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Efficacy of oil formulation of *Nomurea rileyi* against *Helicoverpa armigera* on chickpea

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ABSTRACT

Field experiment was carried out to determine the effectiveness of oil formulations of an entomogenous fungus, *Nomurea rileyi* (Farlow) Samson on *Helicoverpa armigera* (Hubner) on chickpea at the field, Department of Plant Pathology, Dr.PDKV, Akola. Results showed that, larval reduction increased in duration after spraying under field condtion. Two sprays of DC-Tron, soybean and sunflower oil formulation were found very effective in reducing larval population, pod damage and increase in grain yield of chickpea. However, endosulfan 35 EC 0.06 per cent treated plot recorded maximum pod damage and higher grain yield than the fungus formulation treatments. On the basis of ICBR, endosulfan ranked first having 1: 21.14 ICBR followed by soybean oil (1:18.40), DC-Tron oil (1:16.57) and sunflower oil formulation (1:16.38).

Key words : *Nomurea rileyi,* Oil formulation, *Helicoverpa armigera,* Chickpea.

Chickpea (*Cicer arietinum* L.) is most important legume, occupying first rank in area as well as production among the pulses grown in the country. Pod borer, *Helicoverpa armigera* (Hubner) is an important major pest of chickpea responsible for its low production. Due to its direct attack on flower or fruiting bodies, high mobility, voracious feeding and high fecundity, it has assumed the status of key pest of many crops. Use of chemical insecticides has witnessed the alarming situation in present agro-ecosystem creating health hazards to the extent of human genetic level and this resulted in increased interest towards biological control in recent years.

Among the existing several entomognous fungi, *Nomurea rileyi* (Farlow). Samson is known to infect mainly several economically important and polyphagous noctuid pests namely *H. armigera, Spodoptrea litura, Trichoplusia ni, Achoea janata, Plusia* sp. Etc (Ignoffo, 1981). Therefore, it has great potential development into myco-insecticide. In this context, attempts were made to prepare some efficient oil formulation of N. *rileyi* and to evaluate their efficacy against *H. armigera* on chickpea under field conditions.

MATERIALS AND METHODS

The experiment were conducted at the field, Department of Plant Pathology, Dr.Panjabrao Deshmukh Agriculture University, Akola (MS), during the *rabi* season under irrigation condition in randomized block design with three replications having plot size of 2.4x 4 m and sowing was done with the ICCV-2 at the spacing of 30x10 cm. Two applications of the fungus formulation in aqueous suspension and oil in water emulsion by high volume sprays were made. A first spray was undertaken on reaching the economic threshold level (1 -2 larvae / m row) and second spray was given after 15 days on reaching the ETL again. In oil formulations, 0.05 ml of each oil, 0.02 ml Tween-80 and 500 ml water as used per plots and final concentration of fungus was made 2.39 x 10^9 spores / ml. Fresh kaolin based formulation was used containing 10^9 spores / ml @ 5 g / liter. Insecticide checks endosulfan 35 EC @ 0.06 per cent concentration and untreated control for comparison. The treatments details given in Tables. The observation on per cent larval reduction 4, 8 and 11 days after treatment (DAT) was worked out by following formula-

$$\% \text{ larval reduction} = \frac{\text{Post treatment population}}{\text{Pre - treatment population}} \times 100$$

At the harvest, the per cent pod damage due to pod borer was calculated as per the following formula –

$$\% \text{ pod damage} = \frac{\text{Total no. of damage pods}}{\text{Total no. of healthy pods}} \times 100$$

Yield performance of the crop in response to different treatment at harvest the grain yield per plot was recorded and converted it on hectare basis. The data thus collected for two years were pooled in respect of per cent reduction in larval population and per cent pod damage due to *H. armigera* were transformed into arc sin and square root values, respectively as per Gomez and Gomez (1984) and along with yield data were subjected to statistical analysis.

RESULTS AND DISCUSSION

Larval reduction:

The pooled data regarding the larval reduction of two seasons were statistically significant (Table 1). Larval

reduction increased with an increase in duration after spraying under field condition. Among the formulation of *N. rileyi* , DC-Tron, soybean and sunflower oil were highly efficient in reducing the larval population and exhibited 73.49, 72.39 and 68.84 per cent reduction. Sesamum , coconut and kaolin were equally effective in reduction of *H. armigera* and recorded 64.52, 64.12 and 60.72 per cent larval reduction. Minimum *i.e*. 52.52 per cent reduction in population was observed in spray of groundnut oil formulation. Amongst the all the treatments, endosulfan 0.06 % expressed higher reduction (90.73 %) in the larval population of *H. armigera*.

