al.*, 2012). Farmer Using pesticide in agriculture from four decades and it is increasing day by day for the protection of crops and plants from diseases, pest, weeds and insects. without pesticide farmer losing

production of crop more than 35% annually in India (Ramesh chand *et al.*, 1997). In 19th century farmer were using synthetic organic pesticide for crops and after that DDT (Dichlorodiphenyltrichloroethane) discovered as an organic pesticide. In 1966 green revolution started in India after that application of chemical like pesticide and insecticide increased so much in farms. Due to this people are facing health related issues and environmental loss (Alagh *et al.*, 1988; Bhardwaj *et al.*, 2013). For the protection of crops and plants pharmaceutical companies adding xenobiotics which contain approximately 25% fungicides, 20 to 25% pesticides, and 40 to 45% herbicide. In these agrochemicals neurotoxin using an active substance for treatment of crop and plants by using granules, spraying and seed dressing (Belzunces *et al.*, 2012). Pollinators such as birds, bats, flies, butterflies, wasps and honeybees, have facing anthropogenic insults by humans for example fragmentation, colony collapse, habitat destruction because of pesticide. In this condition, for successful beekeeping people

needed a new guidance. Decline of productivity in honeybees' products and affecting honeybees' colonies health because of pesticide contaminated flowers. In this situation for greater manage, should recognize how honeybees are expose to agrochemicals and their effects of such exposure on bees' health, colony and their productivity Pollinators like birds, bats, flies, butterflies, wasps and honeybees, have facing anthropogenic insults by humans for example fragmentation, colony collapse, habitat destruction because of pesticide. In this condition, for successful beekeeping people needed a new guidance. Decline of productivity in honeybees' products and affecting honeybees' colonies health because of pesticide contaminated flowers. In this situation for greater manage, should recognize how honeybees are expose to agrochemicals and their effects of such exposure on bees' health, colony and their productivity (Sanchez-bayo *et al.*, 2016).

Usage of pesticide pattern:

India is tropical country; the utilization pattern is also highly asymmetrical to insecticide (Bhardwaj *et al.*, 2013). So, application of insecticide in India is not identical to world in general. Globally people use 44% of insecticide but in India farmer use 76% of insecticide (Mathur *et al.*, 1999). Use of fungicide and herbicide is less as equivalence to pesticide in India. Crop wise data shows only on cotton pesticide consumption is nearly 37% and followed by in paddy nearly 20% of insecticide use. In India together they consume 57% of pesticide and other crops like pulses and wheat application of insecticide is 4%, vegetables 9% and other crops use 7%. In state wise comparison more pesticide consume by Andhra Pradesh nearly 23% and after that Maharashtra and Panjab (Ramesh *et al.*, 2006).

Effects of pesticide on bees:

There are many ways for affecting bees by pesticides. Weed flowers which consider as a very good food source in dearth period for bees but due

to herbicide spray weed flora get destroy. Use of herbicidal spray bees die and sometimes fully colony destructed by agrochemicals. Contaminated pesticide water also affect to water carrier and contaminated pollen and nectar causes full brood mortality. Plants flower and honeybee's mutualism process break by these agrochemicals. Residues of pesticide present in urban landscape and also in biosphere acting as a contaminant. Because of them non target plants and animals are affecting badly like fish, birds, beneficial insects, non-targeted plants, beneficial soil microorganism and other organism (Bhardwaj *et al.*, 2013). In human being mostly children are affecting by neurological disorder, cancer, acute poisoning, effect on development and reproduction harm. In one of survey researcher got shocking results they observed high level of pesticide contain in human blood sample which is from villagers in Panjab state. Panjab state recognize as an India's green revolution state. From that blood sample researchers observed six to thirteen types of pesticides which are chlorpyrifos, Endosulfan, Phosphomidon, Malathion, HCH, DDT, Monocrotophos, and Aldrin which causes cancer, neurological disorder, affect in development and reproduction. Many villagers are found cancer patient due the exposure of pesticide (Mathur *et al.*, 2005).

