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Effect of different Biopesticides and insecticides treatments on population of natural enemies (coccinelids and spider) in Chickpea (*Cicer Arientinum*)

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Abstract
The present investigation was undertaken to find out suitable and low cost substitute for the management of *Helicoverpa armigera* (Hubner) on chickpea by using microbials and botanicals. The field trial was laid out in the premises of Insectary, Entomology Section, College of Agriculture, Nagpur, during the rabi season of 2013-14. The experiment was laid out in randomized block design (RBD) with three replications and eight treatments including control (water spray). The observations were recorded on average per cent pod damage caused by *Helicoverpa armigera* (Hubner) and average grain yield of chickpea. Cumulative effect of various treatment on natural enemies i.e. coccinelids and spiders was studied after 14 days after spraying revealed that the treatment control (water spray) invited highest population of natural enemies to the tune of 1.08 no./plant.

Keywords: Biopesticides, Insecticides, population, natural enemies, coccinelids, spider & Chickpea.

Introduction
Chickpea (*Cicer arientinum* Linn,) is the third most important pulse crop cultivated world wide and one of the most important staple legume food crop in India. It is the potent source of dietary constituent i.e. lysine, phosphorus and calcium and also a major part of the protein requirement. There are several pulse crops considered important at various locations throughout the world. Bengal gram or chickpea first domesticated in the Middle East, is widely cultivated in India, Mediterranean area, the Middle East, Ethiopia, Mexico, Argentina, Chile and Peru. Chickpea, one of the prime pulse crop of India in terms of both area and production. India is the largest producer of chickpea in the world sharing 65.25 and 65.49 per cent. Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Gujarat, Andhra Pradesh and Karnataka are the major chickpea producing states sharing over 95 per cent area. Insect pests stand as a major bottleneck in realizing higher yield. More than 50 species of the insect pests reported infesting chickpea under field and storage conditions (Garg and Surendra, 2000) [1]. *Helicoverpa armigera* (Hubner), (Family-Noctuidae, order-lepidoptera) popularly known as gram pod borer or American bollworm is a cosmopolitan, polyphagous and dynamic insect pest causing drastic yield losses in chickpea.
In India, annual crop losses caused due to this pest has been estimated at 2000 crores despite the use of chemical insecticides worth about 500 crores for combating this pest (Pawar, 1998) [5]. The population of this pest fluctuates drastically resulting in significant yield losses upto 70% (Lal *et al*. 1985) [3]. In Maharashtra losses due to this pest reported to the extent of 20% (Mahajan *et al*. 1990) [4]. In the present scenario the menace caused by *Helicoverpa armigera* (Hubner) becomes stumbling block in chickpea production. No doubt, several chemical insecticides have been found effective against this pest. However, due to overuse and misuse of these chemical insecticides, natural balance has been disturbed, leading to enormous problems such as resistance, residue, resurgence and destruction of natural enemies, pollution, and health hazards etc. There is need of comprehensive management strategy, to confront this pest and to find out ecofriendly, reliable substitute for such chemical insecticides. Biological component viz. microbials and botanicals are found promising for the management of this pest. Keeping in view of the emerging crisis, pragmatic efforts have been made, in the present study for the suppression of this pest by using microbials and botanicals alone and in combination with recommended insecticide. In this context this research was aimed with the objective - to study the effect of different biopesticides and insecticides treatments on average population of natural enemies (coccinelids and spider) in Chickpea (*Cicer Arientinum*).

Materials & Methods

The field trial was laid out in the premises of Insectary, Entomology Section, College of Agriculture, Nagpur, during the rabi season of 2013-14 considering the objectives to find out suitable and low cost substitute for the management of *Helicoverpa armigera* (Hubner) on chickpea.

A) Materials-

For conducting the present investigation, required material like chickpea seed (Variety Jaki-9218), fertilizers, agricultural implements, bullock pair, chemical insecticide (quinolphos), neem seed, Neem oil, HaNPV, Beauveria bassiana, spinosad, polythene bags, measuring cylinder, labels, plastic bucket, pegs, threads, measuring tape etc. were made available by Entomology Section, College of Agriculture, Nagpur.

