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Management of *Callosobruchus chinensis* on Stored Chickpea (*Cicer arietinum*) with *Brassica juncea*

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Abstract: The efficacy of Taramira (*Brassica juncea*) oil, leaf powder and seed powder was tested against chickpea beetle (*Callosobruchus chinensis* L.) attacking stored chickpeas (*Cicer arietinum*). The taramira oil was applied at 0.125, 0.25, 0.5 and 1.0 mL/40 g of chickpea grains. Similar concentrations were applied in case of taramira leaf and seed powder. Observations were taken on the number of holes per grain of chickpea made by *C. chinensis*, number of eggs laid per grain, adult emergence from 10 egg laid grains and percent weight loss. It was concluded that the effect of taramira oil was significantly different from the control at all the concentrations applied. Best results were obtained by 1.0 mL of oil/40 g of chickpea grains. The 0.5 and 0.25 mL/40 g of grains also gave good results. Insect control was moderate at 0.125 mL/40 g of grains. Similar results were observed from leaf and seed powder. From the results it could be concluded that taramira could play an important role in the management of this pest.

Key words: Management, *Brassica*, anti-nutritional factors, fumigation, plant materials, Khattak's formula

INTRODUCTION

Control of stored product insect population mostly depends on the application of liquid and gaseous insecticides[1]. The repeated use of insecticides has disturbed the biological control systems by natural enemies and led to the outbreaks of insect pests, development of insect resistance, damaged non-target organisms and also led to environmental and human problems[1-3]. Malathion resistance has been widely documented from many important stored product insect pests throughout the world[3]. Due to these reasons scientists are trying to adopt alternative methods of pest control including use of plant materials.

Chickpea is important for its nutritive seeds having 25.3-28.9% protein contents after dehulling[4]. Many insect pests, fungi and viruses attack chickpeas both in field and storage conditions[5-8]. Among the stored insect pests, *Callosobruchus chinensis* is the major pest of chickpeas[9]. The attack of *C. chinensis* is associated with an increase in the anti-nutritional factors like saponin, phytic acid and trypsin inhibitor activity[10]. The attack of *C. chinensis* is also associated with a significant decrease in B complex vitamins[11]. The recommended methods which had been used for the control of bruchid beetles include the use of chemicals like BHC, DDT, derris, lindane, pyrethrum or fumigation with methyl bromide[6].

Different scientists have worked on many plant extracts including oils for the management of insect pests. Ethanol extracts of many plant materials including *Brassica juncea* have been used against *C. chinensis* with significant control[12]. Out of some oils, Neem oil has been noticed to give highest adults mortality in *C. chinensis*[13]. Caster oil was found to be more effective against *C. chinensis* attacking stored chickpea than ash and neem leaves[14]. Oils of different plant materials such as neem, groundnut, mustard, coconut, sunflower, sesame etc. have been found to be effective against *C. chinensis*[15-19]. Oils of *Azadirachta indica* and *Cedrus deodara* were tested against *Callosobruchus chinensis* with good results[20]. Out of several plant materials used against *Callosobruchus chinensis* the leaf powder of nishinda (*Vitex negundo*) proved to be most effective in reducing the number of eggs laid, adult emergence and seed weight losses[21].

The objective of this experiment was to test the efficacy of *Brassica juncea* to be used for the management of *Callosobruchus chinensis* attacking stored chickpeas.

MATERIALS AND METHODS

The experiment was carried out in the laboratory conditions at Department of Entomology, University of Arid Agriculture, Rawalpindi during 2003-04. Plastic jars of 250 g capacity were taken from the market and brought to the laboratory of Department of Entomology. Chickpea (*Cicer arietinum*) variety CM 2000 was obtained from

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Pulse Section of National Agriculture Research Centre, Islamabad.

In each plastic jar 40 g of un-infested chickpea grains were added along with ten pairs of adult *Callosobruchus chinensis* from the 1 day old adult culture. Oil of *Brassica juncea* (Taramera) was obtained by physical extraction using a local machine "Cohlu". *B. juncea* oil was applied in four treatments of 0.125, 0.25, 0.5 and 1.0 mL/40 g of chickpea grains along with one remained untreated as control. Each treatment was replicated three times. Treatments were assigned to the chickpea grains following Completely Randomized Design.

