INCIDENCE AND EXTENT OF DAMAGE DUE TO INSECT PESTS OF STORED CHICKPEA CICER ARIETINUM (L.) IN HARYANA STATE, INDIA

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ABSTRACT

Chick pea, Cicer arietinum (L.) an important leguminous crop, is commonly cultivated in different parts of world, where it is often severely damaged in storage conditions. So, the main constraint for production of chick pea is post-harvest loss during storage. The chick pea production amounted to 75.5 per cent of the total pulses production and storage was 57.9 per cent of total chick pea production of surged farmers. Five insect pests i.e. Callosobruchus chinensis (L.), Tribolium castaneum (H.), Trogoderma granarium (E.), Rhizopertha dominica (E.), and Sitophilus oryzae (L.) were observed in stored chick pea. The present study concluded that major insect infesting chick pea was C. chinensis which reached its peak during September – October and the grain damage was rated the highest during January-February (13.75 %) and lowest during June-July (3.05 %).

Key words: Chick pea, Callosobruchus chinensis, Incidence, Damage, Storage.

INTRODUCTION

Pulses are wonderful gift of nature as they nourish mankind with highly nutritious food and keep the soil alive and productive by fixing atmospheric nitrogen into soil without any extra cost. They constitute the main source of plant protein in developing countries like India, where per capita availability of pulses is 39.9 g/day (Chaturvedi and Ali, 2000) i.e. very low as against FAO/WHO’s recommendation of 80 g/capita/day. Chick pea is the most important pulse crop of India and occupies 8.17 million hectares with production of 7.48 million tones, accounting for 35.09 per cent and 51.02 per cent of total area and production, respectively. In Haryana total production of chick pea during 2009-2010 was 0.06 million tones covering in about 0.08 million hectares (Anonymous, 2011).

In the developing world, three quarters of all seeds planted are derived from stocks maintained in the store houses by farmers. Although these stocks provide farmers with a degree of food security, they are susceptible to losses or damage caused by insects, rodents, fungal attack and environmental changes. Out of five species, Callosobruchus chinensis (L.), C. maculates (L.), C. analis (F.) were reported to occur in stored pulses (Raina, 1970) while Srivastava and Dadheech (1973) reported that Callosobruchus chinensis (L.) and C. maculates (L.) were the most common species. Mookherjee et al. (1970) witnessed Trogoderma granarium (E.) and Rhizopertha dominica (F.) in addition to bruchids in store gram. chick pea, Cicer arietinum (L.) an important leguminous crop, is commonly cultivated in different parts of world, where it is often severely damaged in storage. So, the main constraint for production of chick pea is post-harvest loss during storage. The bruchids have been observed to be the most important species in chick pea, C. arietinum (L.) during storage (Sarwar et al., 2005). The present investigation was undertaken to assess the incidence of insect pests in stored chick pea.

MATERIALS AND METHODS

The experiment was carried out in Haryana state under CMJ University, Shillong. The state was divided into four agro climatic zones keeping in view the climatic conditions, particularly the rain-fall, and contiguity of the area (Dass, 1977). Zone I, II, III and IV, which included Kaithal and Jind, Rohtak and Sonipat, Rewari and Mohindergarh, and Bhiwani and Hisar districts, respectively. From each
zone 10 villages were selected and from each village
5 farmers were selected at random to collect chickpea
samples during the study period. The collection of
sample was done during June-July (1st survey),
September-October (2nd survey) and January-
February (3rd survey) from 40 villages. Information
on production of pulses, storage and marketable
surplus, was recorded. A representative sample of
approximately 2kg was taken from each farmer and
sub-sample of approximately 500gm was brought
for further studies. Representative sub-sample of
100gm was taken from original 500gm sample. Live
adult bruchids were collected in small plastic jars
and counted. Therefore, the sub-sample was spread
in a tray and live insects of other species were
counted. In case of T. granarium and T. castaneum
both adults and larvae were counted while in others
only adults were considered. Mean population of
each insect species, in each village and each zone
and finally in the whole state, was calculated.
Population fluctuation during different survey was
worked out. To study the grain damage, samples of
1000 grains were taken randomly from the
representative sample. Damaged and undamaged
grains were separated and their number was
counted. The percentage of grain damage was
calculated with the following formula:

