

EVALUATION OF DIFFERENT BIO PESTICIDES AGAINST *SPODOPTERA LITURA* (FABRICIUS) INFESTING GROUNDNUT

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ABSTRACT

Investigation on evaluation of different bio pesticides against Spodoptera Littura on groundnut was made at Entomology Farm, Anand Agricultural University, Anand during summer - 2011. Among evaluated all bio pesticides Spodoptera Nuclear Polyhedrosis Virus @ 250 LE/ha, azadiractin @ 0.4 per cent, neem oil @ 0.3 per cent and Neem Seed Kernel Extract @ 5 per cent gave effective control of S. litura on groundnut crop. The Beauveria bassiana, Naffatia Leaf Extract, tobacco decoction and Bacillus thuringiensis were found less effective. The maximum yield of pod and haulm were found in the plots treated with SNPV followed by azadiractin, NSKE and HaNPV. The treatments of SNPV, HaNPV, azadiractin and NSKE gave NICBR of 1 : 5.40, 1 : 4.44, 1 : 3.91 and 1 : 1.26, respectively.

KEY WORDS: Bio-pesticides, groundnut, NICBR, *S. litura*

INTRODUCTION

Groundnut (*Arachis hypogaea* Linnaeus) is an annual legume crop and belongs to family Leguminosae. It is grown in tropical and sub-tropical regions and in the continental part of temperate countries. The seed (kernels) contains up to 50 per cent of a non drying oil, 40-50 per cent fat, 20-50 per cent protein and 10-20 per cent carbohydrate (Mehta, 2002). Groundnut seeds are nutritional source of vitamin E, calcium, phosphorus, magnesium, zinc, iron, riboflavin, thiamine and potassium. Groundnut oil is considered as stable and nutritive, as it contains just the right proportion of Oleic (40-50 %) and Linoleic (25-35 %) acids (Mathur and Khan, 1997). Groundnut kernels are consumed directly as

raw, roasted, fried or boiled products and also used in varieties of culinary preparations like peanut butter, peanut milk, chocolates etc. Oil extracted from the kernel is used for culinary purpose. The cakes and straws are used as cattle feed. These multiple uses of groundnut plant make it an excellent cash crop for domestic markets as well as for foreign trade in several developing and developed countries (Kumar *et al.*, 2007). The crop is mainly attacked by 500 species of arthropod. The major insect pests damaging to groundnut crop are Aphid (*Aphis craccivora* Koch), Leaf miner (*Stomopteryx nertara* Meyrick), Stem borer (*Sphenoptera perotett* Cameron), White grub (*Holotrichia consanguinea* Blanchard), Bihar hairy caterpillar (*Spilosoma oblique*

Walker), Red hairy caterpillar (*Amsacta albistriga* Butler), Leaf eating caterpillar (*Spodoptera litura* Fabricius), Pod borer (*Helicoverpa armigera* (Hubner) Hardwick), Jassid (*Empoasca kerri* Pruthi), Thrips (*Scirtothrips dorsalis* Lindman), Jewel beetle (*Sphenoptera indica*), Termites (*Odontotermes obesus* Rambur) and Grasshopper (*Hieroglyphus banian* Fabricius) (Atwal and Dhaliwal, 2008). In Middle Gujarat, *S. litura* solely damaging the crop in *kharif* as well as in *summer* seasons. The use of different chemical insecticides, this pest developed resistance against insecticides. Keeping this in view, study was under taken on evaluation different bio pesticides against this pest.

MATHOD AND MATERIALS

With a view to find out the effective and economical bio pesticides against *S. litura* infesting groundnut crop, the experiment was carried out at Entomology Farm, Anand Agricultural University, Anand in Randomized Block Design with three replications. Groundnut (GG 20) was sown at a spacing of 75 cm between two rows and 10 cm within the rows during 2nd week of February, 2011 in a gross and net plot area of 4.0 m x 3.0 m and 3.0 m x 1.5 m, respectively. The first spray of respective bio pesticides was applied when *S. litura* larval population found more than one larvae per five plants and subsequent second spray was done after 15 days. The observations on numbers of *S. litura* larvae were recorded from randomly selected five plants from each net plot. Similarly, total and damaged leaves by *S. litura* were recorded from three branches of each selected plants prior to 1 day of each spray as well as 1, 3, 7, 10 and 15 days after each spray. The data were analyzed periodically, pooled over period as well as pooled over sprays to check the effectiveness of treatments.

