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Relative Toxicity of Some Modern Insecticides Against *Spodoptera litura* Fabricius on Castor

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***Abstract* – Investigation on relative toxicity of selected modern insecticides against *S. litura* revealed that emamectin benzoate a semi synthetic derivative of natural product was the most toxic and effective insecticide as its LC_{50} value was 0.0013. On the other hand, novaluron found to be the least toxic in which the LC_{50} value was worked out to the tune of 0.0146.**

***Keywords* – Relative Toxicity, *Spodoptera litura*, Moderninsecticides & Castor.**

I. Introduction

Castor (*Ricinus communis* Linnaeus) is one of the most important oilseeds crop. India is the largest producer of castor seed and oil. It is of great importance for industrial, manures and medicinal use. Apart from fulfilling the internal demand of oil for various industries in recent years, it has played an important role in earning substantial foreign exchange through export of castor oil. The castor oil finds diversified application in industries and hence, there is a great demand in industrially developed countries. It is used in production of paints and varnishes, lacquers, sulfonated oils, artificial leathers, lubricants and greases, hydraulic fluids, cosmetics, soaps, printing ink and linoleum. It also serves as a raw material of various important chemical such as sebacic acid and for the manufacture of nylon. Further, its cake is excellent manure containing 4.5 per cent nitrogen, 2.6 per cent phosphoric acid and 1.0 per cent potash. The castor hulls are used as manure after decomposition and its stalks are useful in manufacturing paper, cardboard and also widely used as a fuel and building huts.

Castor is one of the important cash crop which can be grown under varying soil types and erratic nature of monsoon due to its drought tolerance habit. The crop is cultivated in about 30 countries including India. India is the largest producer of castor seed and oil, which account for 5 per cent area and 64 per cent production in the world (Damodaran and Hegde, 2002).

In India the castor is cultivated in the states of Gujarat, Andhra Pradesh, Tamilnadu, Karnataka and Orissa accounting for about 90% of the area and production. It is cultivated in an area of 8.52 lakh hectare with a production of 10.2 lakh ton of castor seed with productivity being 1331 kg/ha during 2008-09 in India. Gujarat ranked the first in area and production with 4.03 lakh hectare producing about 8.5 lakh ton of castor seed annually along with an average productivity of 1972 kg per hectare (Anonymous, 2009).

Among the various pests attacking the crop, castor leaf eating caterpillar, *S. litura*, commonly known as tobacco caterpillar, a polyphagous pest is occurring in the entire castor growing countries in Asia, Australia and the Pacific basin (Feakin, 1973) and causes extensive damage W to the crop at its initial stage. Its outbreaks also occur in Saurashtra region of the Gujarat State. Earlier, the pest was referred with different scientific synonymous viz., *Noctua litura* Mmssn, *Prodenia reline* Frans and *Prodenia litura* Fabricius (Anonymous, 1986b; Lefroy, 1908).

The loss caused by *S. litura* in different castor cultivars has been estimated to the tune of 12.0 to 23.50 per cent under Junagadh condition (Anonymous, 1986a).

As *S. litura* is one of the important pests and causes considerable damage to the crop, blanket use of insecticides have recommended for the effective and economic control of the pest in castor. The judicious application of insecticides created many adverse effects resulting in to environmental pollution and health hazards and development of resistance in *S. litura* to several insecticides.

II. Materials and Methods

Commercial formulations of Chloranthranilide (Coragen, 18.5SC, M/s Dupont India Limited), Flubendiamide (Fame, 39.35SC, M/s Bayer Crop Science Limited), Spinosad (Tracer, 45SC, M/s Dow Agro Sciences), Novaluron (Rimon, 10EC, M/s Indofil Chemicals Company), Chlorpyriphos (Durnet, 20EC, BASF India Limited), Emamectin benzoate (Em-1, 5W SG, M/s Northern Minerals Limited) were obtained from the respective firms. *S. litura* egg masses and larvae were collected from Castor plants located at Instructional Farm, College of Agriculture, Junagadh. Insects were reared on fresh groundnut leaves in B.O.D. incubator maintained 27 ± 2ºC 78 ± 2% R.H. Six graded concentration of each insecticide (*viz.*, Chloranthranilide, Flubendiamide, Spinosad, Novaluron, Chlorpyriphos, Emamectin benzoate) was prepared from formulated insecticides for bioassay studies in the laboratory against larvae of *S. litura*. One ml of each concentration was sprayed by using Potter's spraying tower in petridish and the same was replicated four time. After drying at room temperature, 10 larvae of *S. litura*, which are six day old, were released in each petridish. An exposure period of one hour was given and then these larvae were transferred in jars containing food. The mortality count was made after 24 hr of feeding. These data were subjected to probit analysis (Finney, 1971) for calculation of LC_{50} values, so as to find relative toxicity of them taking standard insecticide as unit (Jotwani *et al.*, 1971).

$$\text{Toxicity ratio} = \frac{LC_{50} \text{ of standard insecticide}}{LC_{52} \text{ of candidate insecticide}}$$

III. Results and Discussion

In this study, the relative toxicity of six different insecticides was worked out and compared by using the LC_{50} of Chlorpyriphos as unity, because this insecticide is recommended for the control of *S. litura*.

