Journal of Advances in Science and Technology

Vol. IV, No. VII, November-2012, ISSN 2230-9659

STUDIES ON EXTENT OF DAMAGE IN CHICKPEA, CICER ARIETINUM (L.) DUE TO PULSE BEETLE, CHALLOSOBRUCHUS CHINENSIS (L.) DURING DIFFERENT STORAGE PERIOD

www.ignited.in

Journal of Advances in Science and Technology
Vol. IV, No. VII, November-2012, ISSN 2230-9659

Studies on Extent of Damage in Chickpea, Cicer Arietinum (L.) Due to Pulse Beetle, Challosobruchus Chinensis (L.) During Different Storage Period

Rupesh Sharma[1] Dr. Renu Devi[2]

[1]Research Scholar, CMJ University, Shillong, Meghalaya, India

[2]Dr. Renu Devi, Training Assistant, K.V.K., Kurukshetra (Haryana)

Abstract – Chickpea samples were collected from randomly selected 200 farmers of 40 villages (10 villages from each 4 zones) during the study period. The collection of sample was done during June-July, 2011 (1st survey), September-October, 2011 (2nd survey) and January-February, 2012 (3rd survey). Thus in the state as a whole, in stored chickpea C. chinensis was the major insect pest during storage. The grain damage was rated the highest during January- February (13.75 %) and lowest during June- July (3.05 %). It was 11.43 % during September- October. The loss in weight was 4.7 % during January- February, 3.8 % during September- October and 1.2 % during June- July. A maximum of 85.0 % surveyed villages had grain damage during September- October and lowest of 66.3 % during June- July. During January- February none of the village was found free from insect attack in zone III and IV. The grain damage in the samples, from different farmers ranged 0 – 86.0 % during January- February in weight, in the state.

----------♦----------

INTRODUCTION

In India pulses occupy 23.28 million hectares area and contribute 14.66 million tones to the world's food basket. Chickpea 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 % and 51.02 % of total area and production, respectively. The chickpea producing areas mainly are the upper basin Ganga and Yamuna viz, Punjab, Haryana, Uttar Pradesh and Bihar and the adjoining tracts of central India viz, Rajasthan, Madhya Pradesh and Maharastra. In Haryana total production of chickpea during 2009-2010 was 0.06 % million tones covering about 0.08 million hectares (Anonymous, 2011).

The beetle family Bruchidae is closely associated with the plant family leguminoseae. Among the pulse beetles, Callosobruchus chinensis (L.), C. maculatus (Fabricius) and C. analis (Fabricius) are the major pests of stored pulses (Mookerjee et al.1970). They are responsible for causing serious losses in store and field with the estimated loss of nearly 0.21 million tones, costing around 315 million rupees (Rathore and Sharma, 2002).

The pulse beetle, a serious pest of all pulses does not only cause quantitative loss but also cause qualitative losses by reducing nutrition and germination, which make pulses unfit for human consumption (Raghvani and Kapadia, 2003).

Among the species of pulse beetle, Callosobruchus chinensis (L.), C. maculatus (F.) and C. analis (F.) are responsible for causing severe damage to stored pulses and are very important from economic point of view. Although these beetles are primarily considered as storage pests but have also been reported as a field pests and infestation may enter the stores from field (Raina, 1971). In India, loss of chickpea seeds due to bruchids alone has been estimated to be 4.8 per cent (Mookherjee et al., 1970).

According to a survey from Haryana conducted during 1973-74, 63.3 % of total Bengal gram production is stored with farmers and the rest 36.7 % is marketable surplus (Dass, 1977). Thus a major portion of gram produced is stored in rural storage structures where it is likely to be damaged by insect-pests, rodents, mites, micro-organisms etc.

Chickpea, 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 chickpea is post-harvest loss during storage. The bruchids have been observed to be the most important species in chickpea, C. arietinum (L.) during storage (Sarwar et al., 2005).

Shaheen (2006) observed the pest status of Pulse Beetle (PB), Callosobruchus chinensis L., in the Punjab province of Pakistan. Per cent damage/infestation by PB to stored chickpea proved this pest as a major one, causing more than 10% damage.

Pokharkar P.K.and Mehta D.M. (2011) reported that Callosobruchus chinensis (L.) is primary and most destructive pest of stored pulses. Pulse beetle causes not only quantitative but also qualitative losses like nutritive loss and germination loss.

MATERIALS AND METHODS

Haryana 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 which included the northern district of Kaithal and Jind had the highest rainfall and longest duration of monsoon. In this zone temperature extremes were less. Zone II included the central districts of Rohtak and Sonepat which had a moderate rainfall. Zone III comprised of the southern districts of Rewari and Mohindergarh with rainfall next to zone I, but extremes of temperature were more than zones I and II, being closed to Rajasthan desert. Zone IV comprised of the western districts of Bhiwani and Hisar having the lowest rainfall and the maximum temperature extremes.

From each zone 10 villages were selected at random. From each village, data were collected from five representative farmers. Thus the results given in this thesis are based on sample from 200 representative farmers from 40 villages, spread over the whole state.

SAMPLING FOR INSECT SPECIES:

Chickpea samples were collected from each of the farmers. Samples were collected three times i.e. June-July, 2011 (1st survey). September- October, 2011 (2nd survey) and January- February, 2012 (3rd survey). A representative sample of approximately 2kg was taken from each farmer. From this sample of 2kg, a representative sub-sample of approximately 500gm was kept in a polythene bag and sealed. It was put in a cloth bag and brought for further studies. For all the three survey, samples were collected from the same farmers.

