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Antifeedant activity of cow-based organic products against *Spodoptera litura* (Fab.) (Lepidoptera: Noctuidae)

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Abstract
Injudicious application of synthetic pesticides for the management of lepidopteran pests like *Spodoptera litura* (Fab.) led to the development of physiological resistance to several classes of insecticides, predominantly against organophosphates and carbamates. In the present study, five woe-based organic products, cow urine, *Panchagavya, Darekastra, Agneystra,* and *Dashaparni* were critically evaluated for their antifeedant activity at the different concentrations against 3rd instar larvae of *S. litura* under laboratory conditions. The maximum antifeedant activity of 60.68 percent was recorded by *Darekastra,* followed by *Panchagavya* with 51.67 percent antifeedant activity (both at 100.00%). The study clearly indicates that all the cow-based test products have variable antifeedant or feeding deterrent properties and could be potentially used for the deterrence of peak pest activity.

Keywords: *Spodoptera litura*, cow-based organic products, antifeedant activity

Introduction

Spodoptera litura (Fab.) (Lepidoptera: Noctuidae), is one of the major polyphagous pests renowned as a tobacco cutworm, cluster caterpillar, cotton leafworm, and tropical armyworm originating from India, China, and Japan (Kandagal and Khetagoudar, 2013) [7] and gregariously feed on nearly 300 different plant species that are members of 99 crop families (Wu *et al*., 2004) [15]. In India, the said pest consumes and undergoes a complete life cycle on more than 40 major plant species, including vegetables, pulses, and cereals. The genus Spodoptera currently has more than 30 species that are found primarily in warm, humid, and moist climates. Of them, nearly 15 species are regarded as economically essential, feeding on major agricultural crops (Zenker *et al*., 2007) [16].

In India, the pest is vastly reported from almost all the agriculturally predominant states and causes considerable economical damage to a wide number of crops including field crops (Dhir *et al*., 1992; Sitaramaiah *et al*., 2001; Bhattacharjee and Ghude, 1985) [6, 11, 3], cash crops (Chari *et al*., 1986) [4], tomato (Patnaik, 1998) [9], soybean and potato (Trivedi, 1988) [13]. There was an outbreak of *S. litura* on major oil seed crops (soybean) in Kota, Rajasthan, and an approximate loss of 300 crores was estimated (Dhaliwal *et al.*, 2010) [5]. The pest also appeared in an epidemic form on soybean in Vidarbha, Maharashtra in 2008 and caused widespread losses of nearly 30.00 to 100.00 percent. In 2005, the outbreak of *S. litura* on sunflower crops in central and southern India devastated the entire sunflower cultivation (Sujatha and Lakshminarayana, 2007) [12].

For the control of various lepidopterous pests, the use of chemicals is more popular among Indian farmers. The sheer number of insecticides being used has caused major concern for pesticide residue on food, environmental contamination, and the destruction of beneficial biocontrol species. Therefore, the identification of potential new safer green insecticides is the ideal method to overcome such consequences. The injudicious use of synthetic pesticides has led to the development of physiological resistance in insects and adverse environmental effects, in addition to high operational costs (Udaiyan *et al*., 2017) [14]. At present, populations of many pests including *S. litura* have developed physiological resistance to many traditional chemical pesticides *viz*., organophosphates and carbamates (Abbas *et al*., 2014, Rabari *et al*., 2016) [1, 10]. In India, *S. litura* manifested physiological resistance to insecticides in crops like soybean, tomato, potato, etc. (Gandhi *et al*., 2016) [8].

At present, there is increasing public awareness about the consequences of chemical pest control and the need for chemical-free food.

In order to overcome the ill effects of insecticides, the alternative is to go for either biocontrol or biotechnology or organic pesticides, or a combination of these. In view of the above points, the present study was planned with a focus on the ovicidal activity of some organic products against *S. litura*.

Materials and Methods

Raising of crop

Tomato seedlings were raised in pots in the screen house. Seedlings of tomato were raised in plug trays filled with a mixture of cocco-peat, perlite, and vermiculite in a ratio of 3:1:1. About four weeks old seedlings were transplanted in the pots in the screen house and leaves were used for maintaining the culture and also for the laboratory studies from time to time.

