Selection of Bio Pesticides against Cauliflower Diamondback Moth: A Review of Literature Prospect

Author's Details

[(1)]Muhammad Bilal Baloch [(2)]Dr Abdullah Dostain [(3)]Dr Shahida Habib Alizai [(4)]Shazia Jaffar

[(1)]Department of Entomology Faculty of Crop Protection Sindh Agriculture University Tandojam, Sind Pakistan [(2)]Livestock and Dairy Development Department Balochistan Quetta Pakistan [(3)]Gender Development Studies Department University of Balochistan Quetta [(4)]Pakistan Study Centre University of Balochistan Quetta

Corresponding; author bilalshahbaloch000@gmail.com

Abstract

An experiment was carried out in the Entomology Experimental Station based-on Agriculture Research Institute (ARI) Tandojam, Sindh Pakistan. In this regard, the Randomized Complete Block Design with three replication and sub-plot size of 3mx3 ($9m^2$) was used. However, 7 treatments with three replications i.e. T1=chemical control (confidor), T2=Neem (Azadirachta indica), T3=Akk (Calotropis procera Alton. F.), T4=Tooh (Citrullus colocynthus Schrad. L.), T5=Datura (Datura stramonium) T6=Tabacco (Nicotiana tabacum) and T7=Control (untreated) were effectively used, in this connection, the pre and post-treatment and observations were also be documented. Against Diamondback moth population on cauliflower the first spray results showed that chemical control(confidor) showed highest efficacy (98.88%), followed by Neem extract (97.23%), Tobacco extract (95.39%), Tooh extract (92.19%), Dhatura (89.79%) and least efficacy was resulted by Akk extract (80.98%). After second spray, chemical control(confidor) showed highest efficacy (99.47%), followed by Neem extract (96.27%), Tobacco extract (96.44%), Tooh extract (91.54%), Akk extract (77.94%) and the lowest efficacy was resulted by Dhatura extract (69.19%) against diamondback moth after second spray. Finally, general or best selection of biopesticides against diamondback moth after 1st and 2nd spray, the treatments were ranked as the: chemical control (confidor); neem extract; tobacco extract tooh extract akk extract and dhatura extract one to seven ranked order respectively

Keywords: *Selection, Bio-pesticides, Diamondback moth, Review of literature, Cauliflower, Pakistan*

Introduction

Cauliflower, *Brassica oleracea* L. is the one of the important vegetable and belongs to the family Cruciferae. In this regard, the Cauliflower plant was considered as the annual plant and also reproduces by seed. Naturally, only in this connection the white head of the plant is edible portion of the plant as well as used for eaten purpose, although the stalk and adjacent thick, green foliage are used as a vegetable. Its term is from Latin caulis (cabbage) an response of its rare place amongst a intimate of food plants which usually yields only leafy greens for eating purposes (Barbara, 1996).

Cauliflower is squat with the term of fat, truncated in carbs nonetheless extraordinary in dietary water, folate and fiber vitamin-C, having a high nutritious compactness. Cauliflower encompasses several phytochemicals, collective in the cabbage family that may be helpful to human healthiness (Kirsh *et al.* 2007; USDA, 2011).

Obviously among the all kind of insects and pests like thrips, whitefly, diamond back moth bollworms, jassids, fruit borers, aphids, leaf hopper were found and observed in the cauliflower plant. Separately from the carnage of the insects and pests, some of the plant extracts act as the anti-feedan, repellant as well as comprises convinced substances, which impedes insect population (Bardin *et al.* 2008; Nzanza and Mashela, 2012; Adalbert *et al.* 2013).

Jeyarani and Kennedy (2004) described that biopesticides being extremely effective in reducing larval population of diamondback moth with uppermost vintage in cauliflower. Waghmare *et al.*, (2006) also found biopesticides being effective against diamondback moth in cabbage, while Hemchandra and Singh (2006) and

