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LABORATORY EVALUATION OF DIFFERENT BIOPESTICIDES ON FECUNDITY AND DEFORMITY AGAINST LATE INSTAR OF *SPODOPTERA LITURA*.

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ABSTRACT
In present study a laboratory evaluation was conducted to determine the efficacy of different biopesticides viz. SlNPV, *Bt*, *B.bassiana*, and their combinations with NSKE 5 % against survivals of 5th instar larvae of *Spodopteralitura* (Fabricius) to investigate possible effect of these biopesticides on fecundity(eggs/female) and deformity of 5th instar larvae of *S. litura*. The treatment of combination of SlNPV + NSKE 5% recorded highest (80.00%) pupal deformity followed by SlNPV (72.72%) and *B.bassiana* + NSKE 5%(66.67 %).The treatment of SlNPV + NSKE 5% recorded highest (85.71%) adult deformity followed by SlNPV (77.78%) and *B.bassiana* + NSKE 5%(72.72%).The lowest fecundity *i.e* 206 eggs/female recorded in treatment of SlNPV + NSKE 5% followed by *B.bassiana* + NSKE 5%(360 eggs/female) and *Bt* + NSKE 5%(390 eggs/female).Neem Seed Kernel extract 5% could interfere with protein metabolism of the insect and showed better results when combined with biopesticides than its sole application.

INTRODUCTION

The tobacco leaf eating caterpillar, *Spodopteralitura* (Fabricius) is an extremely dangerous pest of many economically important crops. It is major pest of oilseed crops in India (Murali Krishna *et al.*,2008). It damages numerous vegetable and field crops in China and many Asian countries (Shivayogeshwara,1991). *S litura*(Fab.) are serious polyphagous pests (Fletcher, 1919) responsible for high yield losses in cotton, redgram, chickpea and groundnut in India(Yasa and Rao,2011).Several workers had tried different insecticides against this pest on various crops,so as to achieve good control and better yield,as aresult number of insecticides have been recommended against this pest. Complete reliance on synthetic pesticides and their indiscriminate use have often resulted in pesticide resistance(Rabari *et al.*,2016), pest resurgence, residual toxicity, imbalance in ecological equilibrium, environmental pollution, (Dubey *et al.*,2011). which led to interest in using alternate eco-friendly , economical methods of pest control, particularly the use different biopesticides and their combination with NSKE.Bioagents play an important role in various pest management strategies such as Integrated Pest Management (IPM) and non-insecticidal pest management(Chauhan *et al.*,2013) .As there is need to promote the use of biopesticidesthis study will give alternative measures for management of *S. litura*.The data generated from present study will be helpful for designing the IPM module of soybean crop. Keeping the above facts in mind the present investigation was undertaken with objective of laboratory evaluation of different biopesticides on fecundity (eggs/female) and deformity of late instar larvae of *S litura* which indirectly help to maintain the pest population under control.

MATERIALS AND METHODS

The present study was carried out in the Insect Toxicology Laboratory, Department of Agricultural Entomology, PGI, Dr. PDKV, Akola (M.S.) during the year 2009-2010 to determine the efficacy of different biopesticides on fecundity and deformity on survivals of 5th instar larvae of *Spodopteralitura*. Various treatments tested are given in Table 1.

Test insect

The eggs and larvae of *S. litura*were collected from castor and soybean plot of Department of Entomology, Dr. PDKV, Akola and reared for one generation on fresh castor leaves in the laboratory at 25 ± 2°C temperature, 75± 2% RH and second generation larvae were used for treatment. The design of experiment used was 'Completely Randomized Design'. The required concentrations of biopesticides were calculated by formula

$$V = \frac{C \times A}{\%\ a.i}$$

Where

V = Volume of biopesticides

C = Concentration required

A = Quantity of water required

% a. i = Percentage of active ingredients in commercial

biopesticides.

The required quantity of biopesticides was taken with the help of micropipette and transferred in to beaker containing distilled water

S.lituraFeeding

Castor was sown in the plot of Department of Entomology, Dr. PDKV, Akola during kharif2009 and leaves were used as feed of *S. litura*.