Pod damage:

Pooled data on per cent pod damage as influenced by different treatments over two seasons are tabulated in Table 2. The formulations and chemical insecticide were effective in reducing the pod damage. Minimum pod damage was observed due to endosulfan (5.04 %) followed by soybean (6.08 %) , DC-Tron (6.09 %), an sunflower oil formulation (6.65 %). These treatments were equally efficient in reducing pod damage. Higher larval reduction due to endosulfan, soybean, DC-Tron and sunflower oil formulations must have reflected in the lower pod damage. Pod damage in untreated control as 15.33 % which was significantly higher than all other treatments.

Grain yield:

Grain yield differences (Table 2) are statistically significant. All the treatments produced significantly higher grain yield than that of control. Maximum grain yield was harvested from the plots sprayed with endosulfan (1592 kg/ha) followed by DC-Tron (1373 kg/ha) and soybean oil formulation (1370 kg/ha). The next effective treatments *viz.* sunflower oil (1334 kg/ha),sesamum oil (1298 kg/ha), coconut oil (1275 kg/ha) and aqueous spray of *N. rileyi* were moderately effective in this regard. Maximum yield was obtained in endosulfan, DC-Tron oil, soybean oil and sunflower oil formulation with consistently higher larval reduction and less pod damage.

Incremental cost benefit ratio (ICBR):

The data on the impact of management of *H. armigera* due to different treatments and its economical returns over two seasons are presented in Table 3, though confirmed that application of endosulfan alone gave maximum benefits with highest ICBR of 1:21.14, while

Table 1 : Effect of different treatments on per cent larval reduction of *H. armigera* at 4, 8 and 11 DAS (pooled)

Sr. No.	Treatment	% larval mortality at DAS		
		4	8	11
1.	Groundnut oil + Nr	9.84	32.53	52.52
		(18.17)*	(34.70)	(46.44)
2.	Sunflower oil + Nr	15.62	44.65	68.84
		(22.99)	(41.86)	(56.16)
3.	Sesamum oil + Nr	14.86	41.08	64.52
		(22.41)	(39.78)	(58.58)
4.	Soybean oil + Nr	19.86	48.74	72.39
		(26.12)	(44.26)	(58.46)
5.	Coconut oil + Nr	14.66	39.55	64.12
		(22.28)	(38.90)	(53.27)
6.	DC-Tron + Nr	20.02	49.01	73.49
		(26.26)	(44.44)	(59.19)
7.	Water + Nr	10.92	34.54	56.31
		(19.15)	(36.00)	(48.65)
8.	Kaoline based	12.57	37.15	60.72
		(20.53)	(37.47)	(51.23)
9.	Endosulfan 0.06%	70.88	82.61	90.73
		(57.41)	(65.48)	(73.94)
10.	Control	3.14	8.86	13.46
		(10.75)	(17.22)	(21.47)
	F' Test	Sig	Sig	Sig
	S.E. ±	0.64	0.85	0.79
	C.D. (P=0.05%)	1.92	2.54	2.34

*Figures in parentheses are arcsin transformed mean values

Table 2 : Effect of different treatments on per cent pod damage at harvest and yield of chickpea (pooled)

Sr. No.	Treatment	% pod damage	Yield Kg /ha
1.	Groundnut oil + Nr	10.35	1042
		(3.20)*	
2.	Sunflower oil + Nr	6.65	1334
		(2.57)	
3.	Sesamum oil + Nr	7.39	1298
		(2.71)	
4.	Soybean oil + Nr	6.08	1370
		(2.45)	
5.	Coconut oil + Nr	8.41	1275
		(2.88)	
6.	DC- Tron + Nr	6.09	1373
		(2.45)	
7.	Water + Nr	9.44	1155
		(3.06)	
8.	Kaoline based	8.59	1224
		(2.92)	
9.	Endosulfan 0.06%	5.04	1592
		(2.26)	
10.	Control	15.53	871
		(3.94)	
	F' Test	Sig	Sig
	S.E. ±	0.11	43
	C.D. (P=0.05)	0.32	146

