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Management of *Spodoptera litura* in Organic Cauliflower Cultivation

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ABSTRACT: Despite the advantages as tools for eco friendly pest management, the use of botanical pesticides remains low indicating problems in their acceptance. In present study the efforts were made to use the locally available plant materials, it will be simpler and cheaper to prepare the extract for pest control. Attempt to replace insecticides to which the *Spodoptera litura* had developed resistance have been made in present study to harvest the pesticide free produce. The experiment was laid in Factorial Randomized Block Design during *Rabi* season of 2020-21 with twelve treatments replicated thrice. The treatments included were, Factor A with organic extracts *viz.*, Triparni extract 10%, PDKV organic formulation 10% and PDKV botanical extract 10% along with control. Wherein Factor B included incubation periods of organic extracts *i.e.* 7 days incubation, 15 days incubation and 30 days incubation. Finally, cauliflower curd yield was recorded in each of the net plot to compare the effect of different treatments against the major pests of cauliflower. The results revealed that among the treatments, minimum population of *S. litura* was observed in plots treated with 30 days incubated PDKV organic formulation (2.28 larvae/plant) followed by 30 days incubated PDKV botanical extract (2.68 larvae/plant) and 30 days incubated Triparni extract (2.85 larvae/plant). However, all these treatments were found at par with each other. Whereas, relatively maximum population of *Spodoptera* was recorded in untreated control (5.37 larvae/plant). However, the treatment of 30 days incubated PDKV organic formulation recorded highest cauliflower yield (22.06 t/ha). Therefore, these organic extracts could be incorporated in integrated pest management program of organically grown crops.

Keywords: Cauliflower, Incubation period, organic extracts, *Spodoptera litura.*

INTRODUCTION

Cauliflower (*Brassica oleracea* var. *botrytis* Linn.) is one of the important cruciferous crop. India is the second largest cauliflower growing country in the world. In India, cauliflower is cultivated on an area of 452 thousand hectare with a production of 8668.22 thousand MT during 2017-18 (Anonymous, 2018). The production of cauliflower is hindered by the incidence of several insect pest, among them *Spodoptera litura* (Lepidoptera: Noctuidae) is polyphagous pest and feeds on crops of economic importance causing considerable damage by defoliation (Jat and Bhardwaj 2005). Insect pest management in cauliflower has traditionally been relied upon synthetic insecticides. Chemical fertiliser and pesticide consumption now stands at an all time high of 137.9 kg/ha and 0.6kg a.i /ha (DES, 2021). The overzealous and indiscriminate use of most of the synthetic pesticides has created different types of environmental and toxicological problems. The biomagnification resulting in environmental pollution and fertile lands are acquiring infertility (Gill and Garg 2014). Today due to the awareness about harmful effects of chemical pesticides, farmers are diverting towards the organic farming. Recently, in different parts of the world, attention has been paid towards exploitation of higher plant products as novel chemotherapeutants in plant protection. The popularity of botanical pesticides is once again increasing and some plant products are being used globally as green pesticides (Gurjar *et al*., 2012). Pest management by using plant extracts can act as valuable input to make efficient use of natural resources and extends relevant support for sustainable agriculture. But there is a need to explore, verify, modify and scientifically validate these practices for their wider use and application. Therefore, the present study was planned to evaluate the organic extracts against *Spodoptera litura* on cauliflower.