Result (Table. 1 & Fig. 1) revealed that Emamectin benzoate was the most toxic and effective insecticides (LC_{50} = 0.0013) for this pest. This insecticide was 2.3846 times more toxic than Chlorpyriphos. However, Flubendiamide was slightly more toxic than Chlorpyriphos, as it was 1.06 time toxic than chlorpyriphos. On the other hand, Novaluron found to be least toxic in which the LC_{50} value was worked out to the tune of 0.0146.

Considering the LC_{50} value of different insecticides under test, they can be ranked in descending order as under:

Emamectin benzoate > Flubendiamide > Chlorpyriphos > Chloranthranilide > Spinosad > Novaluron.

The effectiveness of each insecticide in comparison to Chlorpyriphos was also assessed. The results revealed that Emamectin benzoate and Flubendiamide were 2.3846 and 1.0689 times more toxic than Chlorpyriphos, respectively. Whereas Chloranthranilide, Spinosad and Novaluron were 0.775, 0.2821 and 0.2123 times less toxic than Chlorpyriphos, respectively.

The observation obtained in present investigation are in close agreement with the results reported by Gupta *et al.* (2004); Dhawan *et al.* (2007); Prasad *et al.* (2007); Firake and Rachna (2009); Ghosh *et al.* (2008) and Shankarganesh *et al.* (2009).

IV. Summary & Conclusion

Relative toxicity of some modern insecticides against *S. litura* on castor was conducted under laboratory condition to determine the LC_{50}. The results of relative toxicity of some modern insecticides showed that emamectin benzoate was the most toxic and effective insecticide as its LC_{50} value was 0.0013 per cent. This insecticide was 2.38 time more toxic than Flubendiamide. Chlorpyriphos was slightly less toxic than emamectin benzoate with LC_{50} 0.0031, followed by chloranthranilide and novaluron with LC_{50} 0.0040 and 0.0146. Spinosad was least toxic with less (0.0110%).

References

[1] Abbott, W. S. (1925). A method of computing the effectiveness of an insecticide. *Journal of Economic Entomology*, 18: 265-267.
[2] Anonymous (1986a). Annual Research Report, Dept of Entomology, Gujarat Agricultural University, Junagadh, pp. 53-55.
[3] Anonymous (1986b). Annual Progress Report of Castor, All-India Coordinated Research Project on Oilseeds, 16-18 June, Gujarat Agricultural University, Dantiwada, p. 5.
[4] Anonymous (2009). Area, production and yield per hectare of castor crops in India. http://www. Karvycomtrade.com/disclaimer.asp
[5] Anonymous (2009). District wise area production and yield per hectare of important food and non food crops in Gujarat state. Directorate of Agriculture, Gujarat state, Gandhinagar.
[6] Atwal, A. S. and Bains, S. S. (1974). Applied Animal Ecology, Kalyani Publishers, Ludhiana, pp. 11-35.
[7] Damodaran, T. and Hegde, D.M. (2002). "Oilseeds Situation: Astatistical compendium", Directorate of Oilseeds Research, Rajendranagar, Hyderabad, Andhra Pradesh.
[8] Dhawan, A. K.; Ashwinder Kaur. and Ravinder Kumar. (2007). Relative toxicity of new insecticides against *Spodoptera litura. Annals of Plant Protection Sciences*, 15: 238-239.
[9] Dhawan, A. K.; Ravinder, S. and Shera, P. S. (2008). Field efficacy of novaluron against tobacco caterpillar, *Spodoptera litura* (Fab.) on Bt cotton. *Pesticide Research Journal*, 20: 75-78.
[10] Dhawan, A. K.; Sarika, S.; Bharathi, M. and Kamaldeep, S. (2007). Susceptibility of *Spodoptera litura* to some novel insecticides. *Pesticide Research Journal*, 19: 169-171.
[11] Feakin, S. D. (1973). Pest control in groundnut. PANS Manual, NO.2 *Centre for overseas pest research*, London, U.K, pp. 197.
[12] Finney, D. J. (1971). *Probit analysis*, Cambridge University Press, Cambridge. pp. 333.
[13] Firake, D. M. and Rachna, P. (2009). Relative toxicity of proclaim 5% SG (Emamectin benzoate) and Dipel 8L (*Bacillus thuringiensis* var. kurustaki) against *Spodoptera litura* Fabricius. by leaf roll method. *Current Biotica*, 3(3): 445-449.
[14] Gupta, G. P.; Seema, R.; Ajanta, B. and Raghuram, M. (2004). Relative toxicity of certain newer insecticides against *Spodoptera litura* Fabricius. *Pesticide Research Journal*, 16(1): 45-47.
[15] Jotwani, M. G.; Raj, B. K. and Pradhan, S. (1971). Bioassay of comparative toxicity of some insecticides to the larvae of *Prodenia litura* F. (Noctuidae: Lepidotera). *Indian Journal of Entomology*, 28(1): 50-53.
[16] Lan, Y. and Zaho, S. (2003). Toxicity of insecticides to *Spodoptera exigua* Hubner. *Journal of Fujian Agricultural and Forestry University*, 32(3): 301-304.
[17] Prasad, K. D.; Madhumathi, T.; Rao, P. A. and Rao, V. S. (2007). Toxicity of insecticides to resistant strain of *Spodoptera litura* (Fab.) on cotton. *Annals of Plant Protection Sciences*, 15 (1): 77-82.
[18] Rao, D. M.; Ahmed, K. and Rao, T. S. R. (1983). Relative efficacy of different insecticides on the control of major pests of coriander. *Indian Cocoa, Arecanut & Spices Journal*, 7(1): 15-16.
[19] Shankarganesh, K.; Swaran Dhingra and Rao, G. R. (2007). Relative toxicity of some synthetic insecticides against different populations of *Spodoptera litura* (Fabricius). *Pesticide Research Journal*, 19(2): 172-175.
[20] Talikoti, L. S.; Sridevi, D. and Ratnasudhakar, T. (2009). Relative toxicity of selected novel insecticides against tobacco caterpillar, S. litura. Indian Journal of Plant Protection, 37(1/2): 183-185.
[21] Varley, G. C. and Gradewell, G. R. (1963). The interpolation of insect population changes. Indian Journal of Agricultural Sciences, 49: 560-566.

