

Impact of different Pesticides on Beneficial Insects: a serious damage to natural ecosystem.

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ABSTRACT

Globally we are aware about some toxic and poisonous chemical pesticides still developing country like India continuously using these pesticides such as monocrotophos and acetamiprid etc. which is neurotoxin and ban in other countries. The present investigation concluded that the monocrotophos and acetamiprid have harmful effect on beneficial insects by treatment of monocrotophos in the cotton seed sown fields and found that mortality rate of beneficial insects like honey bee, wasp, mantid, ants etc. was increased up to 68% which causes serious damage to natural predation of pest and increase in imbalance of ecosystem.

Key words: Monocrotophos, acetamiprid neurotoxin, pesticides etc.

INTRODUCTION

To increase the yield of cotton the farmers uses large amount of several different pesticides such as organophosphate, organochlorine, carbamate, neonicotinoids and fungicides insecticides, and herbicides. The worldwide consumption of pesticides is about two million tons per year, of which 24 % is consumed in the USA alone, 45 % in Europe and 25 % in the rest of the world (Pathak *et al*, 2012). India's share is just 3.75 %. The usage of pesticides in India is only 0.5 kg/ha, while in Korea and Japan, it is 6.6 and 12.0 kg/ha, respectively (Gupta PK 2004). Out of the total consumption of pesticides, 80 % are in the form of insecticides, 15 % are herbicides, 1.46 % is fungicide and less than 3 % are others. In comparison, the worldwide consumption of herbicides is 47.5 %, insecticides are 29.5 %, and fungicides, 17.5 % and others account for 5.5 % only (Gupta PK 2004).

Still the small scale farmer prefers this cheapest, moderately available and can kill broad numerous pest at a time which can cause health and environmental problems.

Pesticides occupy a special position among the many chemicals to which man can be exposed, in that they are deliberately diffused into the environment for the purpose of killing or damaging some forms of life.

Ideally, the injurious action of pesticides should be highly specific for undesirable target organisms and innocuous to desirable, non-target organisms. In the present study we determine how the pesticides (monocrotophos) are destroying beneficial insects at the alarming level.

MATERIAL METHODS

The experiments were conducted during the year 2014 and 2016. In the cotton Growing season of Bodwad Dist Jalgaon M.S India. Starting from 12th June 2014 sample of dead beneficial insects were collected from the middle and the corner of the cotton cultivated area to determine the rate of beneficial insect mortality. Before spraying of insecticide the sample considered as control and after spray the sample were collected and considered as treated. the Monocrotophos and Acitamiprid was used as pesticide for the present study. For foliar treatment, insecticides were diluted with water (200 l/fed). Each was sprayed using a knapsack sprayer with one nozzle.

Sample collection of dead beneficial insects:

Samples of dead (beneficial insects) were collected from the five different villages near to the Bodwad Taluka, namely as Bodwad, Saalshingi, Bhankheda, Vichwa and Shelwad. From each village selected ten cotton fields respectively. The area of field was considered near about 1 acre. Sample collected from the middle and the corners of the cotton cultivated area determines the rate of insect mortality. Abbott's formula is used to, (classic papers: ABBOTT'S FORMULA by journal of the American mosquito control association volume-3 no- 2 pp-302, June 1987) (3) Calculate the insect mortality rate.

*ABBOTT'S FORMULA: $X-Y/X * 100 = \text{Percent mortality.}$*

X = the percent dead in the check

Y = the percent dead in treated

X-Y = the percent killed by the treatment. The percentage of the reduction of the insects

Population was calculated according to the following equation:

$\% R = \frac{[(\text{No. of insects in the control} - \text{No. of insects in the treatment}) / \text{No. of insects in The control}] \times 100$

RESULTS & DISCUSSION

In the present investigations difference in the mortality rate of insects in the various fields of cotton was found. Notably In the control fields of Bodwad village the mortality rate was in the range of 1- 18 % during the year 2014 and 2016. The treated fields with monocrotophos the Rate of mortality was found 96.6% and 98.49 % as per given in graph No 1 and Table No -1. While in next year treated field's has 85.5 % and the acetamiprid has 72.8% mortality. The monocrotophos is more toxic to the insects consequently the mortality rate increased. Out of 10 fields 4 were spread with acetamiprid and 6 fields were spread with monocrotophos. High mortality rate was found in field no. 7, 85.5% while the acetamiprid spread field -6 shown 72.8% mortality. The variation in the death rate may be due to improper use of insecticides dilutions, spraying techniques and inadequate knowledge of use of insecticides.