Bioassay method

The leaf dip method suggested by Ahmed *et al*. (1995)was used for bioassay. Leaf disc of 5 cm diameter of tender castor leaves were cut and dipped in required concentration of pesticides for 10 seconds with gentle agitation and allow to air dry and placed on filter paper. Ten larvae of *S.litura*were released in each petridish. Thirty larvae were used for each treatment. There are total eight treatments and each treatment was replicated thrice. Castor leaves dipped in distilled water fed to *S.litura*treated as control.

Statistical analysis

The per cent mortality data in each treatment was recorded. The mortality percentage were then corrected by using abbott's formula (Abbott, 1925) for adjusting the natural mortality observed in control and then data were subjected to statistical analysis.

$$\text{Corrected mortality Percentage} = \frac{T - C}{100 - C} \times 100$$

Where, T = Observed mortality in treatment

C = Observed mortality in Control

RESULTS AND DISCUSSION

Efficacy of biopesticides against 5th instar larvae of *S. litura*

At 1st day after treatment

The data presented in Table 2 revealed that the result at 1st day after treatment was non- significantly different between the treatments. But, numerically SLNPV + NSKE 5% recorded highest mortality.

At 3rd day after treatment

The treatment SLNPV + NSKE 5% was significantly superior over all the treatments recorded 24.07 per cent mortality followed by SLNPV (17.04%) and *B. bassiana* + NSKE 5% (10.00%). The next effective treatments were Bt + NSKE 5% and Bt recorded 6.67 per cent mortality each and proved equally effective.(Table 2)

At 5th day after treatment

The data presented in Table 2 revealed that the per cent mortality in 5th instar at 5th day after treatment was relatively increased as the time of exposure was increased. All the treatments were significantly superior over control. SLNPV + NSKE 5% was most effective treatment(61.85%) followed by SlNPV(58.52%) and *B. bassiana* + NSKE 5% (54.81%) .the next effective treatment were Bt + NSKE 5% , Bt and NSKE 5% recorded 37.78, 27.41 and 24.07 per cent mortality, respectively.

At 7th day after treatment

The data presented in Table 2 revealed that the per cent mortality at 7th day after treatment was highest. All the treatment were statistically superior over control. The treatment SLNPV + NSKE 5%was significantly superior over all the treatment recorded 64.08 per cent larval mortality followed by SLNPV, *B. bassiana* + NSKE 5%, Bt + NSKE 5% , Bt and NSKE 5% recorded 60.37, 57.04, 42.96, 35.55 and 24.81 per cent mortality respectively.

The similar results were also reported by Vimala Devi *et al*. (1996). Narasimhamurthy *et al*.(2012) evaluated efficacy of SLNPV with NSKE 5% against *Spodopteralitura*and found that highest per cent mortality of larvae of *S litura* was recorded in SLNPV + NSKE 5 %(81.66 %) followed by SLNPV + Neem oil 0.1%. The addition of NSKE 5% followed by NSKE 5% with SLNPV showed additive effect in reduction of larval population of *S. litura*. Azadirachtin and its content has antifeedant activity affected the feeding inhibitory activity of *S. litura*(Roy and Saraf, 2006)The*Bt* recorded 40.00 per cent mortality. These results are in corroboration with findings of Zaz and Kushwaha (1993) reported 32.5 per cent mortality in 6th instar larvae of *S. litura*.

Pupal deformity in survivals of 5th instar *S litura*

The data regarding per cent pupal deformity in survivals of 5th instar given (Table 3) revealed that the treatment SINPV + NSKE 5% was recorded highest (80%) pupal deformity followed by SINPV(72.72%), *B. bassiana* + NSKE 5%(66.67%), *Bt* + NSKE 5%(62.50%), *Bt*(55.56%) and NSKE 5% (52.38 %). *B. bassiana* recorded comparatively minimum pupal deformity of 47.83 per cent.

The data regarding pupal weight (Table 3) revealed that treatment SINPV + NSKE 5% recorded minimum pupal weight of 0.27 g. Deviprasad*et al*. (1990) who reported that botanicals in combination with NPV were effective against larvae and pupae of tobacco leaf eating caterpillar.Basavaraju *et al*.(2010) recorded that NSKE 5% in combination with SLNPV could achieve effective control of *S. litura* in potato . The treatment *B. bassiana* + NSKE 5% recorded 66.67 per cent pupal deformity. This finding is in agreement with the finding of

