EFFICACY OF SOME BOTANICALS AGAINST PULSE BEETLE, 
CALLOSOBRUCHUS CHINENSIS (L.) IN CHICKPEA

V. Venkatesham et al.,

KEYWORDS

Callosobruchus chinensis
Chickpea
Botanical extracts
Seed damage
Weight loss
INTRODUCTION

Pulses are the richest source of protein. Among the pulses, chickpea [Cicer arietinum (L.)] is having vital role in the diet of rural and urban masses. Under normal conditions of storage, chickpea is damaged by a bruchid viz. Callosobruchus chinensis (L.) up to a great extent especially at the farmer/trader level where storage conditions are not up to the mark and susceptible for the insect attack. Pulse beetle causes loss to a great extent. (Aslam and Suleman, 1999) revealed that pulse beetle (C. chinensis L.) is a destructive pest of chickpea under storage. Hence, it becomes inevitable to control this insect by using various suitable control measures like sun drying, use of inert dusts, therefore the Synthetic organic chemicals are used to protect stored pulses and found effective in controlling the pest but having the toxic effect to grain and human beings. Since use of insecticides is not advised on food grains directly, it has been practice in the past to use plant extract as grain protectants (Jilani et al., 1988). (Mann et al., 2002) revealed the increasing concern about pesticide accumulation in the environment which has stimulated the search for natural compounds that could replace synthetic insecticides in insect pest control. This has led to diversify the control measures that should be non-toxic and effective approach against the pulse beetle. The plant products such as roots, barks, leaves, flowers are admixed with grain. Due to non-toxic nature of these products, they have been well used for small-scale storage, domestic purposes in rural areas. The losses caused by pulse beetle were estimated by releasing 5 pairs of adults in jars each containing 500g chickpea grains. The lowest mean seed damage and weight loss were recorded in case black paper treated seed (5 g/kg) and Groundnut oil (5 mL/kg) i.e., 0.00, 0.00 per cent and 0.07, 0.07, respectively after 30 days. Similar trend was found even after 120 days i.e., 0.00 per cent and 0.29, 0.31, respectively. Next best treatment was Mustard oil (5 mL/kg) seed damage and weight loss i.e., 0.41 and 0.59, respectively after 30 days. And after 90 days it was 0.61 and 0.80, respectively. The descending order of remaining treatments is asafoetidia, sesamum oil and chilli they were also found to be significant in reducing the seed damage and weight loss as compared to control. However, black pepper and groundnut oil provided the best protection of chickpea seed against the pulse beetle.

MATERIALS AND METHODS

A Laboratory experiment was conducted on “Estimation of losses in stored chickpea caused by pulse beetle, Callosobruchus chinensis L.” In the Department of Entomology and Agricultural Zoology, Banaras Hindu University, Varanasi during year 2013-14.

Rearing and maintenance of culture

The nucleus culture of the test insect was obtained from storage laboratory, Department of Entomology and Agricultural Zoology, BHU. The culture of pulse beetle was maintained on chickpea at room temperature in the Bio-agent laboratory. Chickpea obtained from local market at Varanasi. It was cleaned, washed, dried and then sterilized at temperature of 50°C overnight to eliminate the hidden infestation, if any. The nucleus culture of C. chinensis was started from a single pair and was multiplied in rearing jars (25cm × 15 cm × 10cm) by releasing...
10 pairs of one day old adults in each glass jar containing 500g seeds for oviposition. After 48 h adults were removed from the jars and discarded. The jars were covered with muslin cloth and tied up with rubber bands. These jars were kept at ambient condition in the laboratory. In order to get a continuous fresh supply of adults of *C. chinensis* for experimentation dated culture was maintained at regular time intervals using the above rearing technique. Care was taken not to touch the seeds and test insects by hand. During experimentation a pair of forceps, Camel hair brush and aspirator was invariably used for transferring insects in seeds.

