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Comparative relative toxicity of some modern insecticides against *Spodoptera litura* fabricius on groundnut

■ NAVEEN KUMAR NUKALA* AND M.F. ACHARYA

Departmment of Entomology, Junagadh Agricultural University, JUNAGADH, (GUJARAT) INDIA

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***Corresponding author:**
Email: nukalanaveen4u@gmail.com

ABSTRACT

Investigation on comparative relative toxicity of some modern insecticides against *S. litura* revealed that emamectin benzoate was the most toxic and effective insecticide as its LC_{50} value was 0.000954. Notably, emamectin benzoate proved very effective in laboratory, as evident from its low LC_{50} values against *S. litura*. As emamectin benzoate is a novel semi-synthetic derivative of the natural product was found to be most toxic. On the other hand, spinosad found to be the least toxic in which the LC_{50} value was worked out to the tune of 0.0158.

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INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a leguminous oilseed crop, grown as monoculture in Saurashtra region of Gujarat and contributes around 88 per cent of total production of groundnut in Gujarat State. Among the various insect pests attacking this crop, leaf eating caterpillar, *S. litura* (Fab.) commonly known as tobacco caterpillar, causes extensive damage and it is found to be serious on groundnut crop (Ali, 1992; Singh and Nath, 1998 and Sitaramaih *et al.*,2001). If not controlled timely, the pest may completely devour the leaves of infested plant resulting in huge crop losses. The relative toxicity was used to measure the potency of different insecticides against *S. litura* on groundnut under laboratory condition. Thus, the values of relative toxicity of modern insecticides with diversified modes of action can be looked upon as a ready reckoner and would form the basis for the selection of insecticides as one of the components of pest management tactics. Also, such baseline data would provide a record for detecting resistance level of *S. litura*, if any, to the various insecticides at different periods.

MATERIAL 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 groundnut 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* (Munir and Saleem, 2004). 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; Jadhav *et al.*, 2006 and Jagtap *et al.*, 2007) for calculation of LC_{50} values, so as to find relative toxicity of them taking standard insecticide as unit (Jotwani *et al*., 1971; Lan and Zaho, 2003).

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

RESULTS AND DISCUSSION

Results (Table 1 and Fig. 1) revealed that emamectin benzoate was the most toxic and effective insecticide (LC_{50} = 0.000954) for this insect. This insecticide was 2.94 time more toxic than chlorpyriphos. Flubendiamide was slightly toxic