Shukla and Kumar (2006) also reported the effect of some indigenous plant products against diamondback moth. Krishna Kumar *et al*. (1983) reported 52% loss in marketable yield of cabbage due to the attack of *P. xylostella*. The farmers use various synthetic pesticides to reduce the damage by this pest, but with limited success. Therefore, considering the importance of this pest in red cabbage cultivation *vis-à-vis* the ill-effects of using synthetic chemicals, an attempt was made to find out the bio-efficacy of the seed extracts of Kochila, *Strychnos nuxvomica* (Loganeaceae) and Yam bean, *Pachyrrizus erosus* (Papilionaceae) using petroleum ether as solvent as well as an entomopathogenic fungus eg., *Beauveria bassiana,* against important on diamondback moth, *P. xylostella* (Vishwakarma *et al.* 2009). The extract from *Citrullus colocynthus* (L.) Schrad (locally named as Tumma in Punjabi and Tooh in Sindhi) is a member of Cucurbitaceae family and the fruits are generally fed to animals for deworming and fruit extract of *Citrullus colocynthus* is also effective against various insect pests of different crops. *Calotropis procera* Alton. F. (locally named Akk) is a famous medicinal plant and extracts made from its leaves and flowers is used for treatment of various human and animal diseases and disorders. The akk extract is reportedly effective to control crop insect pests (Sultana *et al.* 2006). However, in this context, current investigation was conducted so that to determine the selection of best biopesticides against insects and pests of cauliflower with the term of review of related literature.

Objectives of the present study

1. To explore the selection of different biopesticides against the cauliflower diamondback moth.

2. To advise most operative and best biopesticide against cauliflower diamondback moth.

Some previous studies based on review of realted literature prospects

Palumbo (2002) evaluated the comparative knockdown and residual efficacy of several conventional, Reducedrisk and biopesticide compounds against western flower thrips in romaine lettuce. Zafar *et al.* (2002) carried out studies on the performance evaluation of cam biopesticides to control cabbage butterfly on cauliflower. Binage *et al.* (2004) conducted a field experiment to evaluate the efficacy of different botanical pesticides, alone and in combination with endosulfan and cypermethrin against various insect pests including aphid. Chatterjee and Chowdhury (2003) evaluated persistent toxicity of five formulations. Singh and Kumar (2003) conducted an experiment to determine the efficacy of neem *Azadirachta indica* based pesticides against the okra fruit borers and sucking complex. Efeito *et al.* (2005) argued that due to the problem of pesticide resistance, alternative techniques for chemical control. Schmutterer, 2005; Tiwari and Srivastava, 2005; Haq, 2006; Hassan *et al.* 2006; & Khattak *et al.* 2006) concluded that some extracts from neem seeds/neem seed kernels and oil extract. Ziga *et al.* (2006) examined the efficacy of three environment friendly substances against aphid. (Adalbert *et al*. 2007; Balog *et al.* 2007) compared the effects of different plant extracts on aphid mortality under laboratory conditions. Dutt (2007) used neem, dhatura and cow urine for the control of cotton insect pests. Gaspari *et al.* (2007) investigated the effects of methanolic extracts of neem *Azadirachta indica.* Khaskheli (2007) applied botanical products for controlling thrips population on cotton. Muthukumar *et al.* (2007) conducted experiment for two rabi seasons (2006–2007) in the experimental field of Division of Entomology, IARI, New Delhi. Nabil *et al.* (2007) applied four treatments to control the aphids using commercial Neem Azal-T/S which significantly reduced the number of aphid. Bardin *et al.* (2008) examined the effect of biopesticides and their efficacy to control insect pests of tomato. El-Hawary *et al.* (2008) tested nimbecidine (Contains 0.03% azadirachtin) and Green Miracle (antitranspirant) alone and in combination against Aphis craccivora Koch. Jha (2008) focused on the assessment of the status of biopesticides use and at farm level presents the empirical evidences of reduction in pesticide use in vegetable production in Nepal. Vijayaraghavan *et al.* (2008) tested the effects of azadirachtin and sub-lethal concentration (LC30) of annona seed extract. Yadav *et al.* (2008) revealed that treatment of neem formulation with azadirachtin-endosulfan at 15 days interval brought down the jassids population up to 0.68/5 plants. Ahmed *et al.* (2009) conducted field experiment to determine the efficacy of six plant extracts against the insect pests of cowpea. Arain (2009)