Table 1: Details of biopesticides

S.N.	Common name	Trade Name	Formulation	Dose of application
1	*B. bassiana*	-	2.00×10^8	@ 4 g / litre.
2	SINPV	Magic	0.5×10^9	@ 0.5 ml / litre
3	NSKE	-	5%	@ 50 g / litre
4	*Bt*	Dipel 8L	3.5% w/w	@ 2 ml / litre
5	*B. bassiana* + NSKE 5%	-	-	@ 4 g / litre. + 50 g / litre
6	SINPV + NSKE 5%	-	-	@ 0.5 ml / litre + 50 g / litre
7	*Bt* + NSKE 5%	-	-	@ 2 ml / litre + 50 g / litre
8	Control	Distilled Water	-	

Table 2: Per cent mortality in 5th instar larvae of *S.litura*due to biopesticides

Treatment	Per cent mortality			
	*1st DAT	**3rd DAT	**5th DAT	**7th DAT
T_1	0.00(0.71)	0.00(0.71)	17.04(24.20)	17.78(24.72)
T_2	0.00(0.71)	17.04(4.16)	58.52(49.91)	60.37(51.06)
T_3	0.00(0.71)	3.33(1.55)	24.07(29.30)	24.81(29.82)
T_4	0.00(0.71)	6.67(2.40)	27.41(31.51)	35.55(36.58)
T_5	0.00(0.71)	10.00(2.83)	54.81(47.78)	57.04(49.05)
T_6	3.33(1.55)	24.07(4.94)	61.85(51.92)	64.08(53.24)
T_7	0.00(0.71)	6.67(2.40)	37.78(37.91)	42.96(40.95)
T_8	3.33(1.55)	3.33(1.55)	3.33(6.15)	6.67(12.29)
'F' Test	NS	Sig.	Sig.	Sig.
SE(m)±	0.60	1.04	4.13	4.06
CD at 1 %	-	3.04	12.06	11.86

The figures in parentheses are √* x + 0.5, ** arc sine transformed values

Table 3: Deformity and fecundity in survivals of 5th instar

Treatment		No. of larvae treated	No. of larvae dead	Per cent mortality	Larval weight (g)	No. of Pupa formed	Pupal weight (g)	No. Of pupa deformed	Per cent pupal deformity	No. Of Adult emerged	No. Of Adult deformed	Per cent adult deformity	Fecun-dity
T_1	*-B. bassiana*	30	7	23.33	0.630	23	0.44	11	47.83	14	8	57.14	690±25
T_2	-SlNPV	30	19	63.33	0.627	11	0.39	8	72.72	9	7	77.78	650±25
T_3	-NSKE 5%	30	9	30.00	0.625	21	0.37	11	52.38	13	8	61.54	450±25
T_4	*-Bt*	30	12	40.00	0.627	18	0.40	10	55.56	13	9	69.23	670±25
T_5	*-B. bassiana* + NSKE 5%	30	18	60.00	0.632	12	0.30	8	66.67	11	8	72.72	360±25
T_6	-SlNPV + NSKE 5%	30	20	66.67	0.631	10	0.27	8	80.00	7	6	85.71	206±25
T_7	*-Bt* + NSKE 5%	30	14	46.67	0.629	16	0.35	10	62.5	10	7	70.00	390±25
T_8	-Control	30	2	6.67	0.632	28	0.50	3	10.71	26	3	11.54	1080±25

Gopalkrishnan and Narayanana (1990) reported that *B. bassiana* (Bals) Vuillemin was pathogenic to all stages of *Helionthisarmigera* (Hubner), 60 per cent pupal mortality at 1.0 x 10^9 conidia/ml and 80 per cent mortality was observed in pre pupae and adults at 1.0 x 10^{10} conidia/ml.Kaur *et al*.(2011) tested virulence of *B. bassiana* against development and reproductive potential of second, third and fourth instar larvae of *S. litura* reported significant decrease in larval period as compared to control. It also induced pupal and adult deformities dominantly.

The treatment *Bt* + NSKE recorded 62.5 per cent pupal deformity and 0.35 g pupal weight. This result is in line with the result of Rajesh Babu *et al*. (2007) who reported that *Bt* 0.2% + Neem oil 5% was found significantly superior by recording highest larval and pupal weight reduction of 30.0 and 31.0 per cent respectively. The treatment *Bt* was recorded 55.56 per cent pupal deformity with 0.40 g pupal weight. These results were in corroboration with findings of Zhong Yong *et al*. (2009) who reported effect of insecticidal protein from *Bacillus thuringiensis* on growth of larvae *i.e*. delay in larval duration, pupal duration, reduction in pupal weight of *S. exigua* in laboratory. NSKE 5% recorded 52.38 per cent pupal deformity with 0.37 g pupal weight. This finding is in confirmation with the finding of Morale *et al*. (2000),Patil and Chavan,(2010) who reported that Neem seed kernel extract 5% significantly affected the larval period, larval mortality and fecundity caused malformation of pupae.

