

## Integrated Pest Management (IPM) Technique against Whitefly of Cauliflower: Technology Adoption in Diffusion of Innovations Prospect

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### Abstract:

A field study was carried out in the experimental station Entomology Section, Agriculture Research Institute, (ARI) Tandojam, Sindh Pakistan during 2018, so as to examine the efficacy of different bio-pesticides against the whitefly of cauliflower. Seven treatments with three replications were applied. In this regard, the pre-treatment was observed and recorded. The results revealed that the non-significant variation was observed at 0.05 level for pre-treatment. The analysis of variance also showed that effect of IPM techniques against whitefly varied significantly ( $P < 0.05$ ), when monitored after 24 hours after first spray ( $F=7.80$ ;  $DF=20$ ;  $P < 0.05$ ). The analysis of variance showed that effect of IPM techniques against whitefly varied significantly ( $P < 0.05$ ) when monitored after 24 hours after 2<sup>nd</sup> spray ( $F=5.39$ ;  $DF=20$ ;  $P < 0.05$ ) highly significant ( $P > 0.05$ ). Based on results following suggestion put forward. Although, the chemical control were effective against the cauliflower whitefly, but on the basis of efficacy, neem extract, shows nearly effect followed by tobacco extract and tooh extract are suggested for safe control of insect pests on cauliflower and no residual effect.

**Keywords:** Integrated Pest Management, Whitefly, Diffusion of Innovation

### Introduction

Cauliflower crop is attacked by a number of insect pests which include root maggots, cutworms, aphids, harlequin bugs, flea beetles, cabbage worms and loopers. Synthetic insecticides are widely used in most developing countries to control these insect pests. This has contributed to the environmental pollution through air or as residues in food. In the last years the use of environmentally bio-pesticides, such as plant extracts widely increased. The diverse biological activities of bio-pesticides (plant extracts) include feeding and oviposition deterrence, repellency, growth disruption, reduced fitness, and sterility (Schmutterer, 2005).

Bio-pesticides are natural control of crop insect pests (Nzanza and Mashela, 2012) and these naturally occurring substances control pests by non-toxic mechanisms (Bardin *et al.* 2008); while synthetic pesticides may adversely affect the organisms such as birds, beneficial insects and mammals (Knott, 1998). However, for achieving high results from bio-pesticides effectively, users need to know a great deal about managing pests (Adalbert *et al.* 2013). Among insect pests, bollworms, fruit borers, aphids, jassids, thrips, whitefly, leaf hopper, diamond back moth found to be infest safflower and the it has been proved that botanical pesticides effectively control these insect pests. Apart from the killing of the insect pests, some of the plant extracts act as repellent, anti-feedant and contains certain chemicals, which inhibits insect population. Prasad and Devappa (2006) reported that the bio-pesticides was found to be effective in suppressing the larval population of the *P. xylostella* as compared to other insecticides with higher yield of cabbage per hectare.

Jeyarani and Kennedy (2004) reported that bio-pesticides being highly effective in reducing larval population of diamondback moth with highest yield in cauliflower. Waghmare *et al.*, (2006) also found bio-pesticides 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 *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). The present study was carried out to screen out plant extracts being used as bio-pesticides against insect pests of cauliflower (*Brassica oleracea* L.) at Tandojam.

### Diffusion of innovations

Rogers contends that diffusion is the procedure by which an innovation is imparted after some time among the members in a social framework. The roots of the dispersion as the diffusion of developments hypothesis are fluctuated and range numerous controls. Rogers suggests that four primary components impact the spread of another thought or as the new idea: the advancement as innovation itself, correspondence channels, time, and a social framework. This procedure or innovation depends intensely on human capital. The advancement as innovation must be broadly received so as to self-support. Inside the rate of appropriation, there is a time when an advancement achieves minimum amount. The classes as categories of adopters are trend-setters, early adopters, early larger part or early majority, late majority and laggards. Diffusion shows itself in various ways and is profoundly subject to the kind of adopters and development choice process. The standard for the adopter classification is inventiveness, characterized as how much an individual receives another thought.

### Objectives

A. to determine the effectiveness of various bio-pesticides as IPM techniques against the whitefly of cauliflower, and B. to suggest the most effective bio-pesticide against cauliflower whitefly.

### Materials and Methods

A field experiment was carried out in the year of 2018, so as to determine the bio-pesticides (plant extracts) and confidor cauliflower against whitefly. The experiment was designed in a three replicated Randomized Complete Block Design (RCBD) with sub-plot size of 3m x 3 (9m<sup>2</sup>). The sowing dates and methods were observed according to the plan of work. The recommended planting rate of 5.0 kg ha<sup>-1</sup> was applied; whereas row to row distance of 60 cm and plant to plant distance of 15 cm was maintained. The seed of cauliflower variety Thori-78 was used throughout the experiment. The extracts of the following botanicals plants were used to investigate their efficacy against cauliflower whitefly. There were seven treatments as shown below:

- 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)

For preparation of plant extract, 10 kg leaves each plants were collected and processed for getting the extract. Each treatments stock weight was 10 kg boiled in 10 liters of water. The leaves of each plant species were taken separately and filtered through muslin cloth. When water remained 5 liters stock solution was ready to spray. After preparing the extracts, 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. Recommended pesticide for cauliflower was sprayed for chemical control (confider) @ 250 ml / acre (0.56ml/plot) and bio pesticide 5liter/Acr (12ml/plot) was sprayed. The data thus collected were subjected to statistical analysis using analysis of variance to know the significance of differences in the population of various insect pests and infestation at different intervals after treatment, and LSD (Least Significance Difference) test was applied to compare different treatments for their efficacies against whitefly.