examined the effect of botanical pesticides against mealy bug. Hanumantharaya *et al.* (2009) stated that safflower aphid is a major pest which causes 30 to 80 per cent yield loss based. Rukhsana *et al.* (2010) reported that among the plant material, best antifungal activity was achieved by extracts of *Azadirachta indica* (Neem). Khanapara and Kapadia (2011) carried out studies and laboratory efficacy of biopesticides. Muzemu *et al.* (2011) concluded that extracts of *Lippia javanica* leaf powder. Sawsan *et al.* (2011) evaluated water extracts of five medicinal and ornamental plant species. Brudea *et al.* (2012) presented the efficacy of the some biopesticides used in the experiments to control fall webworm. Debashri and Tamal (2012) stated that although both synthetic and natural of pesticides are used extensively in the agricultural fields to control crop pests. Gupta *et al.* (2012) studied the persistence of cypermethrin, deltamethrin, profenofos, and triazophos in cauliflower curd. Mari (2012) examined the efficacy of different bio-pesticides against 2nd and 3rd in star *Plutella xylostella* larvae on cauliflower under laboratory conditions. Nzanza and Mashela (2012) concluded that whitefly (*Bemisia tabaci,* Homoptera: Aleyrodidae) and aphid (Homoptera) on tomato (*Solanum lycopersicum*) are economically important insect pests that are difficult to manage due to their resistance to a wide range of chemical pesticides. Gupta *et al.*, (2013) developed a bio-intensive pest management system for the thrips. Hence, all the previous studies reveals that the bio-pesticides were effective efficacy against the vegetables pests and insects.

Materials and methods

Entomology Experimental Station based on Agriculture Research Institute (ARI) Tandojam Sindh Pakistan was used for the present experiment with intention to selection of biopesticides against cauliflower diamondback moth. While biopesticides (plant extracts) plus confidor were used against the diamondback moth of cauliflower plant. In this context, the RCBD with three replication was used. Whereas the Randomized Complete Block Design with sub-plot size of 3mx3 ($9m^2$) was used in this connection. Further, methods and sowing dates were also perceived according to the work of plan. In addition, suggested planting rate of 5.0 kg ha^{-1} was pragmatic; however row-to-row space of 60 cm and plant-to-plant space of 15 cm was keep up. Finally, variety Thori-78 seed of cauliflower was used during the course of the research. The excerpts of the succeeding botanicals florae were used to examine their effectiveness in contradiction of cauliflower pest and insect. There were 7treatments show below:

***T**one*	*Chemical control (confidor)*
***T**two*	*Neem (Azadirachta indica)*
***T**three*	*Akk (Calotropis procera Alton. F.)*
***T**four*	*Tooh (Citrullus colocynthus Schrad. L.)*
***T**five*	*Datura (Datura stramonium)*
***T**six*	*Tobacco (Nicotiana tabacum)*
***T**seven*	*Control (untreated)*

For preparation of plant extract, 10 kg leaves each of Neem (*Azadirachta indica*), Tobacco (*Nicotiana tabacum*), Akk (*Calotropis procera*), Tooh (*Citrullus colocyanthus* Schrad. L.) and Datura (*Datura stramonium*) were collected and processed for getting the extract. Each treatments stock weight was 10 kg boiled in 10 liters of water. When water continued 5 liters stock solution was standing by to spray. Afterward concocting the abstracts, the cauliflower plants were sprayed with a knapsack hand sprayer. In all two sprays were carried out, and the efficacy was examined after 24, 48, 72, 96 hours 1 week and 2 weeks of spray and compared with control. Suggested pesticide for cauliflower was sprayed for chemical control (confider) @ 250 ml / acre (0.56ml/plot) and bio pesticide 5liter/Acr (12ml/plot) was sprayed. Thus the information was statistical investigation by using the one-way-ANOVA. Least Significance Difference test was also steered with the purpose of compare different treatments used in present experiments for their selection and efficacies against the diamondback moth.

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Layout plan of the experiment

LAYOUT: Randomized Complete Block Design
REPLICATIONS: Three
PLOT SIZE: 3m x 3m ($9m^2$). N

Treatments 07

T1= Chemical control (*confidor*)
T2= Neem (*Azadirachta indica)*
T3= Akk (*Calotropis procera* Alton. F.)
T4= Tooh (*Citrullus colocynthus* Schrad. L.)
T5= Datura (*Datura stramonium*)
T6= Tobacco (*Nicotiana tabacum*)
T7= Control (untreated)

3m RI		RII		RIII
T_1	FEEDING CHANNEL	T_7	FEEDING CHANNEL	T_3
T_3		T_4		T_2
T_5		T_3		T_6
T_7		T_5		T_4
T_2		T_6		T_1
T_6		T_2		T_5
T_4		T_1		T_7
MAIN CHANNEL				

Results

Diamondback moth (First spray)

Diamondback moth population on cauliflower as affected by biopesticide application suggested non-significant variation for pre-treatment insect count (F=1.05; DF=20; P>0.05) and when observed after 24 hours of spray (F=2.54; DF=20; P>0.05); while the insect population significantly reduced after 48 hours of second spray (F=18.30; DF=20; P<0.05), 72 hours after spray (F=26.41; DF=20; P<0.05), 96 hours after spray (F=30.97; DF=20; P<0.05); one week after spray (F=51.74; DF=20; P<0.05) and two weeks after spray (F=36.06; DF=20; P<0.05).

