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Efficacy of ecofriendly botanical extracts of Ginger (*Zingiber officinale*), Garlic (*Allium sativum*) and Tobacco (*Nicotiana tabacum* L) for the control of cabbage looper (*Trichoplusia binotalis*) under agro ecological conditions of Peshawar, Pakistan

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Abstract

Field investigation was carried out for the control Cabbage looper during July 2015-16, at new developmental farm of the University of Agriculture Peshawar-Pakistan in RCBD arrangements with three treatments i.e. Garlic, Ginger and Tobacco @3.00% extracts. Golden Acre variety of cabbage was grown for investigating cabbage looper infestation as the infestation of cabbage looper starts proliferating we applied treatments. Results indicated that over all minimum infestation of cabbage looper was recorded from the plot treated with Garlic extracts @3.00% was (8.53%) followed by Ginger extract @3.00% (10.14%) and Tobacco Extract @3.00% (11.02%) while maximum infestation was recorded from the Check plot (182.02%). Data of present investigation revealed that botanical extracts are very useful for the control of cabbage looper if applied at initial stage of cabbage looper infestation, as botanical extracts have edge of less hazardous for human health, environment friendly, and safe for natural enemies.

Keywords: Cabbage, *Trichoplusia binotalis*, Botanical extracts, Ginger, Garlic, Tobacco

1. Introduction

Cabbage (*Brassica oleracea* L) is a leafy green or purple biennial plant, grown as an annual vegetable crop for its dense-leaved heads. Smooth-leaved firm-headed green cabbages are the most common, with smooth-leaved red and crinkle-leaved savoy cabbages of both colors. It is a multi-layered vegetable and one of the best sources of source of Vitamin C after Citrus, lemon and Guava. Cabbage is use in both forms fresh and cooked In Pakistan. The total area under cultivation of cabbage in Pakistan is 13.6 thousand hectares with production 234.4 thousand tons (MINFAL, 2014)^[4].

The cabbage looper, (*Trichoplusia binotalis* Hiibner), is the major pest of cabbage. Cabbage loopers are leaf feeders, and in the first three instars they confine their feeding to the lower leaf surface, leaving the upper surface intact. The fourth and fifth instars chew large holes, and usually do not feed at the leaf margin. In the case of cabbage, however, they feed not only on the wrapper leaves, but also may bore into the developing head. Larvae consume three times their weight in plant material daily (McEwen and Hervey 1960)^[5].

Bio pesticides or botanical extracts are good and alternative to synthetic pesticides having edge of environment friendly and safe for natural enemies, humans and other animals, e.g. most botanical pesticides have low to moderate mammalian toxicity and having no adverse effect on environment (Hassan, 1992)^[3].

Cabbage looper is one of the serious pests of cabbage in Peshawar region and for the control of cabbage looper in cabbage field usually synthetic insecticides were used that have serious issues with human health and natural enemies. Keeping in view the importance of Cabbage usage both in raw and cooked form in Peshawar region and hazardous effect of synthetic insecticides on human health, the present investigation was conducted to find safe and effective control of the Cabbage Looper. The objective of research is promoting use of bio-pesticides as they are non-hazardous for human health and also environment friendly.

2. Materials and methods

Field location

The Experiment was carried out at new developmental farm of Agriculture University Peshawar-Pakistan in a Randomized Complete Block Design (RCBD) with three treatments including check plot. Cabbage variety Golden Acre was sown in a plot size of 9x3 m² in bunds. Row to row and plant to plant distance maintained was 50-60 cm and 30-40 cm respectively. All the Botanical extracts were applied as foliar application when sufficient population of cabbage looper was seen on cabbage crop with the help of hand sprayer.

Extraction procedure in laboratory from the leaves of Tobacco

The leaves of Tobacco were purchased from the local market. The leaves were washed with distilled water to remove dust, dirt and other pollutants and then place in shade for shelter dry for one week. The dried leaves were crushed with grinder to make fine powder. 50 g of powdered was weighed and then passed to a cellulose extraction thimble (Whatman, UK). Plant materials were extracted by using 250 ml ethanol for 5 hours at (78 °C) in a Soxhlet apparatus (250 ml) and the obtain extracts were pour in to the flask separately. The abstract was measured and from each plant materials a final volume of 200 ml was made and pour into the round bottom flasks. The flasks contain plant materials were fitted at the bottom of Rotatory evaporator (Buchi; R-114; Switzerland) separately and evaporated to dryness at a temperature 85 °C. The flasks which contain plant dried materials were detached and weighed. Weight of dried extracts was calculated by subtracting the already noted weight of empty flask and few milliliters of ethanol to help in dissolution of extract with water. To the extract add 50 ml of distilled water to get 1 g/ml (100% w/v) concentration (Prishanthini, 2014) [5].

Extraction procedure of plant material from blubs and rhizomes of Garlic and Ginger

Fresh Ginger rhizomes and Garlic blubs (500 g) each were chopped into small pieces and stirred with diethyl ether (2_1 litre) for 6h. The combined ether extracts were filtered and solvent evaporated at room temperature. The oil (500 mg) so obtained was subjected to preparative TLC (hexane, diethyl ether, 1:1 by volume). The uppermost layer was scraped and extracted with diethyl ether to yield a compound (75 mg, 15% yield) which was identified as pure extracts of Ginger and Garlic (75% purity) by its mass spectral data add 50 ml of distilled water to get 1gml-1 (100% w/v) concentration (Agarwal., 2001) [2]

Data recording

Data were recorded as number of cabbage looper larvae on head of cabbage plant from five selected cabbage plants in each plot before application and after application of botanical extracts. Infestation data were noted after interval of 24, 48, 72 and 168 hours, respectively.