The groundnut crop was harvested at proper maturity stage. The healthy pods and haulm were weighed treatment wise from each net plot area and converted in to kilogram per hectare basis. The avoidable losses due to *S. litura* were calculated with the help of following formula described by Poul (1976). The economics of each treatment were also counted.

$$\text{Avoidable losses (\%)} = \frac{\text{Yield in treatment which give the highest yield} - \text{Yield in treatment which give highest yield}}{\text{Yield in treatment which give highest yield}} \times 100$$

RESULTS AND DISCUSSION

The observed population of *S. litura* per five randomly selected plants after first spray, second spray as well as pooled over two sprays are presented in Table 1. The treatment of SNPV was found significantly superior (2.16 larvae / five plants) to all the evaluated bio pesticides after first spray (Table 1). Azadiractin, Neem oil and NSKE treated plots noticed 2.36, 2.53 and 2.67 larvae per five plants, respectively. The *Bb* and NLE exhibited 2.74 and 2.85 larvae per five plants, respectively. Of the evaluated bio pesticides, the highest larval population (3.50 larvae / five plants) was found in plots treated with HaNPV followed by tobacco decoction (2.96 larvae / five plants). The data of second spray (Table 1) indicated that the plots treated with SNPV was found significantly superior (1.66 larvae / five plants) to all the evaluated bio pesticides Except *Azadiractin* in suppression of *S. litura* population. The treatments of neem oil (2.06 larvae / five plants) and NSKE (2.22 larvae / five plants) found equally

effective against *S. litura* on groundnut. The *Bb* (2.39 larvae / five plants), tobacco decoction (2.39 larvae / five plants), NLE (2.39 larvae / five plants) and *Bt* (2.67 larvae / five plants) treatments were at par with each other in checking the *S. litura* incidence on groundnut. Among the tested bio pesticides, HaNPV registered highest (3.34 larvae / five plants) larval population of *S. litura*. The results of pooled over sprays (Table 1) clearly exposed that the lowest numbers of larvae per five plants (1.90) was recorded in the plots treated with SNPV and it was at par with azadiractin (2.12 larvae / five plants), neem oil (2.29 larvae / five plants) and NSKE (2.46 larvae / five plants). The treatments of *Bb*, NLE, tobacco decoction and *Bt* exhibited larval population between 2.56 and 2.74 per five plants. In contrast to this, the highest (3.42 larvae / five plants) larval population was found in plots treated with HaNPV.

The results of leaf damage in percentage due to *S. litura* after first spray, second spray as well as pooled over two sprays are presented in Table 1. The data of first spray indicated superiority of SNPV (7.21 %) and azadiractin (8.63 %) against the pest. The superiority of these bio pesticides were observed throughout the experimentation. The treatments of neem oil and NSKE were found statistically at par with each other and exhibited 9.85 and 10.60 per cent leaf damage, respectively. The NLE treatment showed 11.59 per cent leaf damage and it was as effective as NSKE. Tobacco decoction (12.95 %) and *Bb* (13.83 %) treated plots were found equally effective against *S. litura*. Among the tested bio pesticides, the highest (15.30 %) leaf damage was noticed in plots treated with HaNPV and it was at par with *Bt* (14.33 %) and *Bb* (13.83 %). The HaNPV was at par with control. The data of second spray (Table 1) indicated that plots treated with

SNPV noted significantly lowest (8.93 %) leaf damage than all the tested bio pesticides except azadiractin (10.14 %). Neem oil and NSKE treated plots recorded 11.25 and 12.36 per cent leaf damage, respectively. The NLE and tobacco decoction as well as *Bb* and *Bt* were at par with each other in their descending order of effectiveness. Among the evaluated bio pesticides, the highest (18.09 %) leaf damage was noticed in plots treated with SNPV followed by *Bt* (15.93 %) and *Bb* (15.14 %) but HaNPV was at par with control. Pooled over sprays results (Table 1) clearly exposed that the plots treated with SNPV proved significantly superior (8.36 %) in controlling the *S. litura* than all the bio pesticides except azadiractin (9.37 %) and neem oil (10.55 %). The treatment of NSKE (11.46 %) was equally as effective as azadiractin and neem oil. The NLE and tobacco decoction recorded 12.36 to 13.49 per cent leaf damage, respectively. Of the evaluated bio pesticides, HaNPV (16.67 %), *Bt* (15.12 %) and *Bb* (14.47 %) fails to check the incidence of *S. litura* on groundnut and these treatments were at par with control. The effectiveness of SNPV @ 250 LE/ha was proved against *S. litura* population on groundnut by Sachithanandam *et al.* (1989) and Dhandapani *et al.* (1993). Choudhary and Shrivastava (2007) reported that neem seed kernel extract @ 5 per cent effectively control the *S. litura* incidence on soyabean. These reports are in accordance with the present findings.