Beauveria bassiana was made available from Plant pathology Section, College Agriculture Nagpur. Also, Rhizobium and Phosphorus solubilising bacteria (PSB) culture for seed treatment was made available from Plant Pathology Section, College of Agriculture, Nagpur.

B) Treatment Details

Table 1: Treatment details as per following

Sr. No.	Treatment Number	Treatment Name	Concentration
1	T1	Neem Seed Extract	5%
2	T2	Neem oil + Detergent powder	2%
3	T3	Beauveria bassiana 108 conidia/ml	2ml/l
4	T4	Azadirachtin 1500 ppm	2.5ml/l
5	T5	HaNPV 500 LE/ha	1ml/l
6	T6	Spinopsad 45 SC	0.01%
7	T7	Quinoplhoos 25 EC	0.05%
8	T8	Control (Water spray)	--

Result & Discussion -

1. Effect of different treatments on the population of coccinelids

The observations on natural enemies (coccinelids) (Tab-2, Fig-1) were recorded on 3,5,10 and 14 days after spraying. Control plot allowed highest population to the tune of 1.08 coccinelids/plant and this treatment was found on par with spinosad 45 SC 0.01(0.94), azadirachtin 1500ppm 2.5 ml/l (0.94) and *Beauveria bassiana* 10^8 conidia/ml 2ml/l (0.91) coccinelids/plant.

Table 2: Effect of treatments on coccinelids

Treat. No.	Treatment	Application of treatment After				Total	Mean
		3DAS	5DAS	10DAS	14DAS		
T1	Neem seed extract 5%	0.78 (0.88)	0.80 (0.89)	0.82 (0.90)	0.83 (0.91)	3.23 (3.58)	0.80 (0.89)
T2	Neem oil + detergent powder 2%	0.66 (0.81)	0.67 (0.82)	0.69 (0.83)	0.71 (0.84)	2.73 (3.30)	0.68 (0.82)
T3	*Beauveria bassiana* 10^8 conidia/ml 2ml/l	0.89 (0.94)	0.90 (0.95)	0.92 (0.96)	0.94 (0.97)	3.65 (3.82)	0.91 (0.95)
T4	Azadirachtin 1500 ppm 2.5 ml/l	0.92 (0.96)	0.94 (0.97)	0.96 (0.98)	0.97 (0.98)	3.79 (3.89)	0.94 (0.97)
T5	HaNPV 500 LE/ha 1ml/l	0.55 (0.55)	0.57 (0.75)	0.59 (0.77)	0.69 (0.78)	2.40 (2.85)	0.60 (0.71)
T6	Spinosad 45 SC 0.01%	0.94 (0.96)	0.91 (0.94)	0.95 (0.98)	0.97 (0.98)	3.77 (3.86)	0.94 (0.96)
T7	Quinolphos 25 EC 0.05%	0.89 (0.94)	0.90 (0.95)	0.92 (0.96)	0.94 (0.96)	3.65 (3.81)	0.91 (0.95)
T8	Control (water spray)	1.06 (1.13)	1.08 (1.17)	1.09 (1.19)	1.10 (1.21)	4.33 (4.70)	1.08 (1.17)
	'F' test						Sig.
	S. E.(m) ±						0.033
	CD at 5%						0.107

*DAS-Days after spraying.

*Figures in parentheses are corresponding arcsine transformed values.

Rosaih (2001 b) reported that, among the predatory population in okra ecosystem, spiders, chrysopids, *Apanteles* sp and coccinelids were most predominant. This clearly indicated increased activity of natural enemies in plots sprayed with botanical insecticides. This finding are in confirmation with the present results.