Number of bored grains
Percent grain damage = × 100
Total number of grains counted

On the basis of this data, per cent grain
damage in each zone and in the whole state was
worked out. To confirm the damaging nature of
insects available during the course of survey, two
categories i.e. sound and broken chickpea grains
were put separately in rearing jars. About 50 insects
of each species were introduced to each jar and the
mouth of the jar was covered with muslin cloth. The
experiment was replicated thrice. Two months later,
all the insects were removed. The trial was
abandoned and types of damage to the grains
inflicted by the insects were recorded. To study the
loss of weight, the damaged and undamaged grains
were separated from a sample of 1000 grains and
weighted to record their weight separately on an
electric single pen balance. Finally, the percentage
of weight loss was calculated with the following
formula after Srivastava et al. (1971). Mean values
of per cent loss in weight of infested grains were
calculated for each village, each zone and the whole
state. An index in the form of grain damage per unit
loss in weight was also worked out. The statistical
analysis was done as per procedure suggested by

RESULTS AND DISCUSSION

Production and storage pattern of pulses in
Haryana

A survey was conducted on 200 farmers in
2011-12, out of total production of 1346 quintals
of all types of pulses, 51.9 per cent was stored by
the farmers and the rest 48.1 per cent was the
marketable surplus. Out of the total production
of pulses, chickpea was 1016 quintals and its
storage was 589 quintals which was 57.9 per cent
of total chickpea production. The production of
all the pulses was in decreasing order of chickpea
> moong > arhar. The chickpea production
amounted to 75.5 per cent of the total pulses
production. Thus, the importance of chickpea,
from the point of view of production and storage at
farmer's levels, in Haryana, was considerably more
than all the other pulses.

<table>
<thead>
<tr>
<th>Name of insects</th>
<th>Per cent samples infested by insects</th>
<th>Population of insects (Mean Population/100g grains in zones)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Surveys</td>
<td>Surveys</td>
</tr>
<tr>
<td></td>
<td>1st</td>
<td>2nd</td>
</tr>
<tr>
<td>C. chinensis</td>
<td>15.75 (19.34)</td>
<td>38.05 (35.25)</td>
</tr>
<tr>
<td>T. castaneum</td>
<td>16.50 (20.47)</td>
<td>26.5 (29.85)</td>
</tr>
<tr>
<td>T. granarium</td>
<td>15.00 (18.45)</td>
<td>14.88 (19.26)</td>
</tr>
<tr>
<td>R. dominica</td>
<td>11.50 (15.16)</td>
<td>17.13 (21.89)</td>
</tr>
<tr>
<td>S. crygae</td>
<td>0.00 (1.81)</td>
<td>0.00 (1.81)</td>
</tr>
<tr>
<td>C.D. at 5%</td>
<td>4.84</td>
<td>4.46</td>
</tr>
<tr>
<td>Total of the State</td>
<td>30.3</td>
<td>50.7</td>
</tr>
</tbody>
</table>

Figures in the parenthesis are "n+1" transformed values
Sample infested during different survey periods:

Five insect pests namely Callosobruchus chinensis (L.), Tribolium castaneum (H.), Trogoderma granarium (E.), Rhizopertha dominica (F.), and Sitophilus oryzae (L.) were observed in stored chickpea. Four insects i.e. C. chinensis, T. castaneum, T. granarium and R. dominica were found in all three survey periods while S. oryzae was observed during 3rd survey period. Data on sample infestation during different surveys (Table 1) revealed that a maximum of 50.7 per cent samples were found infested during September-October followed by 43.3 per cent during January-February and minimum 30.3 per cent during June-July. The samples infested by C. chinensis (38.05 %) and R. dominica (17.13 %) were observed maximum during September-October. A fast increase in the infestation of C. chinensis was observed up to September-October but it was steady in case of T. castaneum and R. dominica. The infestation of T. castaneum increased with storage period and 16.5, 26.5 and 29.0 per cent samples were found infested during June-July, September-October and January-February, respectively. But the infestation of sample by T. granarium decreased with storage period. The infestation by S. oryzae was absent during June-July and September-October and also found negligible in 3rd survey periods.