Neural effects of Insecticide:

Effect on Behavioral and physiological damage because of molecular interaction of insecticide with specific target on insect biological system. Metabolic perturbation, cognitive and non-cognitive behavioral disabilities induce due to functional alteration, e.g., destruction of metabolic resources and disturbance in muscular activity (Belzunces *et al.*, 2012).

Cognition:

The process of understanding through thought, experiences and obtaining knowledge, memory, awareness, perception, interpretation and

problem solving. These things damaged by agrochemicals when chemical interaction with neural receptors, cell signalling pathway and ionic channels.

Memory and learning:

Memory and learning useful for honeybees respond to need of the colony throughout their life. In recent studies researcher observed after application of parathion pesticide in feeding area, honeybees visit early hours of the day. Parathion disturbed their circadian cycle and organophosphate and methyl-parathion damage visual and olfactory process of honeybee (Williamson *et al.*, 2013).

Colony collapse disorder (CCD):

In this CCD abnormal phenomenon occurs when worker bee take flight for food and water collection after that they do not return to hive, leaving behind queen and due to no food other remaining bees and brood start die off and some of get infected by various disease because of no cleaning of hive and mites attacks on hive (Srinivasan *et al*; Sanchez-bayo *et al.*, 2016). CCD was a major concern in 2006 in United States. Initially beekeeper was confused why this CCD is happening, what are the causes of it and they not able to understand. One year later in European country beekeeper started reporting about colony collapse disorders in 2007. After that slowly colony collapse disorder spread in Asia. In research study researcher observed CCD causes due to application of neonicotinoid insecticide, pathogens, environmental stresses and nutritional deficits (Chandra *et al.*, 2019).

Pesticide method of application and period of application:

Powder form of pesticide such as dust particle remain stick to plant exterior for long time which is unsafe to honeybees (Kapil *et al.*, 1970). Safest insecticide is granular as compare to wettable powder form granular with systemic action may pollute nectar and it is harmful for bees. Fumigant insecticide also unsafe for bees. Micro

capsulated granules putting on flowers this one also unsafe for bees, while foraging capsule collected by bees and store in hive that could be dangerous for adult bees in, they beaten it and also if they fed this to brood, all brood can be destroyed. While collection of nectar and pollen if bees pass through pesticide sprayed area that is also harmful for honeybees (Sanchez-bayo *et al.*, 2016).

CONCLUSION:

Study shows, globally decline of pollinators such as honeybees because of uncontrolled use of pesticide. We know honeybees play a vital role in pollination service on plants and crops and also play key role in ecological and economic. Application of insecticide is influencing communication, physiological developmental, behavioural, flight damage and indirectly damaging food of honeybees; this could be effects on standard and quantity of hive products. Both beekeeper and honey bee affected by practices of agrochemicals in farm. In flower blooming time farmer applying agrochemicals such as pesticide and at the same time flower blooming time bees collect pollen and nectar actively as an outcome it harms to the bee's colony. In some area farmer mixing two kinds of pesticide and that is not scientifically legal. The government need to take action on it, give substitutes of pesticide, provide support and design new laws and enforce it as soon as possible. So, they may move to sustainable, ecological and healthy way of farming. Farmers should minimize the use of agrochemicals and start using organic pesticide or bio pesticide. This will protect contamination in water bodies, surrounding landscape and other pollinators.

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Table I. Specific modes of action related to the insecticide activity of pesticides (Belzunces et al., 2012)

Insecticide class	Main neuronal targets	Mode of Action	Effects
Neonicotinoids	nAChR	Agonist	Hyper activation of cholinergic neurons
Organophosphate	AChE	Inhibition	Hyper activation of cholinergic neurons
Carbamates	AChE	Inhibition	Hyper activation of cholinergic neurons
Pyrethroids	Voltage-gated Na ⁺ channel	Prolonged opening of sodium channels	Increase sodium permeability of nerve membrane