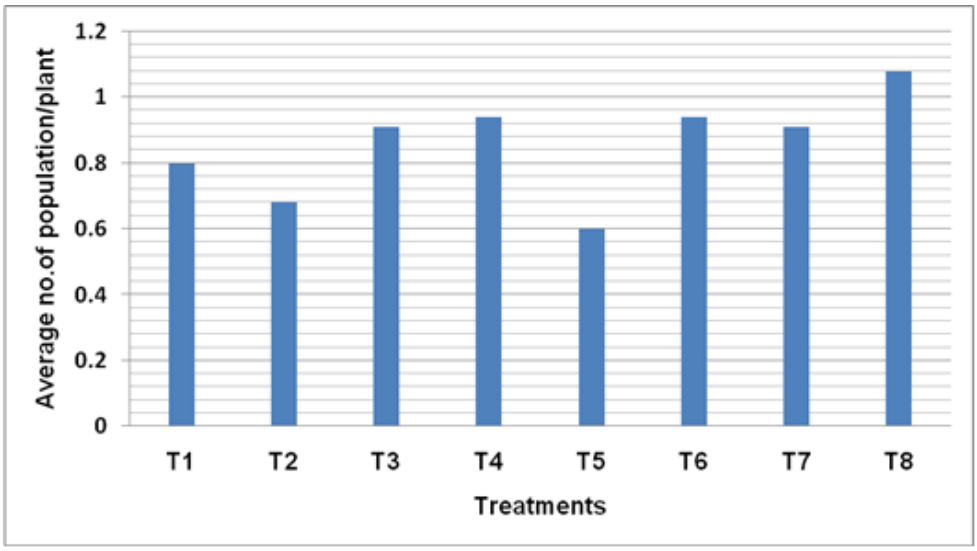

Fig 1: Effect of treatments on natural enemies (coccinelids)

The remaining treatment neem seed extract 5% recorded 0.80 coccinelids/plant and was found statistically superior on treatment neem oil + detergent powder 2% (0.68) coccinelids/plant and HaNPV 500 LE/ha 1ml/l (0.60) coccinelids/plant. Kaethner (1999) [2] reported that neem seed extract and neem oil were harmless to the eggs and larvae of *chrysoperla carnea steph* and *coccinella septumpunctata thumb.* These findings are in support of our present investigation.

2. Effect of different treatments on the population of spiders

The observations on natural enemies (spiders) (Table-3) were recorded on 3, 5, 10 and 14 days after spraying. Control plot allowed highest population to the tune of 1.09 spiders/plant and this treatment was found on par with spinosad 45 SC 0.01% (0.96), azadirachtin 1500ppm 2.5 ml/l (0.96), quinolphos 25 EC 0.05% (0.93) and *Beauveria bassiana* 10^8 conidia ml/l 2ml/l (0.93) spiders/plant.

The remaining treatment neem seed extract recorded 0.82 spiders/plant and which was found on par with treatment neem oil + detergent powder 2% (0.69) spiders/plant and treatment HaNPV 500 LE/ha 1ml/l (0.61) spiders/plant which where on par with each other. Rosaih (2001 a) reported that natural enemies like syrphids and spiders survive in all botanicals treatments and were almost equal to untreated control (1.87 spiders and 2.70 syrphids/plant) as compared to monocrotophos (0.41 spiders and 1.66 syrphids/5 plants).

Table 3: Effect of treatments on spider Population

Treat. No.	Treatment	Application of treatment After				Total	Mean
		3DAS	5DAS	10DAS	14DAS		
T1	Neem seed extract 5%	0.79 (0.89)	0.82 (0.90)	0.83 (0.91)	0.84 (0.91)	3.28 (3.62)	0.82 (0.90)
T2	Neem oil + detergent powder 2%	0.67 (0.82)	0.69 (0.83)	0.71 (0.84)	0.72 (0.85)	2.79 (3.34)	0.69 (0.83)
T3	*Beauveria bassiana* 10^8 conidia/ml 2ml/l	0.90 (0.95)	0.92 (0.96)	0.94 (0.97)	0.96 (0.98)	3.72 3.86)	0.93 (0.96)
T4	Azadirachtin 1500 ppm 2.5 ml/l	0.94 (0.97)	0.96 (0.98)	0.97 (0.98)	1.00 (1.01)	3.87 (3.94)	0.96 (0.98)
T5	HaNPV 500 LE/ha 1ml/l	0.57 (0.75)	0.59 (0.76)	0.69 (0.78)	0.62 (0.79)	2.47 (3.08)	0.61 (0.77)
T6	Spinosad 45 SC 0.01%	0.94 (0.97)	0.96 (0.98)	0.97 (0.98)	1.00 (1.01)	3.87 (3.94)	0.96 (0.98)
T7	Quinolphos 25 EC 0.05%	0.90 (0.95)	0.92 (0.96)	0.94 (0.97)	0.96 (0.98)	3.72 (3.86)	0.93 (0.96)
T8	Control (water spray)	1.08 (1.16)	1.09 (1.19)	1.10 (1.21)	1.10 (1.22)	4.37 (4.78)	1.09 (1.19)
	'F' test						Sig.
	S. E.(m) ±						0.062
	CD at 5%						0.186

*DAS-Days after spraying.