* Figures in parentheses are square root transformed mean values

Table 3 : Incremental cost benefit ratio of various treatments

Sr. No.	Treatments	% larval mortality 11 DAS (Pooled)	% pod damage (Pooled)	Grain yield Kg/ha (Pooled)	Additional grain yield over control (Kg/ha)	Additional cost obtd. Rs.	Cost of production of *N.rileyi* and oil for 1 spray	Total input cost for 2 spray	Net return	ICBR	Rank
1.	Groundnut Oil + Nr	52.52 (46.44)*	10.35 (3.20)**	1042	171	2736	84.25	416.50	2319.5	1:5.57	9
2.	Sunflower oil + Nr	68.84 (56.16)	6.66 (2.57)	1334	463	7408	86.00	420.00	6988.00	1:16.38	4
3.	Sesamum oil + Nr	54.52 (58.58)	7.39 (2.71)	1298	427	6832	84.25	425.00	6407.00	1:15.07	5
4.	Soybean oil + Nr	72.39 (58.46)	6.08 (2.45)	1370	499	7984	81.75	411.50	7572.5	1:18.40	2
5.	Coconut oil + Nr	64.12 (53.27)	8.41 (2.88)	1275	404	6464	111.00	470.00	5994.0	1:12.75	6
6.	Coltex oil + Nr (DC-Tron + Nr)	73.49 (59.19)	6.09 (2.45)	1373	502	8032	86.00	457.00	7575.00	1:16.57	3
7.	Water + Nr	56.31 (51.23)	9.44 (8.06)	1155	284	4544	71.00	390.00	4154.00	1:10.65	7
8.	Kaoline + Nr	60.72 (51.23)	8.59 (2.92)	1224	353	5648	153.50	555.00	5093.00	1:9.17	8
9.	Endosulfan 0.06 %	90.73 (73.94)	5.04 (2.26)	1592	721	11536	145.35	538.70	11390.65	1:21.14	1
10.	Control	13.46 (21.47)	15.53 (3.94)	871	--	--	--	--	--	--	--
	S.E. ±	0.79	0.11	43.1	--	--	--	--	--	--	--
	C.D. (P=0.05)	2.34	0.32	146.2	--	--	--	--	--	--	--

*ARCSIN values
**Square root transferred values
Market rate of chickpea Rs. 1600/100 Kg

Oils-Grounut	Rs. 53/Kg	Caltex	Rs. 135/lit
Sunflower	Rs. 60/Kg	Kaoline	Rs. 55/Kg
Sesamum	Rs. 70/Kg	Endosulfan	Rs. 171 /lit
Soybean	Rs. 42/Kg	Coconut	Rs. 70 /Kg
Labour Charges	Rs. 47/day	Sprayer Charges	Rs.15/day

among the oil formulations of *N. rileyi i.e.* soybean oil formulation emerged as the second best economically viable treatment with ICBR 1:18.40.DC-Tron oil, sunflower and sesamum oil formulation also registered maximum money value *i.e.* Rs.8032, 7408 and 6832 with ICBR of 1:16.57, 1:16.38 and 1:15.07, respectively.

The results in case of endoulfan are in agreement with the result of Khan *et al.* (1993) who noticed high percentage of reduction in *H. armigera* larval population, minimum pod damage and higher grain yield of chickpea with the treatment of endosulfan. The aforesaid findings regarding effectiveness of *N.rileyi* in combination with oils is in confirmation with Pallavi Nahar *et al.* (2003) who reported that two application of oil formulation of *N.rileyi* @ $5x10^{12}$ conidia/ha/3 liter effectively reduced larval population, pod borer damage and increased grain yield of chickpea. The effectiveness of *N.rileyi* with vegetable oil was also reported in tomato against *H. armigera* (Anonymous, 2001), in pigeon pea (Pallavi Nahar *et al.*, 2004).

Although endosulfan proved more effective than all the *N.rileyi* oil formulations. Demerits of chemical *i.e.* high cost with several undesirable consequence such as development of resistant in insect pest, threat to natural bio-agent, contamination of food with residues and environment pollution. Management through entomopathogen like *N.rileyi* which is highly cost effective and safe towards non-target organism will form the best mycoinsecticide for the management of *H. armigera* on chickpea and variety of crops.

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