Oil was applied by soaking cotton in it. This was done so that the oil does not mix with the grains of chickpea. The jars were closed from their top using Muslin cloth and were placed in incubator. The average temperature and relative humidity of incubator were 30±2°C and 50±60% respectively. The data on average number of holes per grain, average number of eggs laid per grain, average number of adults emerged and percentage weight loss were collected at specific intervals.

RESULTS AND DISCUSSION

The data on different parameters were collected and then analyzed using a computer software Minitab and exhibited in the form of tables. The results on each parameter are discussed as under.

a) Effect of taramira oil on *Callosobruchus chinensis* L.

Number of holes per grains: It can be seen from the Table 1 that all the treatments of taramira oil (*Brassica juncea*) applied against *Callosobruchus chinensis* were significantly different from the control. 1.0 mL of oil proved to have maximum effect against *C. chinensis* and it was statistically different from all other treatments. Oil applied at 0.5 mL/40 g of chickpea grains also showed good results and these results were similar to 0.25 mL but different from 0.125 mL. Two treatments i.e. 0.25 and 0.125 mL gave equivalent results. Most severe damage was seen in case of control.

Number of eggs per grain: Table 1 show that when compared with the control, all the treatments were significantly different from the control. The results of taramira oil (*Brassica juncea*) at concentration of 1.0 mL/40 g of chickpea were highly significant but similar to 0.5 mL. Treatment 0.5 mL also gave good results which were not statistically different from 0.25 mL. Treatment 0.125 mL was not found effective against *Callosobruchus chinensis* in controlling the fecundity. Highest number of eggs laid by *C. chinensis* were found in case of control.

Number of adults emerged per ten chickpea grains: The results shown in Table 1 show that all the concentrations of Taramira oil (*Brassica juncea*) were significantly different from control. Least number of adults emerged in case of 1.0 mL of oil/40 g of chickpea grains. It was significantly different from all other concentrations of oil. Results from 0.5 and 1.0 mL were statistically similar and gave better results. Least effective of all the concentrations of Taramira oil was 0.125 mL by supporting more adult emergence. Highest number of adult emergence was observed in case of control.

Percent weight loss in chickpea: At the end of experiment percentage weight loss was calculated from all the samples following Khattak's formula[22] and is shown in the Table 1.

The results from all the Taramira oil treatments were significantly different from the control. Minimum weight loss was recorded in case of 1.0 mL of Taramira oil per 40 mL of chickpea grains. There was not significant difference between 0.5 and 0.25 mL and both showed good results. More weight loss was seen in case of 0.125 mL. Again maximum weight loss of chickpea grains was seen in case of control.

b) Effect of Taramira leaf powder on *Callosobruchus chinensis* L.

Number of holes per grain: All treatments used were significantly different from the control. One g of taramira leaf powder was significantly different from all other treatments resulting in minimum number of holes per grain. Three treatments i.e. 0.5, 0.25 and 1.125 g were similar to each other. Maximum number of holes were again resulted in case of control (Table 2).

Number of eggs per grain: Minimum number of eggs per grain were obtained in case of 1 g of taramira leaf powder. Treatment 0.5 and 0.25 g were similar to each other and statistically different from both 1 and 0.125 g and maximum eggs were found in case of control (Table 2)

Number of adults emerged per ten chick pea grains: Least number of adults emerged in case of 1 g of taramira leaf powder. Again 0.5 and 0.25 g of taramira leaf powder were similar to each other and different from 1 and 0.125 g. Again control supported the maximum emergence of adults of *Callosobruchus chinensis* from the eggs (Table 2).

Table 1: Effect of different concentrations of taramira oil on *Callosobruchus chinensis* L

Treatments (mL of Taramira Oil/40 g of Chickpea)	No. of holes/grain	No. of eggs/grain	No. of adults emerged/10 grains	% Weight loss
1.0 mL	0.0989±0.0226a	0.2234±0.028a	0.56±0.126985a	04.72±1.89a
0.5 mL	0.5214 ±0.095b	0.487±0.118bc	2.89±0.6584b	15.66±4.35b
0.25 mL	0.7189±0.1928bc	0.749±0.287c	2.944±0.854bc	25.9±6.324bc
0.125 mL	0.786±0.1825c	1.492±0.382d	4.833±1.0654c	56.25±8.65c
Control	1.566±0.365d	3.109±0.465e	9.3301±1.3654d	81.15±12.354d

Means followed by the same letters are not significantly different from one another at $\alpha = 0.05$

Table 2: Effect of different concentrations of taramira leaves on *Callosobruchus chinensis* L

