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Repellant 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 cow-based organic products, cow urine, *Panchagavya, Darekastra, Agneystra,* and *Dashaparni* were critically evaluated for their repellent activity at the different concentrations against 3rd instar larvae of *S. litura* under laboratory conditions. The maximum repellency of 80.00 percent was recorded by *Darekastra,* followed by *Panchagavya* with 76.67 percent antifeedant activity (both at 100.00%). The study clearly indicates that all the cow-based test products have significant repellent 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 leaf worm, and tropical armyworm originating from India, China, and Japan (Kandagal and Khetagoudar, 2013) [6] and gregariously feed on nearly 300 different plant species that are members of 99 crop families (Wu *et al*., 2004) [14]. 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) [15].

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) [5, 10, 2], cash crops (Chari *et al*., 1986) [3], tomato (Patnaik, 1998) [8], soybean and potato (Trivedi, 1988) [12]. 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) [4]. 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) [11].

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) [13]. 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, 9]. In India, *S. litura* manifested physiological resistance to insecticides in crops like soybean, tomato, potato, etc. (Gandhi *et al*., 2016) [7].

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 °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.

Repellant activity

The repellant effect of all the treatments was studied against 3rd instar of *S. litura*. Leaves of tomato were dipped in the desired concentrations of treatments for 30 seconds. Ten larvae were released in each Petri plate provided with filter paper. The leaves in control treated were with distilled. Each treatment was replicated thrice. Data were recorded on the number of larvae repelled within two hours of treatment and per cent repellency was calculated as per the following formula (Zhang *et al* 2015) [16]:

$$\text{Repellency (\%)} = \frac{\text{No.of larvae repelled in treatment-No.of larvae repelled in control}}{\text{No.of larvae repelled in treatment+No.of larvae repelled in control}} \text{X } 100$$

Results and Discussion

The study was taken up with 3rd instar larvae of *S. litura*. The observations were recorded and calculations were done as detailed in the table no. 1. The data recorded on repellency varied from 20.00 to 80.00 per cent, the minimum and maximum corresponding to cow urine at 5.00 per cent and *Darekastra* at 100.00 per cent, respectively. *Darekastra* was found to be showing maximum repellency absent the test insect with 50.00, 58.33, 61.90, 65.21, 68.00 and 80.00 per cent at concentrations 5.00, 10.00, 20.00, 40.00, 80.00 and 100.00 per cent respectively, followed by *Panchagavya* with mean repellency of 60.84 per cent. Cow urine and *Dashaparni* caused least mean repellency of 43.48 and 51.38 per cent, respectively compared to other cow-based organic products.

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

Cow-based organics	Per cent repellancy at concentrations						Mean
	5	**10**	**20**	**40**	**80**	**100**	
Cow urine	20.00 (26.55)	33.33 (35.24)	42.85 (40.87)	50.00 (44.39)	54.74 (47.58)	60.00 (50.74)	43.48
Panchagavya	42.85 (40.87)	52.00 (42.35)	58.33 (49.77)	65.21 (53.83)	70.00 (56.76)	76.67 (61.12)	60.84
Darekastra	50.00 (44.98)	58.33 (45.19)	61.90 (51.86)	65.21 (53.83)	68.00 (55.57)	80.00 (63.43)	63.90
Agneystra	44.44 (41.79)	50.00 (44.98)	52.30 (46.29)	54.50 (47.56)	56.21 (48.54)	70.00 (56.78)	54.57
Dashaparni	33.33 (35.24)	47.36 (43.46)	50.00 (44.98)	52.38 (46.34)	60.00 (50.74)	65.21 (53.83)	51.38
Mean	38.12	48.20	53.07	57.46	61.75		
CD (P=0.05)	Treatment (A) = 1.09 Concentration (B) =1.41 A x B = 2.44						

Values in parentheses are sine transformed

Published information on repellency on organic products against field pests including *S. litura* are scanty

Conclusion

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

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