The data (Table-1) revealed that by efficacy, the chemical control (confidor) ranked 1st reducing diamondback moth population from 1.27/leaf to 0.02/leaf after two weeks of spray showing the highest efficacy of 98.88; and neem extract ranked 2nd, decreasing insect population from 1.17/leaf to 0.04/leaf showing efficacy of 97.23 %; while tobacco extract ranked 3rd by efficacy against diamondback moth decreasing its population from 1.30/leaf to 0.07/leaf showing efficacy of 95.39 %. Tooh extract ranked 4th, decreasing diamondback moth population from 1.19/leaf to 0.0.11/leaf after 2 weeks of spray showing efficacy of 92.19 %, and the Akk extract ranked 5th, decreasing diamondback moth population from 1.19/leaf to 0.28/leaf after 2 weeks of spray showing efficacy of 80.98 percent; while Dhatura extract ranked 6th, causing minimum decrease in diamondback moth population from 1.11/leaf to 0.14/leaf after 2 weeks of spray with lowest efficacy of 89.79 %. According to the efficacy of biopesticides against diamondback moth after first spray, the treatments ranked as: chemical control, neem extract, tobacco extract, tooh extract, akk extract and dhatura extract.

Second spray

The analyses of variance for Diamondback moth population on cauliflower as affected by biopesticide application demonstrated non-significant variation for pre-treatment insect count (F=0.51; DF=20; P>0.05) and when observed after 24 hours of spray (F=1.17; DF=20; P>0.05); while the insect population significantly reduced after 48 hours of second spray (F=28.64; DF=20; P<0.05), 72 hours after spray (F=46.13; DF=20; P<0.05), 96 hours after spray (F=79.12; DF=20; P<0.05); one week after spray (F=53.60; DF=20; P<0.05) and two weeks after spray (F=32.50; DF=20; P<0.05).

Table-1 Efficacy of various biopesticides against diamondback moth infestation on cauliflower as compared to chemical control (Confidor) at different intervals after first spray.

Plant extracts	Pre-treatment	Post treatment observation/plant after:						Pest Reduction /plant	Reduction %
		24hrs	48hrs	72hrs	96hrs	1week	2week		
Chemical Control (confidor)	1.27	1.08	0.54	0.38	0.29	0.01	0.02	1.26	98.88
Neem extract	1.17	0.78	0.43	0.39	0.36	0.03	0.04	1.14	97.23
Akk extract	1.19	1.10	0.69	0.61	0.56	0.23	0.28	0.97	80.98
Tooh extract	1.19	1.07	0.64	0.55	0.52	0.09	0.11	1.10	92.19
Dhatura extract	1.11	1.03	0.72	0.62	0.51	0.11	0.14	0.99	89.79
Tobacco extract	1.30	1.14	0.66	0.53	0.50	0.06	0.07	1.24	95.39
Untreated	1.20	1.19	1.17	1.15	1.15	1.19	1.19	0.01	1.22
S.E.±	0.0880	0.1158	0.0773	0.0713	0.0713	0.0826	0.0984		