In the control fields of Saalshingi the mortality rate was in the range of 2-18% during both the experimental years. The mortality rate of treated fields of the village Saalshingi is given in to the graph and table no.2. In 1st year monocrotophos spread field no.5 has highest mortality rate 86.70 % while the lowest mortality rate was found in field no. 6, 49.40 % treated with acetamiprid. In 2nd year the highest mortality was shown by treated cotton field no.7 that is 86.30% spread with acetamiprid and the monocrotophos spread field was shown by 2nd highest mortality rate it was 70.67%. In the field no.8 the mortality rate was very much reduced that is 17.78%. It is due to the proper pest management by the farmers and proper over look of the field because the farmer applied IPM techniques.

In the Bhankheda the reading was not much differ as that of previous villages in the experimental year 1st. There was four fields were spread with monocrotophos and 6 fields were spread with acetamiprid. Out of that field no. 4 and 8 spread with acetamiprid was found the highest mortality rate that is 71.53 % and 76.82 %. When we observed the fields in 2nd experimental year there was increased in mortality rate of insects. But it was due to the monocrotophos as compare to acetamiprid that was shown by field no. 4 and 7 96.52% and 93.7%. This was due to the heavy rainfall which causes favorable conditions for insect's growth. Rest of the fields has also increased rate of mortality of the insects.

Table 1: Showing insect mortality percentage in the cotton field of Bodwad.

Sr. No.	Control mortality of insects		Treated mortality of insects by monocrotophos		Treated mortality of insects by acetamiprid	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
1.	3%	10%	62%	---	---	53%
2.	16%	8%	68%	---	---	42%
3.	8%	2%	---	35%	59%	---
4.	12%	5%	57%	48%	---	---
5.	4%	8%	---	22%	59%	---
6.	5%	11%	60%	---	---	55%
7.	3%	16%	82%	---	---	58%
8.	15%	4%	---	---	64%	51%
9.	2%	3%	72%	48%	---	---
10.	18%	9%	--	61%	66%	---

Table 2: Showing insect mortality percentage in the cotton field of Saalshingi

Sr. No.	Control mortality of insects		Treated mortality of insects by monocrotophos		Treated mortality of insects by acetamiprid	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
1.	9%	2%	---	52%	---	66%
2.	12%	8%	---	58%	59%	---
3.	4%	3%	---	61%	---	50%
4.	10%	15%	60%	---	48%	---
5.	2%	4%	83%	---	52%	---
6.	3%	12%	---	45%	43%	---
7.	8%	18%	71%	---	---	56%
8.	10%	10%	---	62%	71%	---
9.	5%	14%	72%	---	---	41%
10.	3%	4%	---	49%	64%	---

Table 3 : Showing insect mortality percentage in the cotton field of Bhankheda

Sr. No.	Control mortality of insects		Treated mortality of insects by monocrotophos		Treated mortality of insects by acetamiprid	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
1.	10%	8%	55%	---	---	52%
2.	3%	4%	---	---	58%	60%
3.	8%	3%	38%	---	---	45%
4.	6%	18%	---	52%	71%	---
5.	1%	17%	59%	---	---	66%
6.	15%	25%	---	---	59%	57%
7.	1%	11%	56%	59%	---	----
8.	18%	14%	---	68%	63%	----
9.	2%	1%	---	70%	48%	---
10.	9%	12%	----	40%	54%	---

Table 4: Showing insect mortality percentage in the cotton field of shelwad.

Sr. No.	Control mortality of insects		Treated mortality of insects by monocrotophos		Treated mortality of insects by acetamiprid	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
1.	24%	2%	61%	69%	---	---
2.	2%	2%	---	65%	45%	---
3.	8%	10%	40%	61%	--	---
4.	1%	12%	42%	---	---	58%
5.	32%	3%	---	----	57%	53%
6.	4%	8%	52%	----	---	59%
7.	10%	11%	---	48%	51%	---
8.	18%	4%	71%	58%	---	---
9.	3%	2%	41%	40%	---	---
10.	12%	15%	---	---	69%	49%

Table no. 5 showing insect mortality percentage in the cotton field of Vichwa.