**Efficacy of botanicals/oils**

With a view to determine relative efficacy of different botanicals against the pulse beetle, *C. chinensis* L., in chick pea, cylindrical glass jars of 2 kg capacity covered with muslin cloth were used for keeping the treated seed samples. These jars were labeled as per the treatment and replication. Each treatment (Table 1) was mixed with 500g chick pea seeds and replicated thrice. Five pairs of freshly emerged (0-24 hours old) pulse beetles were released in each replicate. The seeds and fruits of various plant materials were dried under the shade and then dried material was powdered in an electric grinder. The powder of black pepper, chilli, asafoetida, ground nut oil, sesame oil, mustard oil was prepared on weight basis (Table 1).

**Per cent Damage**

For evaluating the effect of botanicals against the pulse beetle *C. chinensis*, the number of damaged seeds out of total number of seeds taken for observation (10 g) was counted in each replicate. Per cent seed damage was calculated after 1, 2, 3 and 4 months of treatments by the formula as described by (Adams and Schuten, 1978).

\[
\text{% seed damage} = \frac{\text{No. of holed seed}}{\text{Total no. of seeds counted}} \times 100
\]

**Weight loss**

After removing the beetles from each jar, the weight of seeds were taken separately on a single pan electric balance for each replicate after one, two, three and four months. The percent loss in weight due to insect damage was calculated by using the following formula of (Dabi et al., 1979).

\[
\text{% weight loss} = \frac{1 - F}{I} \times 100
\]

Where,

\( I = \text{Initial weight of seeds}, \ F = \text{Final weight of seeds}\)

**RESULTS AND DISCUSSION**

Effect of botanicals on seed damage and weight loss

Efficacy of botanicals in protecting chickpea from *C. chinensis* showed that after one month of storage period black pepper at 5g/kg and groundnut oil at 5ml/kg seed were the best protectants and there was no development of bruchid after its application. Black pepper and groundnut oils were equally effective after two months of storage, as it gave cent per cent protection (Table 2). In all other treatments, there was an increase in the per cent damage and weight loss. Mustard oil at 5ml/kg seed was next to black pepper and groundnut oil in effectiveness (0.52 per cent seed damage and 0.68 per cent weight loss). Even after three months, the pulse beetle treated with black pepper and groundnut oil showed zero per cent damage and weight loss proving it to be the best protectant.

Four months after storage black pepper and groundnut oil were the only treatments to retain its effectiveness (zero per cent damage and weight loss). The treatment mustard oil at 5ml/kg seed was third best protecting chickpea. The treatments asafoetida at 5g/kg, chilli 5g/kg, and sesame 5ml/kg seed afforded effective protection against the bruchid damage and weight loss for four months as compared to the control (100.00 per cent damage and 48.83 per cent weight loss) (Table 3).

### Table 1: Botanical materials used against *C. chinensis* infesting chickpea

<table>
<thead>
<tr>
<th>Common name</th>
<th>Scientific name</th>
<th>Family</th>
<th>Plant parts used</th>
<th>Conc. which were used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black pepper</td>
<td><em>Piper nigrum</em> L.</td>
<td>Piperaceae</td>
<td>Seed powder</td>
<td>5g/kg</td>
</tr>
<tr>
<td>Chilli</td>
<td><em>Capsicum annuum</em></td>
<td>Solanaceae</td>
<td>Fruit powder</td>
<td>5g/kg</td>
</tr>
<tr>
<td>Asafoetida</td>
<td><em>Phelura asafoetida</em></td>
<td>Pheluraceae</td>
<td>Root extract</td>
<td>5g/kg</td>
</tr>
<tr>
<td>Groundnut oil</td>
<td><em>Arachis hypogea</em></td>
<td>Fabaceae</td>
<td>Seed oil</td>
<td>5ml/kg</td>
</tr>
<tr>
<td>Mustard oil</td>
<td><em>Brassica juncea</em></td>
<td>Cruciferaeae</td>
<td>Seed oil</td>
<td>5ml/kg</td>
</tr>
<tr>
<td>Sesame oil</td>
<td><em>Sesamum indicum</em></td>
<td>Pedaliaceae</td>
<td>Seed oil</td>
<td>5ml/kg</td>
</tr>
</tbody>
</table>