MATERIAL AND METHODS

The present investigation with an object to evaluate the efficacy of organic extracts against *Spodptera litura* on cauliflower was conducted during *Rabi* season of 2020-21. The experiment was laid in Factorial Randomized Block Design with twelve treatments replicated thrice. The treatments included were, Factor A with organic extracts *viz*., Triparni extract 10%, PDKV organic formulation 10% and PDKV botanical extract 10% along with control. Wherein Factor B included incubation periods of organic extracts *i.e.* 7 days incubation, 15 days incubation and 30 days incubation. The transplanting of Cauliflower var. Tetris (Syngenta) was done on 6th December 2020 with 60 cm × 45 cm spacing in a gross plot size of 5.20 m × 4.40 m. In all two treatment sprays were applied at 15 days interval. The observations were recorded at an interval of 3, 7 and 14 days after spraying. Filtration of the organic extracts was done shortly before application in the field using muslin cloth. The stickiness and adherence of each of the organic extract was enhanced by the addition of 0.2 % detergent powder as surfactant. Cauliflower curd yield data was recorded from each of the net plot to find out most economical and effective treatment for the management of *S. litura* on cauliflower. As per Gomez and Gomez (1984) the data obtained during the present course of investigation was converted to appropriate transformation and was subjected to statistical analysis to test the level of significance.

RESULT AND DISCUSSION

Efficacy of organic extracts against *Spodoptera litura* on cauliflower. The cumulative mean data presented in Table 1 revealed that all the treatments were significantly effective in reducing the larval population of *S. litura* at three days after spray. Among the treatments 30 days incubated PDKV organic formulation recorded minimum population of *Spodoptera* (2.06 larvae/plant). However, this treatment was found at par with 30 days incubated PDKV botanical extract, 30 days incubated Triparni extract and 15 days incubated PDKV organic formulation with population of 2.40, 2.45 and 2.64 larvae/ plant, respectively. These were followed by treatment of 15 days incubated PDKV botanical extract (2.98), 15 days incubated Triparni extract (2.98), 7 days incubated PDKV organic formulation (3.15), 7 days incubated PDKV botanical extract (3.25) and 7 days incubated Triparni extract (3.30). Whereas, maximum population of *Spodoptera* was recorded in untreated control plot (4.68 larvae/plant).

The results showed that at seven days after spray (Table 2) all the treatments found effective in reducing the population of *Spodoptera* as against untreated control. Among the treatments, 30 days incubated PDKV organic formulation was found most effective in recording minimum population of *Spodoptera* (1.35 larvae/plant). However, this treatment was found statistically at par with 30 days incubated PDKV botanical extract (1.67 larvae/plant) and 30 days incubated Triparni extract (1.86 larvae/plant). The next in order of efficacy were the treatment of 15 days incubated PDKV organic formulation, 15 days incubated PDKV botanical extract, 15 days incubated Triparni extract, 7 days incubated PDKV organic formulation, 7 days incubated PDKV botanical extract and 7 days incubated Triparni extract recorded 2.02, 2.15, 2.23, 2.40, 2.52 and 2.60 larvae/plant, respectively. However, all these treatments were found at par among themselves. Whereas, maximum population of *S. litura* was observed in control plot (4.89 larvae/plant).

At fourteen days after spray (Table 3) minimum population of *S. litura* was observed in plots treated with 30 days incubated PDKV organic formulation (2.28 larvae/plant) followed by 30 days incubated PDKV botanical extract (2.68 larvae/plant) and 30 days incubated Triparni extract (2.85 larvae/plant). However, all these treatments were found at par with each other. Next in order of efficacy were treatment of 15 days incubated PDKV organic formulation (3.40), 15 days incubated PDKV botanical extract (3.48), 15 days incubated Triparni extract (3.49), 7 days incubated PDKV organic formulation (3.55), 7 days incubated Triparni extract (3.67) and 7 days incubated PDKV botanical extract (3.69). Whereas, relatively maximum population of *Spodoptera* was recorded in untreated control (5.37 larvae/plant).