Population of insects: The population of different insects, in different surveys (Table 1), clearly shows that the population of all insects which was as low as 5.9 during June – July increased enormously to 20.2 during September – October but again declined considerably to a low level 3.9 during January – February. The population of T. castaneum increased from 1.3 in June – July to 1.58 in January – February with the increased storage periods. The population of T. granarium increased from 0.98 during June – July to 1.55 during September – October but again decreased to 0.2 during January – February in 100gm grain sample. The population of C. chinensis fluctuated much during different periods of storage as it was 2.8 during June – July which increased to 16.15 during September – October but declined the negligible level of 0.95 during January – February. Thus, it could be concluded that major insect infesting chickpea was C. chinensis which reached its peak during September – October. T. castaneum, T. granarium and R. Dominica were of lesser and S. oryzae was of negligible importance. Based on the results of per cent samples infestation, out of five insects observed in the state, only four namely: C. chinensis, T. granarium, T. castaneum, R. dominica were commonly observed. Borikar et al. (1977) observed rice weevil, lesser grain borer, khapra beetle,

| Table 2: Per cent samples infested and villages having infestation during different periods in different zones |
| Zone | Per cent samples infested | Per cent villages surveyed having infestation |
|      | Surveys | 1st | 2nd | 3rd | Mean | Surveys | 1st | 2nd | 3rd |
| I    | 30.1 | 42.1 | 31.6 | 34.6 |      | 100 | 100 | 90 |
| II   | 28.3 | 53.9 | 51.0 | 44.4 |      | 95  | 100 | 90 |
| III  | 30.0 | 50.7 | 43.3 | 41.3 |      | 100 | 100 | 90 |
| IV   | 32.6 | 56.2 | 47.2 | 45.3 |      | 90  | 100 | 80 |
| Mean for whole state | 30.3 | 50.7 | 43.3 |      | 96.3 | 100 | 87.5 |

| Table 3: Per cent grain damage during different surveys |
| Zone | Mean grain damage during |
|      | Survey | 1st | 2nd | 3rd |
| I    | 0.6(6.80) | 3.6(8.60) | 3.9(7.76) | 2.7(7.72) |
| II   | 1.9(6.74) | 7.8(15.67) | 7.9(11.00) | 5.87(11.14) |
| III  | 4.1(12.44) | 14.9(21.21) | 21.9(27.58) | 13.63(20.41) |
| IV   | 5.6(12.35) | 19.4(26.39) | 21.3(26.93) | 15.43(21.89) |
| Mean for State | 3.05(9.58) | 11.49(17.97) | 13.75(18.32) |

C.D. at 5% for: Survey = (2.84), Zone = (3.29), Survey x zone = (5.70)
Figures in the parenthesis are Angular transformed values.
**TABLE 4:** Per cent samples having grain damage and loss in grain weight during different surveys