The effect of different bio pesticides on pod and haulm yield, avoidable losses and on production economics of groundnut due to *S. litura* are given in Table 2. The plots treated with SNPV produced highest yield (1142.00 kg/ha) of groundnut pod and it was at par with azadiractin (1031.00 kg/ha) and neem oil (936.00 kg/ha). The groundnut pod yield produced between

797.00 and 867.00 kg/ha from the plots treated with HaNPV, NSKE and *Bt*. Among the tested bio pesticides, the lowest (681.00 kg/ha) yield was noted in plots treated with NLE followed by tobacco decoction and *Bb* (Table 2). Highest (3583.00 kg/ha) yield of groundnut haulm was obtained from the plots treated with SNPV and it was at par with azadiractin (3500.00 kg/ha), HaNPV (3333.00 kg/ha) and NSKE (3333.00 kg/ha). The *Bt*, neem oil, *Bb* and tobacco decoction exhibited yield in between 3220 and 3270 kg/ha. Among the evaluated bio pesticides, the plots treated with NLE produced the lowest (3139.00 kg/ha) yield of haulm followed by tobacco decoction and *Bb* (Table 2).

Maximum yield was increased in the plots treated with SNPV (78.69 %) followed by azadiractin (61.30 %), neem oil (46.52 %) and HaNPV (35.65 %). Enhancement of yield due to the effect of bio pesticides was between 18.50 and 27.50 per cent in the plots treated with *Bb*, *Bt* and NSKE. The pod yield increased below 10 per cent in NLE and tobacco decoction. So far the avoidable losses (Table 2) in yield of groundnut pod is concerned, it varied from 9.73 to 44.04 per cent in different treatments, considering the maximum (1141.67 kg/ha) yield of SNPV taken as base. The avoidable losses were lowest (9.73 %) in the treatment of azadiractin followed by neem oil (18.01 %), HaNPV (24.09 %) and NSKE (28.71 %) as against 44.04 per cent in control plots. The avoidable losses between 30 and 41 per cent in the treatments of *Bt*, *Bb*, tobacco decoction and NLE. Maximum (17.27 %) yield was increased in the plots treated with SNPV followed by azadiractin (14.54 %), NSKE (9.09 %) and HaNPV (9.09 %). Enhancement of yield due to the effect of bio pesticides was observed in between 2.70 and 6.90 per cent in the plots treated with NLE, *Bb*, tobacco

decoction, neem oil and *Bt*. So far the avoidable losses (Table 2) in yield of groundnut haulm is concerned, it varied from 2.32 to 14.73 per cent in different treatments, considering the maximum (3583.33 kg/ha) yield of SNPV taken as base. The avoidable losses were lowest (2.32 %) in the treatment of azadiractin followed by NSKE (6.98 %), HaNPV (6.98 %) and *Bt* (8.91 %) as against 14.73 per cent in control plots. The avoidable losses were between 9 and 13 per cent in plots treated with neem oil, *Bb*, tobacco decoction and NLE.

As far as the economics, the treatments of SNPV, HaNPV, azadiractin and NSKE gave NICBR of 1 : 5.40, 1 : 4.44, 1 : 3.91 and 1 : 1.26, respectively. The remaining bio pesticides viz., *Bb*, *Bt*, tobacco decoction and NLE exhibited poor or negative NICBR (-0.89 to 0.45).

CONCLUSION

From the above results, it can be extracted that the treatments of *Spodoptera* Nuclear Polyhedrosis Virus @ 250 LE/ha, azadiractin @ 0.4 per cent, neem oil @ 0.3 per cent and Neem Seed Kernel Extract @ 5 per cent gave effective control of *S. litura* on groundnut crop. The *Beauveria bassiana*, Naffatia Leaf Extract, tobacco decoction and *Bacillus thuringiensis* were found less effective. On the other hand, *Helicoverpa armigera* NPV was not effective and found at par with control in checking the *S. litura* on groundnut crop.

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Table 1: Effectiveness of bio pesticides against *S. litura* on Groundnut