The present findings pertaining to efficacy of organic extracts with different incubation periods against *Spodoptera litura* finds support in the work carried out by earlier workers. Kamal Narayan *et al*. (2022) in their experiment on field evaluation of botanicals revealed that *Calotropis* leaf extract recorded 57.36 per cent reduction in Mustard Web Worm (*Crocidolomia binotais* Zell.) larval population. Whereas, Ali *et al* (2018) recorded 70-75% *S. litura* larval mortality with *Nerium odorum* and *Parthenium hysterophorus* L. (leaf and flower) extracts when applied at 15% concentration in addition to significant antifeeding effect. The present results are in conformity with the research work of Phambala *et al*. (2020) reported that in contact toxicity tests, the highest *Spodoptera frugiperda* larval mortality was obtained from *Nicotiana tabacum* (66%). Similarly, Emeasor and Okpara (2019) reported that leaf extract of *Carica papaya* significantly reduced the population of flea beetles by 20.7% and leaf defoliation by 57.7% in okra which translated to better yield. Moreover, Ruby Garg *et al.* (2022) also recorded the effective control of onion thirps with the application of plant extracts. The experimental results of Vinyas *et al.* (2022) revealed effective control of mustard insect pests with plant extracts like Dashparni Ark, NSKE and Cow urine. The present results are in confirmation with those of Joshi *et al.* (2020) reported that the

bioformulations with mixture of different botanicals such as 30 days incubated dashparni ark (*i.e*. combination of leaf extracts of Karanja, Nirgudi, Custard apple, Papaya, Castor, Neem, Garlic, green Chilli along with cow dung and cow urine), *Brahmastra*, *Neemastra*, *Agniastra*, and garlic + ginger + mint mixture had feeding deterrence against *Agrotis ipsilon.*

Effect of organic extracts on yield of cauliflower curd. The data presented in Table 4 regarding interaction effect of organic extracts with different incubation periods on cauliflower curd yield. All the treatments recorded significantly higher yield of cauliflower as compare to untreated control. Among the treatments 30 days incubated PDKV organic formulation recorded highest cauliflower yield (22.06 t/ha). However, this treatment was found at par with 30 days incubated PDKV botanical extract (21.28 t/ha), 30 days incubated Triparni extract (20.69 t/ha), 15 days incubated PDKV organic formulation (20.47 t/ha), 15 days incubated PDKV botanical extract (19.63 t/ha) and 15 days incubated Triparni extract (19.18 t/ha). The next effective treatments were 7 days incubated PDKV organic formulation (18.19 t/ha), 7 days incubated PDKV botanical extract (17.76 t/ha) and 7 days incubated Triparni extract (16.26 t/ha). Whereas, lowest yield of cauliflower was recorded in untreated control (11.50 t/ha).

The earlier researcher Chavada *et al*. (2020) in their field experiment on evaluation of different botanicals against cabbage aphid recorded 66.89% increase in yield over control with treatment of tobacco decoction 2%. The results of present studies finds support in the research work of Emeasor and Okpara (2019) evaluated different leaf extracts against okra Flea beetles, *Podagrica* spp. and harvested higher yield from the plots treated with *Carica papaya* extract. Murovhi *et al.* (2020) studied the efficacy of plant materials in controlling aphids on okra and reported that *Carica papaya* extract had the highest average yield (36.40 q/ha) followed by *Tobacco* extract (34.65 q/ha).

Table 1: Efficacy of organic extracts with different incubation periods against *S. litura* on cauliflower at three days after spray.

Treatments	*Spodoptera* larvae/plant Incubation period of extracts (in days)			Factor 'A' (Extract)
	7	15	30	
Triparni Extract 10%	3.30 (1.82)	2.98 (1.72)	2.45 (1.57)	2.91 (1.72)
PDKV Organic Formulation 10%	3.15 (1.77)	2.64 (1.62)	2.06 (1.44)	2.62 (1.62)
PDKV Botanical Extract 10%	3.25 (1.80)	2.98 (1.72)	2.40 (1.55)	2.88 (1.69)
Control (water spray)	4.13 (2.03)	4.35 (2.09)	4.68 (2.16)	4.39 (2.09)
Factor 'B' (Incubation Period)	3.46 (1.86)	3.24 (1.80)	2.90 (1.70)	

	Factor ' A'	Factor ' B'	Interaction (A×B)
'F' test	Sig	Sig	Sig
SE(m)±	0.05	0.04	0.07
CD (p=0.05)	0.11	0.10	0.20

Note: Figures in parentheses are corresponding square root transformation values.