<table>
<thead>
<tr>
<th>Zone</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; Survey</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; Survey</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; Survey</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; Survey</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; Survey</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>12.0</td>
<td>20.0</td>
<td>26.9</td>
<td>0.2</td>
<td>1.2</td>
<td>1.6</td>
</tr>
<tr>
<td>II</td>
<td>15.0</td>
<td>42.0</td>
<td>28.8</td>
<td>0.8</td>
<td>2.9</td>
<td>2.6</td>
</tr>
<tr>
<td>III</td>
<td>30.0</td>
<td>52.6</td>
<td>61.6</td>
<td>2.4</td>
<td>5.0</td>
<td>7.9</td>
</tr>
<tr>
<td>IV</td>
<td>29.0</td>
<td>65.7</td>
<td>92.2</td>
<td>1.4</td>
<td>6.1</td>
<td>6.5</td>
</tr>
<tr>
<td>Mean</td>
<td>21.5</td>
<td>45.1</td>
<td>52.4</td>
<td>1.2</td>
<td>3.8</td>
<td>4.7</td>
</tr>
</tbody>
</table>

**B. chinensis, T. cataneum** and flat grain beetle with average population of 0.25, 1.00, 0.25, 4.50/0.50 and 4.50 insects in 100g sample of chickpea, respectively.

**Samples infested during different periods in different zones:** Total number of samples infested during September-October (50.7 %) was higher than other survey periods (Table 2) while the same was the least during June-July (30.3 %). Overall infestation of 45.3 per cent samples was the maximum in zone IV followed by 44.4, 41.3 and 34.6 per cent in zone II, III and I, respectively.

**Per cent villages surveyed infested by insects:** All the surveyed villages had one or the other species of infesting chickpea (Table 2). During June-July, it was only in zone IV and II that samples collected from 10.0 and 5.0 per cent villages, respectively were found free from insects. During the 2<sup>nd</sup> survey, all the samples throughout the state were found infested by one or the other species of insect. During the 3<sup>rd</sup> survey, 20.0 per cent villages in zone IV and 10.0 per cent villages in zone I, II and III were found free from insects.

**Grain damage:** *C. chinensis* was found damaging the grain of both categories i.e. sound and broken grained while the remaining observed insects except *S. oryzae* could feed only on broken grains. So, in this study *C. chinensis* was observed the primary insect-pest of stored Chickpea while *T. granarium*, *T. castaneum* and *R. dominica* were the secondary insect-pests. *S. oryzae* was observed as the scavenger. The mean grain damage of 13.75 and 11.43 per cent was found during the 3<sup>rd</sup> and 2<sup>nd</sup> surveys, respectively which was significantly higher than the grain damaged of (3.05 %) during 1<sup>st</sup> survey. Among the zones, the highest grain damage of 15.43 per cent was in zone IV followed by 13.63, 5.87 and 2.7 per cent in zone III, II and I, respectively. There was no significant difference between zone IV and III, and also between zone II and I (Table 3). Shaheen (2006) reported that damage/infestation by Pulse beetle to stored chickpea proved this pest as a major one, causing more than 10 per cent damage. During the 1<sup>st</sup> survey, maximum grain damage of 5.6 per cent was recorded in zone IV followed by 4.1, 1.9 and 0.6 per cent in zone III, II and I, respectively. In 2<sup>nd</sup> survey, the same trend was observed. The maximum grain damage of 19.4 per cent was recorded in zone IV followed by 14.9, 7.8 and 3.6 per cent in zone III, II and I, respectively. There was no significant difference between zone III and IV but these significantly differed with zone II and I. During the 3<sup>rd</sup> survey, maximum grain damage of 21.9 and 21.3 per cent was recorded in zone III and IV, respectively. There was no significant difference between these zones, but significantly differed with zone II and I. During January-February, the average grain damage was 52.4 per cent, the being 26.9 to 92.2 per cent of the samples.

**Per cent loss in grain weight:** With the increase in storage periods, the per cent loss in grain weight increased from 1.2 per cent during June – July to 4.7 per cent during January – February (Table 4). During June – July, the highest loss of 2.4 per cent was recorded in zone III and minimum of 0.2 per cent in zone I. During September – October, a maximum loss of 6.1 per cent was observed in zone IV and a minimum of 1.2 per cent in zone I. During January – February, a maximum loss of 7.9 per cent in zone III and minimum of 1.6 per cent was observed in zone I.
REFERENCES