## Results and discussion

### Whitefly First Spray

The present experiments were conducted during the year of 2018 at Entomology Section, Agriculture Research Institute (ARI) Tandojam, Pakistan so as to investigate the effect of bio-pesticides against whitefly using the IPM techniques of synthetic chemical (confidor/ Diamond) and Neem (*Azadirachta indica*), Akk (*Calotropis procera* Alton. F.), Tooh (*Citrullus colocynthus* Schrad. L.), Datura (*Datura stramonium*), and Tobacco (*Nicotiana tabacum*).

**Table 1, Analysis of variance for pest population, pre-treatment**

Score	DF	Sum of Squ:	M: Squ:	F. Ration	Probability
Replications	2	0.15592	0.07796	0.35	0.8955
Treatment	6	0.50387	0.08398		
Error	12	2.86428	0.23869		
<b>Total</b>	20	3.52407	-----		

While their efficacy were compared with an untreated control was also maintained. The white fly posing threat to Cauliflower production was shown in tables-1. In this regard, the non-significant variation was observed at 0.05 level for pre-treatment.

**Table 2. Analysis of variance for pest population, 24 hours after spray**

Score	DF	Sum of Squ:	M: Squ:	F. Ration	Probability
Replications	2	0.09741	0.04870	7.80	0.0014
Treatment	6	5.85078	0.97513		
Error	12	1.50019	0.12502		
<b>Total</b>	20	7.44838	-----		

The analysis of variance showed that the effect of IPM techniques against white fly varied significantly ( $P < 0.05$ ) when monitored after 24 hours after first spray ( $F=7.80$ ;  $DF=20$ ;  $P < 0.05$ ), and highly significant ( $P > 0.05$ ) when monitored for 24 hours as shown in table-2, that IPM techniques showed their effect throughout the observational period after first spray against white fly. Ahuja et al., 2012, and Nzanza and Mashela (2012) reported that the mixture of neem and wild garlic was more effective in reducing population densities of whitefly and aphid than either plant extract applied alone.

### Whitefly Second Spray

**Table 3. Analysis of variance for pest population, pre treatment**

Score	DF	Sum of Squ:	M: Squ:	F. Ration	Probability
Replications	2	0.03780	0.01890	1.40	0.2930
Treatment	6	1.36490	0.22748		
Error	12	1.95653	0.16304		
<b>Total</b>	20	3.35923	-----		

The bio-chemical and Neem (*Azadirachta indica*), Akk (*Calotropis procera* Alton. F.), Tooh (*Citrullus colocynthus* Schrad. L.), Datura (*Datura stramonium*), and Tobacco (*Nicotiana tabacum*) were used in the present study. Three white fly posing threat to Cauliflower production was shown in table-3. In this regard, the non-significant variation was observed at 0.05 level for pre-treatment.

**Table 4. Analysis of variance for pest population, 24 hours after spray**

Score	DF	Sum of Squ:	M: Squ:	F. Ration	Probability
Replications	2	0.00058	0.00029	5.39	0.0065
Treatment	6	2.63218	0.43870		
Error	12	0.97722	0.08143		
<b>Total</b>	20	3.60998	-----		

The analysis of variance showed that the effect of IPM techniques against white fly varied significantly ( $P < 0.05$ ) when monitored after 24 hours after first spray ( $F=5.39$ ;  $DF=20$ ;  $P < 0.05$ ), and highly significant ( $P > 0.05$ ) when monitored for 24 hours as shown in table-4, that IPM techniques showed their effect throughout the observational period after first spray against white fly. Rukhsana et al. (2010) reported that among the plant material, best antifungal activity was achieved by extracts of *Azadirachta indica* (Neem), and *Allium sativum* (garlic) at the concentration of 0.015.

## Conclusions and Suggestions

Seven treatments were formed including a control such as: 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*) and T7=Control (untreated) were use as IPM techniques against the whitefly at the experimental area of the Entomology Section, Agriculture Research Institute (ARI) Tandojam so as to examine the efficacy of different bio-pesticides against whitefly of cauliflower. Based on results following suggestion put forward. Although, the Chemical control were effective against the cauliflower whitefly, but on the basis of efficacy, neem extract, shows nearly effect followed by tobacco extract and tooh extract are suggested for safe control of insect pests on cauliflower and no residual effect.

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