Raising of culture of *Spodoptera litura* (Fab)

The initial culture (fourth or fifth instar larvae) of *S. litura* was collected from a polyhouse in the university and brought to laboratory. These larvae were reared on tomato leaves in plastic jars (18 x 15 cm) till pupation. The larvae pupated in soil and 2-3 days old pupae were removed, sexed and kept separately in another jar (15 x 13 cm) for adult emergence. The mass rearing was carried out under controlled conditions at 25±1 ^{0}C and 70-80 per cent relative humidity. The emerged adults were sexed on the basis of wing pattern and transferred to glass chimneys for mating. In each chimney, one pair of moths was released and their tops were covered with muslin cloth. A cotton swab soaked in honey solution (15%) was also provided in each chimney as food for the moths in a 60mm x 15mm petri plate. The eggs laid by the moths on muslin cloth/ crumpled paper (placed in the chimney) were collected. The papers and muslin cloth pieces having egg masses were then transferred to plastic jars and used for the laboratory studies.

Antifeedant/Feeding deterrence activity

The deterrence activity of the treatments against *S. litura* was studied using tomato leaves. Leaf was cut and dipped in desired concentration of treatment for 30 seconds. The treated leaf was kept in Petri plate (diameter 90 mm) after shade drying in the laboratory. Ten larvae of *S. litura* were released in each Petri plate. Each treatment was replicated thrice.

Observations on number of punctures made by larvae on leaf were counted after 12 hour of treatment and per cent deterrence was calculated as per formula given here under:

$$\text{Feeding deterrence (\%)} = \frac{\text{No.of punctures in control-No.of punctures in treatment}}{\text{No of punctures in control}} \times 100$$

Results and Discussion

Observations on feeding deterrence of cow-based organic products and were evaluated by exposing 3rd instar larvae of *S. litura* to treated leaf discs for 12 hours. The data on feeding of holes by the larvae were recorded.

Data pertaining to five organic products i.e., cow urine, *Panchagavya, Darekastra, Agneystra* and *Dashaparni* is given in the table no.1. Least feeding deterrence effect in cow urine and Dashaparni were observed at 5 per cent concentration. At this concentration 10, 13.33 and 15.38 per cent, deterrence was found in *Agneystra*, *Panchagavya* and *Darekastra*, respectively. With the increase of test concentration, the deterrence effect increased. At 100.00 per cent concentration, the highest feeding deterrence of 60.68 per cent was recorded by Darekastra at 100.00 per cent concentration, followed by *Panchagavya* with 57.67 per cent. The mean deterrence of different concentrations varied significantly amongst different treatments. Interaction effect (A x B) was also found to be significant in all the treatments.

The study indicates that all the organics has feeding deterrence against *S. litura*. Literature on these aspects in relation to the treatments tried in the present investigation is scanty. Bharathi (2005) [2], found Panchagavya, NSKE and Panchagavya + *V. negundo* to result higher antifeedant properties than the sole application of either NSKE or *V. negundo*.

Table 1: Evaluation of feeding deterrent activity of cow-based organic products against *S. litura* (3rd instar)

Cow-based organics	Per cent feeding deterrence at concentrations						Mean
	5	10	20	40	80	100	
Cow urine	0.00 (0.25)	13.33 (21.40)	15.38 (23.08)	18.75 (25.64)	25.00 (29.98)	41.23 (39.93)	18.94
Panchagavya	13.33 (21.40)	14.28 (22.19)	20.00 (26.55)	30.76 (33.67)	35.71 (36.68)	57.67 (49.34)	28.62
Darekastra	15.38 (23.08)	15.38 (23.08)	20.00 (26.55)	33.33 (35.24)	38.46 (38.71)	60.68 (51.14)	30.53
Agneystra	10.00 (18.42)	12.50 (20.69)	17.64 (24.82)	25.00 (29.98)	29.41 (32.82)	51.49 (45.83)	24.34
Dashaparni	0.00 (0.25)	13.33 (21.40)	15.38 (23.08)	20.00 (26.55)	23.52 (28.99)	47.52 (43.58)	19.95
Mean	7.74	13.76	17.68	25.56	30.41	51.71	

CD (P=0.05)
Treatment (A) = 0.90 Concentration (B) =1.16
A x B = 2.02
Values in parentheses are sine transformed

Conclusion

From the results of present investigation, it is concluded that all the cow-based organic products evaluated are having significant feeding deterrence properties against *S. litura.* Maximum feeding deterrence activity was recorded by *Darekastra*, followed by *Panchagavya* mean while *Dashaparni* and cow urine had the lowest.

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