### Table 2: Effect of different botanicals/oils on seed damage caused by the pulse beetle in chickpea after one, two, three and four months of storage

<table>
<thead>
<tr>
<th>Botanical/oils</th>
<th>Dosage</th>
<th>% seed damage after 30 days</th>
<th>After 60 days</th>
<th>After 90 days</th>
<th>After 120 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black pepper</td>
<td>5g/kg</td>
<td>0.00 (0.00)</td>
<td>0.00 (0.00)</td>
<td>0.00 (0.00)</td>
<td>0.00 (0.00)</td>
</tr>
<tr>
<td>Asafoetida</td>
<td>5g/kg</td>
<td>1.33 (6.62)</td>
<td>9.17 (17.63)</td>
<td>18.16 (25.22)</td>
<td>28.03 (31.97)</td>
</tr>
<tr>
<td>Chilli</td>
<td>5g/kg</td>
<td>6.50 (14.77)</td>
<td>51.14 (45.65)</td>
<td>88.33 (70.02)</td>
<td>98.17 (82.22)</td>
</tr>
<tr>
<td>Groundnut oil</td>
<td>5ml/kg</td>
<td>0.07 (1.52)</td>
<td>0.11 (1.87)</td>
<td>0.21 (2.63)</td>
<td>0.29 (3.10)</td>
</tr>
<tr>
<td>Mustard oil</td>
<td>5ml/kg</td>
<td>0.41 (3.66)</td>
<td>0.52 (4.12)</td>
<td>0.55 (4.24)</td>
<td>0.61 (4.48)</td>
</tr>
<tr>
<td>Sesame oil</td>
<td>5ml/kg</td>
<td>6.20 (14.41)</td>
<td>47.28 (43.44)</td>
<td>67.51 (55.25)</td>
<td>80.08 (63.49)</td>
</tr>
<tr>
<td>Control</td>
<td>-</td>
<td>-</td>
<td>7.57 (15.97)</td>
<td>56.03 (48.46)</td>
<td>92.62 (74.24)</td>
</tr>
<tr>
<td>SEM</td>
<td>-</td>
<td>0.065</td>
<td>0.180</td>
<td>0.056</td>
<td>0.142</td>
</tr>
<tr>
<td>CD at 5%</td>
<td>-</td>
<td>0.198</td>
<td>0.550</td>
<td>0.171</td>
<td>0.434</td>
</tr>
</tbody>
</table>

*Figures in parenthesis are angular transformed values of percentage*
The present finding is in conformity with the results of Mandeep Pathania Thakur, (2009) revealed that black pepper fruit powder caused 100 per cent mortality after 7 days’ exposure thereby minimizing the weight loss of seeds as a result of pest infestation at 0 per cent. Similar result was found by Kumud Rai Pandey (2011), Anshtu et al. (2010), Shah Hussain, (2008), Devi and Kalita, (2011) revealed that percentage of grain damage and percentage of weight loss, was observed the most effective in black pepper treated seed, Vaidya and Mehta (2000). Singh and Jakmola (2011) who reported grain damage was protected by the number of plant powders. Mummigatti and Raghunathan, (1977) reported that oils of groundnut, and mustard inhibited the multiplication of C. chinensis. Lower infestation of C. chinensis in green gram seeds treated with groundnut oil, as reported by Sujatha and Punnaiyah, (1985). Singh et al. (2006) recorded no weight loss on pea seeds treated with mustard oil at 2mL/kg. Jat et al. (2013) reported that the losses were increased with increase in storage period

From the present study, it can be concluded that black pepper 5g/kg, groundnut oil 5mL/kg seed can be used for successful protection of chickpea seeds up to four months of storage. These treatments are likely to be economical.

REFERENCES