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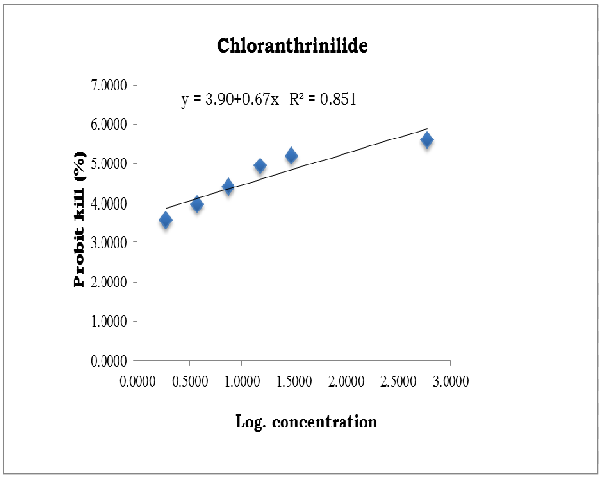
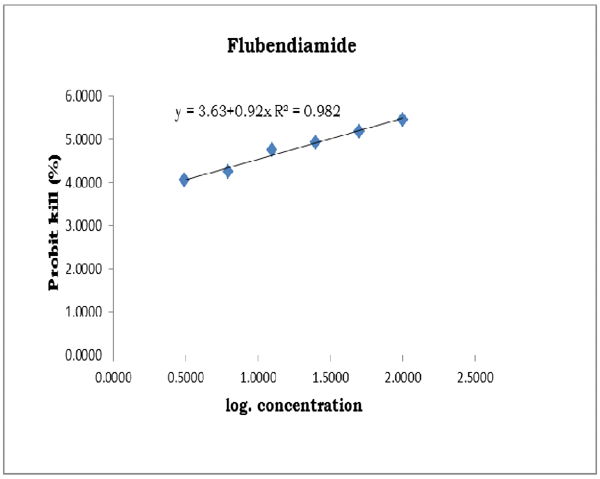
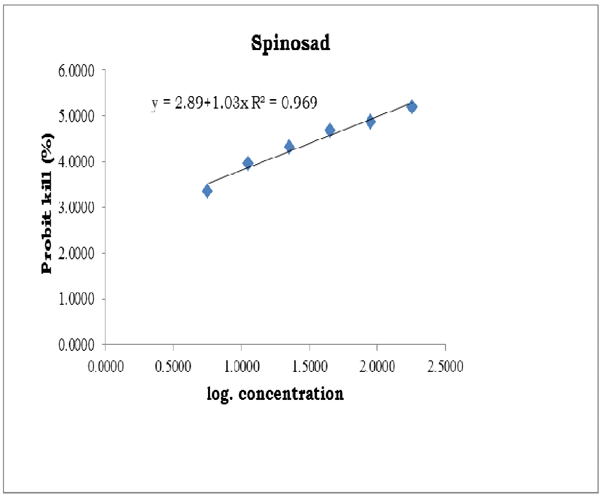
Table 1. Relative toxicity of some modern insecticides against *S. litura* under laboratory condition