Treatments		No. of Larvae / Five Plants After Sprays			Damage (%) After Spray		
		First Spray	Second Spray	Pooled Over Sprays	First Spray	Second Spray	Pooled Over Sprays
NSKE @ 5 %		1.78(2.67)	1.65(2.22)	1.72(2.46)	19.00(10.60)	20.58(12.36)	19.79(11.46)
Neem oil @ 0.3%		1.74(2.53)	1.60(2.06)	1.67(2.29)	18.29(9.85)	19.60(11.25)	18.95(10.55)
SNPV @ 250 LE/ha		1.63(2.16)	1.47(1.66)	1.55(1.90)	16.23(7.21)	17.39(8.93)	16.81(8.36)
HaNPV @ 450 LE/ha		2.05(3.50)	2.06(3.34)	2.06(3.42)	23.03(15.30)	25.17(18.09)	24.10(16.67)
NLE @ 10 %		1.83(2.85)	1.70(2.39)	1.76(2.60)	19.90(11.59)	21.26(13.15)	20.58(12.36)
Azadiractin @ 0.4 %		1.69(2.36)	1.55(1.90)	1.62(2.12)	17.08(8.63)	18.57(10.14)	17.82(9.37)
Bb @ 0.4 %		1.80(2.74)	1.70(2.39)	1.75(2.56)	21.83(13.83)	22.90(15.14)	22.36(14.47)
Bt @ 0.2 %		1.85(2.92)	1.76(2.67)	1.80(2.74)	22.24(14.33)	23.52(15.93)	22.88(15.12)
Tobacco decoction @ 2 %		1.86(2.96)	1.70(2.39)	1.78(2.67)	21.09(12.95)	22.01(14.05)	21.55(13.49)
Control		2.14(4.08)	2.12(3.99)	2.13(4.04)	23.71(16.17)	25.89(19.07)	24.80(17.59)
Mean		1.83	1.72	1.78	20.24	21.69	20.96
S. Em. ±	T	0.03	0.03	0.06	0.40	0.49	0.89
	P	0.03	0.02	0.01	0.33	0.40	0.19
	S	-	-	0.01	-	-	0.12
	T × P	0.08	0.07	0.02	1.04	1.28	0.38
	P × S	-	-	0.04	-	-	0.60
	T × S	-	-	0.02	-	-	0.27
	T × P × S	-	-	0.05	-	-	0.84
C.D. at 5 %	T	0.09	0.08	0.18	1.13	1.37	2.63
	P	0.08	0.06	0.03	0.98	1.20	0.52
	S	-	-	0.02	-	-	0.33
	T × P	NS	NS	NS	NS	NS	NS
	P S	-	-	NS	-	-	NS
	T × S	-	-	0.05	-	-	NS
	T × P × S	-	-	NS	-	-	NS
C.V.%		7.70	7.29	5.03	8.94	10.20	6.97

Bb : *Beauveria bassiana*

NLE : *Naffatia Leaf Extract*

SNPV : *Spodoptera Nuclear Polyhedrosis Virus*

Bb : *Beauveria bassiana*

Bt: *Bacillus thuringiensis*

Bt : *Bacillus thuringiensis*

NSKE: *Neem Seed Kernel Extract*

HaNPV: *Helicoverpa Nuclear Polyhedrosis Virus*

NLE : *Naffatia Leaf Extract*

Figures outside the parenthesis are $\sqrt{X + 0.5}$ transformed values, those inside are retransformed values

Table 2: Effect of bio pesticides on yield and its economics of groundnut due to *S. litura*

Treatments	Pod			Haulm			NICBR
	Yield (kg/ha)	Increased yield over control (%)	Avoidable losses (%)	Yield (kg/ha)	Increased yield over control (%)	Avoidable losses (%)	
NSKE @ 5 %	814.00	27.39	28.71	3333.00	9.09	6.98	1 : 1.26
Neem oil @ 0.3 %	936.00	46.52	18.01	3261.00	6.72	9.00	1 : 7.52
HaNPV @ 450 LE	867.00	35.65	24.09	3333.00	9.09	6.98	1 : 4.44
SNPV @ 250 LE	1142.00	78.69	0.00	3583.00	17.27	0.00	1 : 5.40
NLE @ 10 %	681.00	6.52	40.39	3139.00	2.72	12.40	1 :- 0.89
Azadiractin @ 0.15 %	1031.00	61.30	9.73	3500.00	14.54	2.32	1 : 3.91
Bb @ 0.4	758.00	18.69	33.58	3222.00	5.45	10.08	1 : 0.45
Bt @ 0.2 %	797.00	24.78	30.17	3264.00	6.81	8.91	1 : -0.31
Tobacco decoction @ 2%	694.00	8.69	39.17	3222.00	5.45	10.08	1 : -0.41
Control	639.00	-	44.04	3056.00	-	14.73	-
S. Em. ±	85.98	-	-	98.98	-	-	-
C.D. at 5 %	255.48	-	-	294.08	-	-	-
C.V.%	17.81	-	-	5.19	-	-	-

Bb : *Beauveria bassiana*

NSKE : Neem Seed Kernel Extract

SNPV : *Spodoptera Nuclear Polyhedrosis Virus*

Bt : *Bacillus thuringiensis*

NLE : *Naffatia Leaf Extract*

HaNPV: *Helicoverpa Nuclear Polyhedrosis Virus*

Labour charge : Skilled- 170 Rs/day, Ordinary- 100 Rs/day

Market price of groundnut pod and haulm 30 and 2 Rs/kg, respectively

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