LSD 0.05	0.1917	0.2524	0.1684	0.1554	0.1554	0.1801	0.2145		
LSD 0.01	0.2687	0.3539	0.2360	0.2179	0.2178	0.2524	0.3007		

The data (Table-2) showed that on the basis of efficacy after second spray, chemical control ranked 1st reducing diamondback moth population from 0.96/leaf to 0.01/leaf after two weeks of spray showing the highest efficacy of 99.47; and neem extract ranked 2nd, decreasing insect population from 0.96/leaf to 0.04/leaf showing efficacy of 96.27 %; while tobacco extract ranked 3rd by efficacy against diamondback moth decreasing its population from 0.94/leaf to 0.04/leaf showing efficacy of 96.44 %. Tooh extract ranked 4th, decreasing diamondback moth population from 1.02/leaf to 0.10/leaf after 2 weeks of spray showing efficacy of 91.54 percent, and the Akk extract ranked 5th, decreasing diamondback moth population from 0.89/leaf to 0.25/leaf after 2 weeks of spray showing efficacy of 77.94%; while Dhatura extract ranked 6th, causing lowest decrease in diamondback moth population from 0.94/leaf to 0.35/leaf after 2 weeks of spray with lowest efficacy of 69.19 %. According to the efficacy of biopesticides against diamondback moth after second spray, the treatments ranked as: chemical control, neem extract, tobacco extract, tooh extract, akk extract and dhatura extract.

Table-2 Efficacy of various biopesticides against diamondback moth infestation on cauliflower as compared to chemical control (Confidor) at different intervals after second spray.

Plant extracts	Pre-treatment	Post treatment observation/plant after:						Pest Reduction /plant	Reduction %
		24hrs	48hrs	72hrs	96hrs	1week	2week		
Chemical Control (Confidor)	0.96	0.86	0.43	0.30	0.15	0.01	0.01	0.95	99.47
Neem extract	0.96	0.87	0.48	0.44	0.40	0.04	0.04	0.92	96.27
Akk extract	0.89	0.82	0.52	0.45	0.40	0.20	0.25	0.69	77.94
Tooh extract	1.02	0.96	0.57	0.49	0.48	0.09	0.10	0.93	91.54
Dhatura extract	0.94	0.90	0.63	0.54	0.47	0.29	0.35	0.65	69.19
Tobacco extract	0.94	0.87	0.51	0.40	0.40	0.03	0.04	0.90	96.44
Untreated	1.01	1.00	0.99	0.97	0.98	1.01	1.01	0.00	0.00
S.E.±	0.0880	0.0806	0.0501	0.0449	0.0401	0.0690	0.0885		
LSD 0.05	0.1917	0.1757	0.1091	0.0978	0.0874	0.1503	0.1229		
LSD 0.01	0.2688	0.2463	0.1530	0.1371	0.1225	0.2107	0.2705		

Discussion

Against Diamondback moth population on cauliflower the first spray results showed that chemical control showed highest efficacy 98.88% against diamondback moth, followed neem extract 97.23%, tobacco extract 95.39%, Akk extract 92.19%, Dhatura 89.79% and least efficacy was resulted by Akk extract 80.98%. After second spray, chemical control showed highest efficacy 99.47%, followed by neem extract 96.27%, tobacco extract 96.44%, Tooh extract 91.54%, Akk extract 77.94% and the lowest efficacy was resulted by Dhatura extract 69.19% against diamondback moth after second spray. Conferring to the inclusive efficacy of biopesticides against the diamondback moth after first and second spray, the treatments ranked as: chemical control, neem extract, tobacco extract, tooh extract, akk extract and dhatura extract. These results are further

supported by Knott (1998) who recoded, neem extract was effective against the vegetable pests. However, Rukhsana *et al.* (2010) noted that the *Azadirachta indica* (Neem) had best antifungal activity.

Conclusions and suggestions

Against Diamondback moth population on cauliflower the first spray results showed that chemical control showed highest efficacy 98.88% against diamondback moth, followed neem extract 97.23%, tobacco extract 95.39%, Tooh extract 92.19%, Dhatura 89.79% and least efficacy was resulted by Akk extract 80.98%. After second spray, showed chemical control highest efficacy 99.47%, followed by neem extract 96.27%, tobacco extract 96.44%, Tooh extract 91.54%, Akk extract 77.94% and the lowest efficacy was resulted by Dhatura extract 69.19% against diamondback moth after second spray. According to the overall efficacy of biopesticides against diamondback moth after first and second spray, the treatments ranked as: chemical control, neem extract, tobacco extract, tooh extract, akk extract and dhatura extract. The Akk extract was also moderately effective to suppress the insect pest infestation. Although, the Dhatura extract was also effective to control the cauliflower insect pests, but its efficacy was lowest among all the other biopesticides and chemical control. While, the biochemical switch on and were operative against the cauliflower diamondback moth based on efficacy, neem extract, shows approximately effect results however, in this prospect tobacco extract and tooh extract would be recommended for the safe control of pests or insect of cauliflower. It was worthwhile mention that they have no residual effect on plants or part of the pants.

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