Adult deformity in survivals of 5th instar *S litura*

The data in respect of per cent adult deformity in survivals of 5th instar given (Table 3) revealed that SINPV + NSKE 5% was recorded highest (85.71%) adult deformity followed by SINPV, *B. bassiana* + NSKE 5% and *Bt* + NSKE 5% recorded 77.78, 72.72 and 70.00 per cent, respectively. The *B. bassiana* recorded comparatively less (57.14%) adult deformity. These findings are in corroboration with findings of Murugan *et al*. (1999) who reported that combination of NPV + Neem shows best effect on adult longevity and fecundity.

The *Bt* recorded 69.23 per cent adult deformity. This finding is in line with the finding of Jayanthi and Padmavathama (1997) who reported that higher concentrations of *Bt* were associated with reduced pupation, high pupal mortality, low percentage emergence of normal adults for all instar.

Fecundity in survivals of 5th instar *S litura*

The data regarding fecundity of survivals of 5th instar (Table 3) revealed that SINPV + NSKE 5% recorded lowest (206 eggs/ female) fecundity followed by *B. bassiana* + NSKE 5% and *Bt* + NSKE 5% recorded 360, 390 eggs/female respectively. This finding is in confirmation with finding of Santharam and Jayaraj (1989) who reported that eggs and larval mortality was occurred in 5th instar of *S. litura* due to application of NPV @ 5 x 10^6 PIBs/ml.

In present investigation treatment of NSKE 5% recorded 450 eggs/female. This result is in corroboration with finding of Morale *et al*. (2000) who reported that NSKE 5% significantly affect the larval period, larval mortality and fecundity of larvae of *H. armigera*. The same results were also reported by Murugan *et al*. (1999) that NSKE significantly reduced oviposition period, adult longevity and fecundity in *Spodopteralitura* which are in line with present findings.

The treatment SINPV + NSKE 5% was found to be most effective in recording highest per cent pupal and adult deformity with minimum fecundity in survivals of 5th instar of *S. litura*. The treatments in combination with NSKE 5% found effective in recording highest per cent of pupal and adult

deformity. The treatments in combination with NSKE 5% found effective in recording lowest fecundity than its sole application.

REFERENCES

Abbott, W. S. 1925. A method of computing the effectivness of an insecticide. *J. Economic Entomology*. **18:** 265-267.

Ahmed, M. A. ,Sayyed, H., Ahmad, M. and Saleem, M. A. 1995. Evidence of resistance to new chemistry insecticides in *Spodopteralitura*. *Indian J. Plant Prot*.**23:** 152-155.

Basavaraju, B. S., Shashank, P. R., Doddbasppa, B., Vijaykumar, L. and Chakravarthy, A. K. 2010 Efficacy of poison baits and biopesticides against *Spodopteralitura*Fab. (Lepidoptera: Noctuidae) in potato; *pest Management in horticultural Ecosystem*. **6(1):** 61-68 (2010)

Chauhan, M. S., Shukla, J. P., Pandey, U. K. and Bhadauria, S. 2013 Efficacy of some plant products as repellent to control *Helicoverpaarmigera* (Hubner) (Lepidoptera: Noctuidae) feed on tomato. *International J. Research in Botany* .pp. 37-43.

Deviprasad, V., Kayaraj, S., Rabindra, R. J. and Reddy, G. P. V. 1990. Studies on interaction of certain botanicals and NPV against tobacco caterpillar, *S. litura*. Proc. Symp. Botanical Pesticides in IPM, Rajamundary, pp. 190-196.

Dubey, N. K., Shukla, R., Kumar, A. Singh, P and Prakash, R 2011: Global Scenario on the application of natural products in Integrated pest management programmes In: Natural products in plant pest management (N K Dubey, eds) India. PP. 1-20

Fletcher, T. B. 1919. Annotated list of Indian Crop pest. Proc. 3rdEnt. Meet. Pusa pp. 67-68.