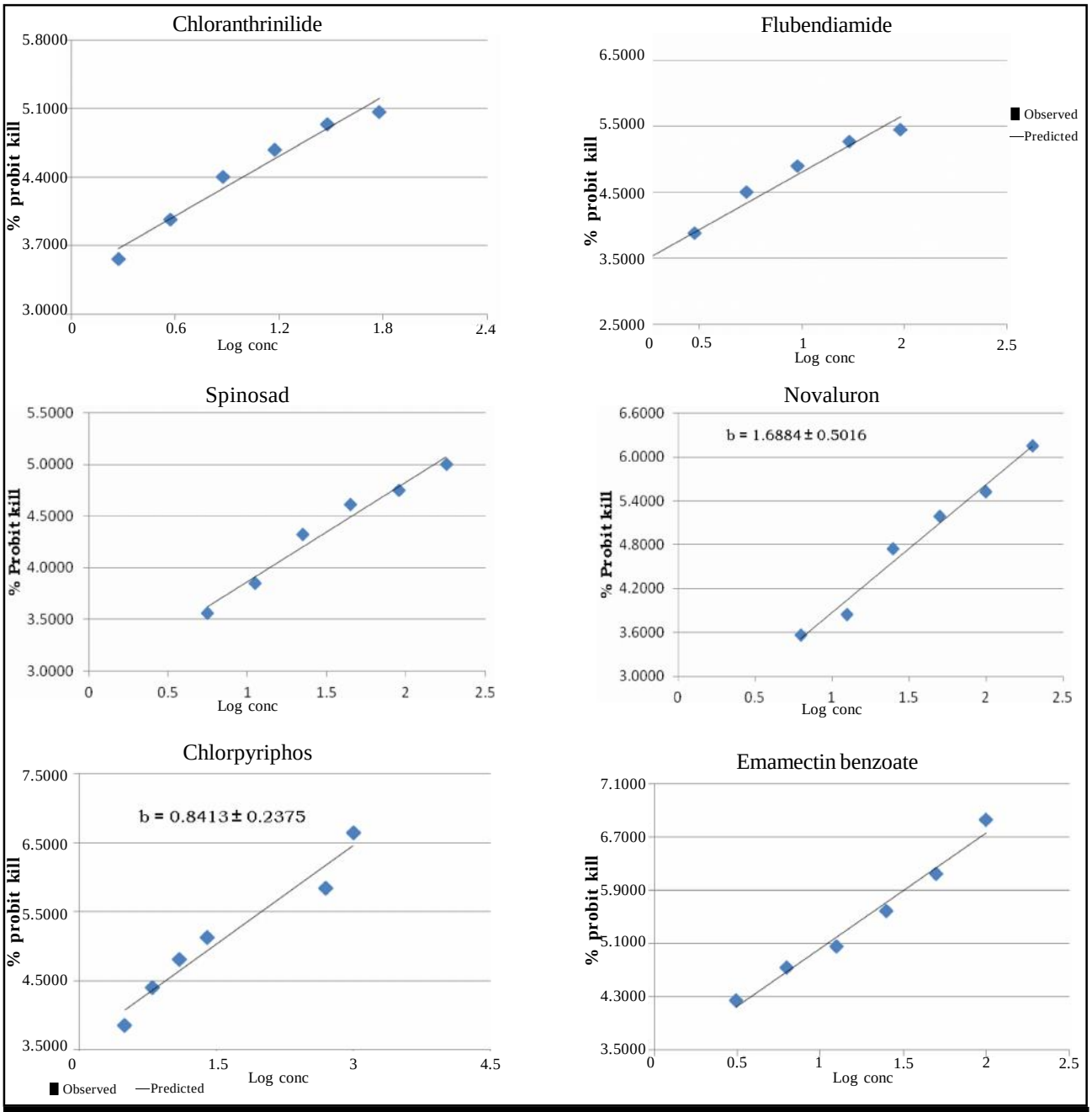

Fig. 1 : Dosage response curve for different insecticides

Table 1 : Comparative relative toxicity of some modern insecticides against S. litura under laboratory condition

Sr. No.	Insecticides	Heterogeneity $\chi 2$	b±S.E.	Regression equation	LC_{50}	Fiducial limits	Relative toxicity
1.	Chloranthranilide	0.1999	0.9253 ± 0.4645	Y = 3.51+0.92x	0.00407	0.01513-0.000009	0.69
2.	Flubendiamide	0.6015	1.1401±0.4851	Y= 3.27+1.14x	0.00323	0.00724-0.0000069	0.86
3.	Spinosad	0.1553	0.8969±0.4756	Y= 3.04+0.89x	0.0158	0.077-0.0000031	0.17
4.	Novaluron	0.3135	1.6884±0.5016	Y = 2.24+1.69x	0.00429	0.00758-0.0000041	0.65
5.	Chlorpyriphos	0.709	0.8413±0.2375	Y = 3.78+0.84x	0.00281	0.00831-0.00001	1
6.	Emamectin benzoate	0.3759	1.6569±0.4732	Y = 3.36+1.65x	0.000954	0.00162-0.0000186	2.94

Y= Probit kill; b= Regression Co-efficient; x=log (Concentration × 10^4); χ^2 = Represented calculated χ^2 values; LC_{50} = Concentration calculated to give 50 per cent mortality

than emamectin benzoate (LC_{50} = 0.00323), followed by chloranthranilide (LC_{50} = 0.00407) and novaluron (LC_{50} = 0.00429). On the other hand, spinosad found to be the least toxic in which the LC_{50} value was worked out to the tune of 0.0158 per cent. Similar results were also obtained by Krishna *et al.*, 2008; Prasanna and Manjula, 2014 on groundnut, Kumar *et al.*, 2001 on chilli, Rathod *et al.*, 2014 on pigeonpea; Mohapatra and Sahu, 2005 on cotton and Rao *et al.*, 2006 on fenugreek.

Notably, emamectin benzoate, a novel semi-synthetic derivative of the natural product proved very effective in laboratory, as evident from its low LC_{50} values against *S. litura*. Gupta *et al.* (2004) reported that emamectin benzoate was the most toxic compound with relative toxicity 6.93 when compared to standard insecticide. Dhawan *et al.* (2007) reported that emamectin benzoate was most toxic compound with relative toxicity 390.0 when compared to standard insecticide, followed by novaluron and flubendiamide with relative toxicity 19.5 and 9.8, respectively. Prasad *et al.* (2007) reported that emamectin benzoate was most toxic compound followed by novaluron and spinosad exhibited poor toxicity against this pest. Firake and Rachna (2009) reported that emamectin benzoate was most toxic compound against *S. litura* with relative toxicity 60.29 when compared to standard insecticide like endosulfan. Shankarganesh *et al.* (2007 and 2009) and Satyanarayana *et al.* (2010) also reported that emamectin benzoate was 2.87 fold toxic to *S. litura* when compared with standard insecticide. More or less similar results were also reported by Reddy *et al.*, 2004 on sunflower; Rojas *et al.*, 2000 on maize and Singh *et al.*, 1990.

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

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

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