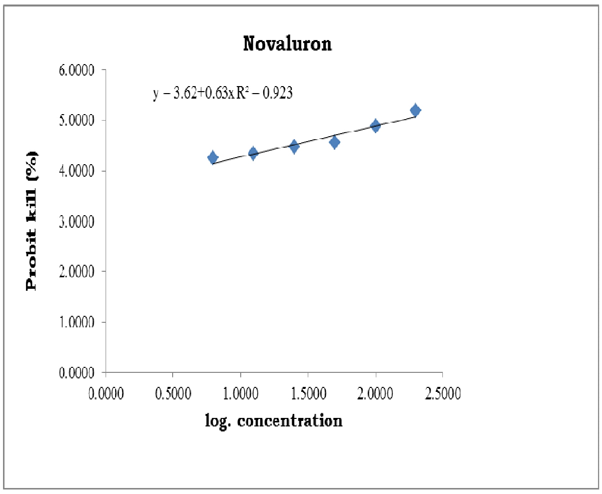
Sr. No.	Insecticides	Heterogeneity		Regression equation	LC_{50}	Fiducial limits	Relative toxicity
		χ^2	b ± SE				
1	Chloranthranilide	1.6063	0.6778 ±0.2600	y = 3.90+0.67x	0.0040	+0.016 -0.0000099	0.77
2	Flubendiamide	0.1820	0.9253 ± 0.3953	y= 3.63+0.92x	0.0029	+0.0077 -0.0000087	1.06
3	Spinosad	0.1058	1.0307 ±0.4901	y= 2.89+1.03x	0.0110	+0.0350 -0.0000028	0.28
4	Novaluron	0.2324	0.6349 ± 0.3778	y = 3.62+0.63x	0.0146	+0.1077 -0.00000501	0.21
5	Chlorpyriphos	2.3984	1.0511 ± 0.3016	y = 3.41+1.05x	0.0031	+0.0090 -0.0000088	1.00
6	Emamectin benzoate	0.0768	1.4230 ± 0.4206	y = 3.39+1.42x	0.0013	+0.0025 -0.0000140	2.38

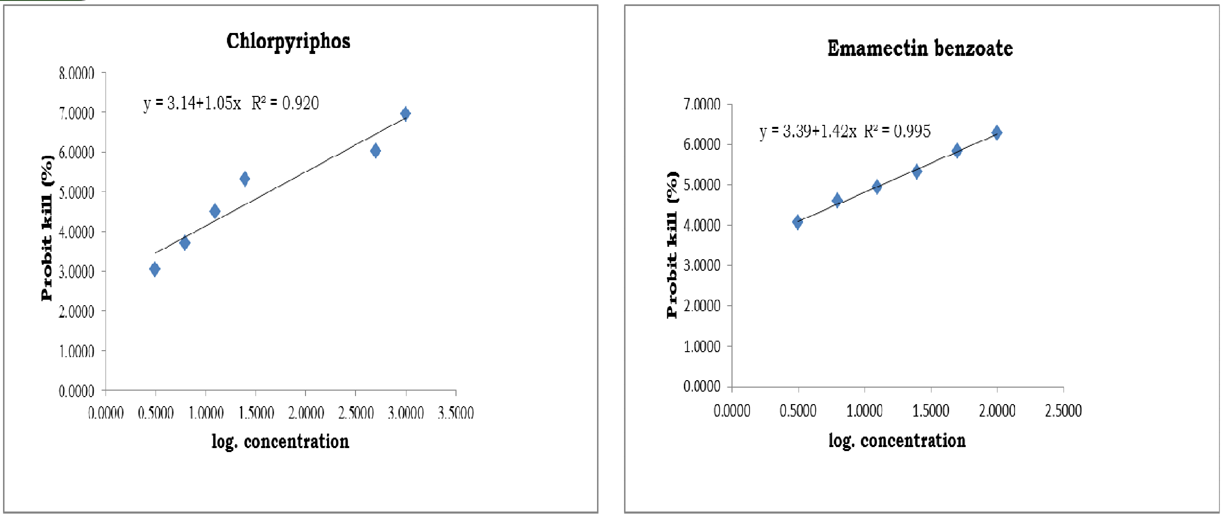
Y= Probit kill b= Regression Co-efficient
x= log concentration χ^2 = Calculated χ^2 value
LC_{50} = Concentration calculated to give 50 per cent mortality











Observed values - Predicted values

Fig. 1. Dosage response curve for different insecticides