Treatments (grams of Taramira leaves/40 g of Chickpea)	No. of holes/grain	No. of eggs/grain	No. of adults emerged/10 grains	% Weight loss
1.0	0.0667±0.0266a	0.1333±0.0666a	0.571±0.5715a	04.5888±1.677a
0.5	0.5333±0.2403b	0.4667±0.1763b	2.571±0.1088b	17.74±8.99b
0.25	0.7333±0.2403b	0.5333±0.1333b	2.809±1.6604b	28.12±4.2b
0.125	0.8±0.1154b	1.4±0.5033c	6.142±2.5605c	59.467±8.44c
Control	1.533±0.0666c	3.0±0.5773d	9.666±0.2898d	83.54±11.84d

Means followed by the same letters are not significantly different from one another at $\alpha = 0.05$

Table 3: Effect of different concentrations of taramira seed powder on *Callosobruchus chinensis* L

Treatments (grams of Taramira seed powder/40 g of Chickpea)	No. of holes/grain	No. of eggs/grain	No. of adults emerged/10 grains	% Weight loss
1.0	0.0547±0.0624a	0.399±0.026a	0.589±0.1083a	04.577±1.687a
0.5	0.677 ±0.268b	0.72±0.178b	2.569±0.5649b	17.755±8.983b
0.25	0.7125±0.1345b	1.88±0.962bc	2.897±1.69b	28.13±4.2b
0.125	0.984±0.205b	2.44±0.866c	6.154±2.5398c	59.158±8.45c
Control	1.426±0.0598c	4.211±1.276d	9.693±0.2938d	83.55±11.88d

Means followed by the same letter(s) are not significantly different from one another at $\alpha = 0.05$

Percent weight loss in chickpea: Minimum weight loss was observed in case of 1 g. Similar results were seen in case of 0.5 and 0.25 g of taramira oil which were significantly different from 0.125 g (Table 2) Maximum weight loss was observed in case of control.

c) Effect of Taramira seed powder on *Callosobruchus chinensis* L.

Number of holes per grain: Taramira seed powder decreased the number of holes per grain made by *Callosobruchus chinensis* and it was different from the control at all the concentrations. Minimum number of holes were seen at 1 g of taramira seed powder per 40 g of chickpea grains. There was no difference between 0.5, 0.25 and 0.125 g. Maximum number of holes were observed in case of control (Table 3).

Number of eggs per grain: The lowest number of eggs per chickpea were observed in case of 1 g. Treatment 0.5 g gave more number of eggs per grain which was similar to 0.25 g. Treatment 0.125 g was similar to 0.25 g but different to 0.5 g. Again control supported the egg laying (Table 3)

Number of adults emerged per ten chick pea grains: Minimum adults emerged in case of 1 g. Treatments 0.5 and 0.25 g were similar while 0.125 g resulted in more number of adults emerged. Maximum adults emerged in case of control (Table 3)

Percent weight loss in chickpea: Least weight loss was observed at 1 g. Treatments 0.5 and 0.25 g were similar to each other while 0.125 g resulted in more percent weight loss. The percentage weight loss was maximum in case of control (Table 3).

The scientists who worked on many plant extracts including oils for the management of insect pests including this pest reported ethanol extracts of many plant materials including *Brassica juncea* effective against *C. chinensis*[12]. Out of some oils, Neem oil has been noticed to give highest adults mortality in *C. chinensis*[13]. Castor oil was found to be more effective against *C. chinensis* attacking stored chickpea than ash and neem leaves[14]. Oils of different plant materials such as neem, groundnut, mustard, coconut, sunflower, sesame etc. have been found to be effective against *C. chinensis*[15-19]. Oils of *Azadirachta indica* and *Cedrus deodara* were tested against *Callosobruchus chinensis* with good results[20]. Out of several plant materials used against *Callosobruchus chinensis* the leaf powder of nishinda (*Vitex negundo*) proved to be most effective in reducing the number of eggs laid, adult emergence and seed weight losses[21].

It could be concluded that the effect of taramira was significantly different from the control at all the concentrations applied. Best results were obtained by 1.0 mL of oil (g in case of powder)/40 g of chickpea grains. The 0.5 and 0.25 mL (g)/40 g of grains also gave good results. Insect control was moderate at

0.125 mL (g)/40 g of grains. From the results it could be concluded that taramira could play an important role in the management of this pest.

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