Gopalkrishnan, C. and Narayanan,K. 1990. Studies on the dose-mortality relationship between the entomofungal pathogen. *Beauveriabassiana* (Bals.) vuillemin and *Heliothisarmigera* (Hubner) (Lepidoptera :Noctuidae). *J. Biol. Control*. **4(2)**: 112-115.

Jayanthi, P. D and Padmavathama, K.1997: Response of tobacco caterpillar *S. litura*(Fab.) to various concentration of Bt sub. Sp. Kurstaki. *Pesti. Res. J*. **19(1):** 20-24.

Kaur, S., Kaur, H. P., Kaur, K and Kaur, A. 2011 Effect of different concentration of *Beauveria bassiana* on development and reproductive potential of *Spodoptera litura* (Fabricius); *J. Biopesticieds*. **4(2):** 161-168 (2011)

Morale, R. S., Sarnaik, D. N., Satpute,U. S., Sadawarte,A. K. 2000. Effect of plant product on growth and development of *Helicoverpaarmigera* (Hubner) on cotton. *Pestology*.**24(1):** 26-28.

Murli Krishna., Devaki, K., Rajareddy,K. and Venkaeswarlu, U. 2008. Efficacy of certain new insecticide molecules against groundnut defoliator, *S. litura* (Fab.) (Noctuidae: Lepidoptera). *Current Biotica*.**2(2):** 173-180.

Murugan, K. 1999. Potentiating effect of neem on nucleopolyhedrosis virus treatment of *Spodopteralitura*(Fab.)*Insect Sci. Applic*.**19(2/3):** 229-235.

Narasimhamurthy,G. M.,Simon Sobita, Anandhi, Chandra shekara raiah. 2012. Studies on efficacy of SLNPV with plant extracts in the management of *Spodopteralitura* (Fabricius) on cabbage. *Vegetable Science*. **39(2):**173-176

Patil, D. S. and Chavan, N. S. 2010 Repellency and toxicity of some boanicals against *Spodopteralitura* (Fabricius) on *Glycine max* (Linn) soybean. *The Bioscan*.**5(4):** 653-654.

Rabri P. H., Dodia,D. A., Davada,A. Y. and Patel, P. S. 2016: Field efficacy of newer insecticides molecules against *Spodopteralitura*Fabricius on cabbage .*The Bioscan*.**11(1):** 173-175.

Rajesh Babu., Krishnaya,G.,Rao,P. V., and Rao,S. V. 2007. Effect of combination of *Bt* and neem on tobacco leaf eating *J. Ent. Res*. **31(2) :** 141-145.

Roy, A .and Saraf,S. 2006 Liimonoids: Overview of significant bioactive triterpenes distributed in plant kingdom. Biol. Pharm. Bull. 29, pp.191-201.

Santharam, G. and Jayaraj,S. 1989. Studies on transmission of NPV of *S. litura* (Fab.) to its progenies. *J. Biol. Control*. **3(1):** 40-49.

Shivayogeshwar, A. B., Mallikharjunaiah, H. and Krishnaprasad, N. K 1991. Integrated Management of *Spodopteralitura*Fabricius (Noctuidae: Lepidoptera) in FCV tobacco crop. Tobacco Research, **17(8):** 59-61.

Vimala Devi, P. S., Prasad,V. G. and Rajeshwari,B. 1996. Effect of *Bacillus thuringiensis* Var. Kurstaki and Neem on castor defoliators. *Achaea janata* (Linnaeus) and *Spodo pteralitura*.*J.Appl.Zool.Res*.**15(1):** 105-111

Yasa, V and Rangarao, G. V. 2011. Relative toxicity of thiodicarb, indoxacarb and spinosad to gram pod borer and tobacco caterpillar: *Pestology Vol*. **34(4):** 77-81

Zaz, G. Mand. Kushwaha, K. S. 1993. Effectiveness of *B. thuringiensis* Berliner against different instar of *S. litura* (Fab.). *Indian J. Entomol*.**55(1):** 62-66.

Zhong-Yong., Chen Gouhua., Lui Xiao Xia., Zhang Qing Wen., Li Jian Cheng. 2009. Effect of insecticidal protein from *Bacillus thuringiensis* on growth and development of *Spodopteraexigua* (Hubner). *J. Yunnan Agricultural University*. 2009. **24(2):** 195-198