*Figures in parentheses are corresponding arcsine transformed values.

3. Cumulative effect of treatments on natural enemies (coccinelids and spiders) on 14 days after spraying

Cumulative effect of various treatments on natural enemies i.e. coccinelids and spiders was studied after 14 days after spraying revealed that (Table-4) the treatment control (water spray) invited highest population of natural enemies to the tune of 1.08 no./plant.

The treatments spinosad 45 SC 0.01% and azadirachtin 1500 ppm 2.5 ml/l was found on par with each other and recorded 0.95 each no. of natural enemies/plant. The remaining treatments quinolphos 25 EC 0.05% and *Beauveria bassiana* 10^8 conidia/ml 2ml/l recorded 0.92 each no. of natural enemies and found on par with each other.

The other treatments neem seed extract 5%, neem oil + detergent powder 2% and HaNPV 500 LE/ha 1 ml/l were recorded 0.81, 0.68 and 0.60 no. of natural enemies respectively. Kaethner (1999) [2] reported that neem extract and neem oil were harmless to the egg and larvae of *Chrysoperla carnea* Steph and *Coccinella septumpunctata* Thumb.

Rosaih (2001a) reported that natural enemies like syrphids and spiders survive in all botanicals treatments and were almost equal to untreated control (1.87 spiders and 2.70 syrphids/plant) as compared to monocrotophos (0.41 spiders and 1.66 syrphids /5 plants). This finding are in confirmation with the present results.

Table 4: Cumulative effect of treatments on natural enemies (coccinelids and spider)

Treat. No.	Treatment	After application of treatment		Total	Mean
		Average population of coccinelids per plant	Average populations of spider per plant		
T1	Neem seed extract 5%	0.80 (0.89)	0.82 (0.90)	1.62 (1.79)	0.81 (0.89)
T2	Neem oil + detergent powder 2%	0.68 (0.82)	0.69 (0.83)	1.37 (1.65)	0.68 (0.82)
T3	*Beauveria bassiana* 10^8 conidia/ml 2ml/l	0.91 (0.95)	0.93 (0.96)	1.84 (1.91)	0.92 (0.95)
T4	Azadirachtin 1500 ppm 2.5 ml/l	0.94 (0.97)	0.96 (0.98)	1.90 (1.95)	0.95 (0.97)
T5	HaNPV 500 LE/ha 1ml/l	0.60 (0.71)	0.61 (0.77)	1.21 (1.48)	0.60 (0.74)
T6	Spinosad 45 SC 0.01%	0.94 (0.96)	0.96 (0.98)	1.90 (1.94)	0.95 (0.97)
T7	Quinolphos 25 EC 0.05%	0.91 (0.95)	0.93 (0.96)	1.84 (1.91)	0.92 (0.95)
T8	Control (water spray)	1.08 (1.17)	1.09 (1.19)	2.17 (2.36)	1.08 (1.80)
	'F' test	Sig.	Sig.		Sig.
	S. E.(m) ±	0.033	0.062		0.047
	CD at 5%	0.107	0.186		0.21

*Figures in parentheses are corresponding arcsine transformed values.

Conclusion

From the above results it is concluded that, the treatments spinosad 45 SC 0.01% and azadirachtin 1500 ppm 2.5 ml/l was found on par with each other and recorded 0.95 each no. of natural enemies/plant. The remaining treatments quinolphos 25 EC 0.05% and *Beauveria bassiana* 10^8 conidia/ml 2ml/l recorded 0.92 each no. of natural enemies and found on par with each other. Cumulative effect of various treatment on natural enemies i.e. coccinelids and spiders was studied after 14 days after spraying revealed that the treatment control (water spray) invited highest population of natural enemies to the tune of 1.08 no./plant.

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