Table 2: Efficacy of organic extracts with different incubation periods against *S. litura* on cauliflower at seven days after spray.

Treatments	*Spodoptera* larvae/plant Incubation period of extracts (in days)			Factor 'A' (Extract)
	7	15	30	
Triparni Extract 10%	2.60 (1.61)	2.23 (1.49)	1.86 (1.36)	2.23 (1.49)
PDKV Organic Formulation 10%	2.40 (1.55)	2.02 (1.42)	1.35 (1.16)	1.92 (1.38)
PDKV Botanical Extract 10%	2.52 (1.59)	2.15 (1.47)	1.67 (1.29)	2.11 (1.45)
Control (water spray)	4.23 (2.06)	4.52 (2.13)	4.89 (2.21)	4.55 (2.13)
Factor 'B' (Incubation Period)	2.94 (1.71)	2.73 (1.65)	2.45 (1.56)	

	Factor ' A'	Factor ' B'	Interaction (A×B)
'F' test	Sig	Sig	Sig
SE(m)±	0.05	0.04	0.08
CD (p=0.05)	0.13	0.11	0.22

Note: Figures in parentheses are corresponding square root transformation values

Table 3: Efficacy of organic extracts with different incubation periods against *S. litura* on cauliflower at fourteen days after spray.

Treatments	*Spodoptera* larvae/plant			Factor 'A' (Extract)
	Incubation period of extracts (in days)			
	7	15	30	
Triparni Extract 10%	3.67 (1.91)	3.49 (1.87)	2.85 (1.69)	3.34 (1.83)
PDKV Organic Formulation 10%	3.55 (1.88)	3.40 (1.84)	2.28 (1.51)	3.08 (1.75)
PDKV Botanical Extract 10%	3.69 (1.92)	3.48 (1.86)	2.68 (1.64)	3.28 (1.81)
Control (water spray)	4.77 (2.18)	5.04 (2.24)	5.37 (2.32)	5.06 (2.25)
Factor 'B' (Incubation Period)	3.92 (1.98)	3.85 (1.96)	3.30 (1.82)	

	Factor ' A'	Factor ' B'	Interaction (A×B)
'F' test	Sig	Sig	Sig
SE(m)±	0.04	0.04	0.08
CD (p=0.05)	0.13	0.11	0.22

Note: Figures in parentheses are corresponding square root transformation values.

Table 4: Effect of organic extracts on cauliflower curd yield.

Treatments	Cauliflower curd yield (t/ha)			Factor 'A' (Extract)
	Incubation period of extracts (in days)			
	7	15	30	
Triparni Extract 10%	16.26	19.18	20.69	18.71
PDKV Organic Formulation 10%	18.19	20.47	22.06	20.24
PDKV Botanical Extract 10%	17.76	19.63	21.28	19.59
Control (water spray)	13.87	13.55	11.50	12.97
Factor 'B' (Incubation Period)	16.57	18.23	18.88	

	Factor ' A'	Factor ' B'	Interaction (A×B)
'F' test	Sig	Sig	Sig
SE(m)±	0.57	0.49	0.98
CD (p=0.05)	1.67	1.44	2.89

CONCLUSION

The treatments with 30 days incubated organic extracts and 15 days incubated organic extracts proved effective in combating the menace of pest of cauliflower and resulted into higher cauliflower curd yield. Thus, these organic extracts would be helpful in mitigating the pest in cauliflower which is alarming in the present situation and could be included in organic cauliflower production as a promising component.

FUTURE SCOPE

The outcome of the present research trials showed the encouraging results of plant extract against pest. Plants are rich sources of natural substances that can be utilized in the development of environmentally safe methods for insect control.

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Conflict of interest. None.

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