Dose of Botanical extracts used

The Extracts of Ginger, Garlic and Tobacco were applied @ 3.00% in 5 liter of water in Hand sprayer and applied as foliar

spray when infestation of cabbage looper was seen in cabbage plots. (Table I)

Table 1: Calculated dose of botanical extracts used against *T. binotalis*

Treatments	Active ingredient	Calculated dose Rate/5litre water
Ginger @3.00%	Ginger Extract	40 ml/9x3m ²
Garlic @3.00%	Garlic Extract	40ml/9x3m ²
Tobacco Extract@3.00%	Nicotine	40ml/9x3m ²
Control

Statistical analysis

The experiment was laid out in Randomized Complete Block (RCBD) design with three treatments and each treatment was replicated three times. The collected data were analyzed with analysis of variance ANOVA and means was separated by using LSD test at 5% level of significance (Steel and Torrie, 1980) [13].

3. Results

Efficacy of botanical extracts on percent infestation of cabbage looper

Botanical extracts were applied when sufficient infestation of cabbage looper were seen in the experimental plot. After the application of botanical extracts data were taken after the interval of 24, 48, 72 and 168 hours, respectively. The data collection procedure was similar to (Abbas *et al.*, 2005). [1] The data after 24 hours of application revealed that statistically all the treatments are significantly difference from each other plot treated with Garlic extract @3.00% showed significantly lowest infestation of cabbage looper (7.74%) followed by Ginger extract @3.00% (8.83%), Tobacco Extract @3.00% (9.33%) and highest infestation of cabbage looper recorded from the control plot was (32.43%). The data taken after 48 hours of application showed that lowest infestation of cabbage looper was recorded from the plot treated with Garlic extract @3.00% (6.22%) followed by Ginger extract @3.00% (7.23%), Tobacco Extract @3.00% (8.44%) while maximum infestation of cabbage looper was recorded from the control plot was (32.56%). Data recorded after 72 hours of application showed that after 72 hours effect of botanical extracts still remain in the field data revealed that lowest infestation of cabbage looper was recorded from the plot treated with Garlic extract @3.00% (7.11%) followed by Ginger extract @3.00% (8.62%), Tobacco Extract @3.00% (9.32%) while maximum infestation of cabbage looper was recorded from the control plot was (34.23%) the findings of our investigation was quite similar to the findings of (Rashid, 2011) [7] they stated that botanical extracts were useful for the control of insect pest if applied at initial stage of infestation. The data of percent infestation by the application of botanical extracts in cabbage plot showed that the effect of botanical extracts tend to decrease with passage of time as percent infestation and population of cabbage looper increase gradually after 168 hours lowest infestation was recorded in plot treated with Garlic extract @3.00% (13.07%) followed by Ginger extract @3.00% (15.91%), Tobacco Extract @ 3.00% (17.02%) while maximum infestation of cabbage looper was recorded from the control plot was (56.87%) Table II.

Table II: Efficacy of botanical extracts on percent infestation of cabbage looper after 24, 48, 72 and 168 hours after application

Treatments	Number of cabbage looper before spray	Number of cabbage looper 24 hours after spray	Number of cabbage looper 48 hours after spray	Number of cabbage looper 72 hours after spray	Number of cabbage looper 168 hours after spray	Overall mean
Garlic extract @3.00%	32.6a	7.74a	6.22a	7.11a	13.07a	8.53a
Ginger extract @3.00%	33.11a	8.83b	7.23bc	8.62b	15.91b	10.14b
Tobacco Extract@3.00%	31.23a	9.33b	8.44bc	9.32b	17.02c	11.02c
Control	32.43a	32.43c	32.56d	34.23c	56.87d	188.52
LSD value	36.3	8.87	8.96	9.03	14.52	

Mean in column sharing dissimilar letters are statistically different at 5% level of probability (LSD test)

4. Discussions

In the present investigation we investigate the effect of botanical extracts of Garlic extract @3.00%, Ginger extract @3.00% and Tobacco Extract @ 3.00% on percent infestation of cabbage looper under field conditions of Peshawar, Pakistan as the consumption of cabbage in Pakistan in more both raw, processed and cooked form. Cabbage looper is severe pest of cabbage usually for control of cabbage looper synthetic insecticides were used that have serious issues with human health and natural enemies. So for human health hazards and environmental pollution we make eco-friendly botanical extracts for its control we grown the golden Acre variety of cabbage application of treatments were done when infestation of cabbage looper infestation increase. Data were recorded as percent infestation of cabbage looper from head of selected five plants in each plot data were recorded after interval of 24 hrs, 48 hrs, 72 hrs and 168 hrs respectively (Peng *et al*, 2010) [6]. Results indicated that botanical extracts showed best results and percent infestation in treated plot and control plot have a vast difference as in control plot overall percent infestation recorded was (188.2%) while in plot treated with botanical extracts showed Garlic extract @3.00% (8.53%) followed by Ginger extract @3.00% (10.14%) and Tobacco Extract @ 3.00% (11.02%). Our aim study is to check the efficacy of botanical extracts on one of the most important pest of cabbage plant. The synthetic insecticide kills non-targeted beneficial insects including predators, parasite and parasitoids while the bio-pesticides have less effect on the beneficial insects (Zehnder, 2007) [8]. From the present investigation we conclude that for environmental safety and health hazards and protection of beneficial insects we suggest the use of botanical extracts of Garlic, Ginger and Tobacco Extracts @3.00% for control of cabbage looper in field from the start of infestation regular spray of botanical extracts to avoid severe infestation.

5. Conclusion and Recommendations

The results of present investigation revealed that botanical extracts are very helpful for the control of cabbage looper. We recommended that use of botanical extracts when infestations were seen in field in early stage as botanical extracts are eco-friendly.

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