Sr. No.	Control mortality of insects		Treated mortality of insects by monocrotophos		Treated mortality of insects by acetamiprid	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
1.	3%	15%	---	64%	45%	---
2	4%	10%	---	30%	48%	---
3	8%	2%	55%	--	---	20%
4	2%	16%	46%	38%	---	---
5	11%	8%	61%	---	---	45%
6	10%	3%	65%	71%	---	---
7	4%	11%	35%	---	---	52%
8	3%	4%	---	---	58%	53%
9	1%	15%	---	50%	42%	---
10	5%	2%	20%	41%	----	---

The observation of 1st year of cotton fields in Shelwad, most of the fields spread with both the insecticides shown decreased rate of mortality near about 40-50% but the field no-1,8 and 10 has found mortality rate 80.27 %, 86.59% and 78.41%. The fluctuation may be due to the variation in the sowing period. Some farmers sowed the field in the first week of month June, which shows low mortality rate of insects due to minimum infestation of insects. In the experimental year 2nd of shelwad, monocrotophos spread fields no.-1, 2, 3 and 8 shown high rates of insects mortality than acetamiprid spread fields no.-5, 6 and 10. The percentage was 70.40 %, 66.32%, 67.77% and 60.41%, the acetamiprid field were 54.63%, 64.31% and 57.64%.

The investigation of cotton fields of village Vichwa which was spread with monocrotophos had high mortality rate in experimental year 1st of about 72.23 %, 69.00 % and 60% in the field no. 6,5 and 3. While the

acetamiprid fields had slightly lower rate of about 59.79 %, 50 % and 47 % in the fields no. 8,2 and 1. In 2nd year of the study of cotton fields in same village, the monocrotophos spread fields no. 1, 10 and 6 found high percentage of insect mortality of about 70.40%, 56.25% and 78.41% while Study of acetamiprid fields no.3, 4, 5 and 7 shown lower mortality rate, that was 43.48 %, 42.43%, 48.27 % and 56.27% compared with monocrotophos ,but the acetamiprid spread field no. 8 shown higher percentage which was 86.59 %, this variation is due to excess use of insecticides and unawareness of proper preparations of dilutions by the farmer.

The present study has found the toxic effect of pesticides monocrotophos and acetamiprid on beneficial insect specially the honey bee and wasp which mostly affected by monocrotophos. The study found farmers of of Taluka Bodwad Dist. Jalgaon generally prefers

monocrotophos and acetamiprid because it is chief in cost and has broad spectrum towards many pests (NRA Review).

The present investigation found monocrotophos is more toxic than acetamiprid because it is non volatile and remains in soil as residues (Jeschke *et al* 2011) which produce soil pollution. The acetamid is a neonectinoid and volatile in nature which causes less soil pollution compare to the monocrotophos but both the pesticides kills non targeted insects. The neonectinoid is new class of insecticide with replacement of old class like organo-chloride, phosphate etc. but the present study found that the neonectinoid (acetamiprid)is also toxic to the beneficial insects(Charmillot *et al* 2001) which causes natural damage to environmental ecosystem, the balance of ecosystem get disturbed consequently the birds which feeds on insects get decreased in population(Tomizawa *et al* 2005) to maintain the balance of food chain and ecosystem we should find the alternative of chemical bases pesticide otherwise the damage could not be overcome easily. This is the right time to save the natural pest control through parasitoids and natural pest enemy but in the present study the above pesticides monocrotophos and acetamiprid are killing the natural pest controlling agent like beneficial insects.

CONCLUSION

The present investigation concluded that the monocrotophos and acetamiprid both Insecticide have harmful effect on beneficial insects because the mortality rate of treated cotton Fields were increased as compare to the untreated cotton fields. It was more in monocrotophos spread fields than acetamiprid spread fields. In study area the farmer mostly prefers monocrotophos was confirmed by interviewed of farmer. monocrotophos has toxic effects on beneficial organism, birds and mammal. The persistence of monocrotophos in the soil is not much because it is biodegradable. The present study observed that soil has less water holding capacity and cotton crop requires more water and this area is dry land type non-irrigated.

Conflicts of interest: The authors stated that no conflicts of interest.

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