The collected samples were analysed for obtaining the following details:

1. GRAIN DAMAGE

From the representative sample, a sample of 1000grains was taken at random. Damaged and undamaged grains were separated and their number was counted. The percentage of grain damage was calculated with the following formula:

$$\text{Per cent grain damage} = \frac{\text{Number of bored grains}}{\text{Total number of grains counted}} \times 100$$

On the basis of this data, per cent grain damage in each village, 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.

2. 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)

$$\text{Per cent loss in weight} = \frac{W1 - W}{W1} \times 100$$

Where,

W1 is the weight of sound grains of 1000 grains.

W is the weight of the total grains in the infested sample (sound + damaged grains).

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.

RESULTS AND DISCUSSION

Quantitative losses

(a) 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.

(i) Grain damage during different storage periods:

The mean grain damage of 13.75 and 11.43 % was found during the 3rd and 2nd surveys, respectively which was significantly higher than the grain damaged of (3.05 %) during 1st survey. Among the zones, the highest grain damage of 15.43 % was in zone IV followed by 13.63, 5.87 and 2.7 % 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 1).

Shaheen (2006) reported that damage/infestation by Pulse beetle to stored chickpea proved this pest as a major one, causing more than 10 % damage.

During the 1st survey, maximum grain damage of 5.6 % was recorded in zone IV followed by 4.1, 1.9 and 0.6 % in zone III, II and I, respectively.

During the 2nd survey, the same trend was observed. The maximum grain damage of 19.4 % was recorded in zone IV followed by 14.9, 7.8 and 3.6 % 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. There was a significant difference between zone III, II and I, During the 3rd survey, maximum grain damage of 21.9 and 21.3 % was recorded in zone III and IV, respectively. There was no significant difference between these zones, but significantly differed with zone II and I. There was also no significant difference between zone II (7.9 %) and I (3.9 %).

Table 1: Per cent grain damage during different surveys

Zone	Mean grain damage during			Mean	Range of grain damage during		
	1st Survey	2nd Survey	3rd Survey		1st Survey	2nd Survey	3rd Survey
I	0.6 (6.80)	3.6 (8.60)	3.9 (7.76)	2.7 (7.72)	0-9	0-18	0-32
II	1.9 (6.74)	7.8 (15.67)	7.9 (11.00)	5.87 (11.14)	0-16	0-29	0-41
III	4.1 (12.44)	14.9 (21.21)	21.9 (27.58)	13.63 (20.41)	0-26	0-42	0-59
IV	5.6 (12.35)	19.4 (26.39)	21.3 (26.93)	15.43 (21.89)	0-53	0-81	0-86
Mean for State	**3.05 (9.58)**	**11.43 (17.97)**	**13.75 (18.32)**		**0-53**	**0-81**	**0-86**

C.D. at 5% for: Survey = (2.84)

Zone = (3.29)

Survey x zone = (5.70)

Figures in the parenthesis are Angular transformed values

(ii) Range of grain damage:

The lowest limit of grain damage during all the survey periods, in all the zones was zero which showed that some farmers kept their grain completely safe from the attack of insects. The highest limit of 53.0 % grain damage during June – July was observed in zone IV and the lowest of 9.0 % in zone I. During September – October, maximum grain damage of 81.0 % was again found in zone IV and a minimum of 18.0 % in zone I. The same trend was observed during January- February. The highest grain damage 86.0 % was found in zone IV and the lowest of 32.0 % in zone I.

(iii) Range of grain damage:

The data in Table 2 revealed that the range of grain damage for different villages, in each zone or in the state, fell between the narrow levels as compared to the farmers. The lower limit of zero was observed during all the three surveys. During June - July, the range was 0 to 19.3 %. The corresponding range during September - October was 0 to 31.2 and during January - February 0 to 39.7 %. In the present study, grain damage increased with the storage period. The similar results had been reported by other workers (Rao et al., 1960; Rajan et al., 1975 and Deniel et al., 1977)

Table 2: Range of mean grain damage in different villages of each zone (%).

Zone	Survey		
	1st	2nd	3rd
I	0-2.1	0-19.0	0-21.2
II	0-8.3	3.1-11.9	0-23.1
III	0-9.1	10.0-29.1	7.1-36.2
IV	0-19.3	11.0-31.2	10.9-39.7
Whole State	0-19.3	0-31.2	0-39.7

(iv) Per cent samples having grain damage:

Data presented in Table 3 revealed that out of the total samples collected during June – July, 21.5 % of the samples were having damaged grain. A maximum of 30.0 % samples having such grain were recorded in zone III and the minimum of 12.0 % in zone I. During September – October on an average 45.1 % sample had grain damage with a maximum of 65.7 % in zone IV and minimum of 20.0 % in zone I. During January February, the average grain damage was 52.4 %, the being 26.9 to 92.2 % of the samples.

Table 3: Per cent samples having grain damage

Zone	Survey		
	1st	2nd	3rd
I	12.0	20.0	26.9
II	15.0	42.0	28.8
III	30.0	52.6	61.6
IV	29.0	65.7	92.2
Mean	21.5	45.1	52.4

(v) Per cent villages having grain damages:

Data presented in Table 4 indicated that a maximum of (85.0 %) villages had grain damage during September – October and minimum of (66.3 %) village during June – July. During June – July, a maximum of 90.0 % villages had grain damage in zone III and minimum of 40.0 % in zone II. During September – October, in zone III and IV none of the village was free from grain damage but in zone II and I, 10.0 and 50.0 % villages, respectively were from it.

During the January – February also all the villages had grain damage in zone III and IV whereas 60.0 % villages were free grain damage in each zone I and II.

Table 4: Per cent surveyed villages having grain damage

Zone	Survey		
	1st	2nd	3rd
I	45	50	40
II	40	90	40
III	90	100	100
IV	80	100	100
Mean	66.3	85	70

PER CENT LOSS IN GRAIN WEIGHT DURING DIFFERENT SURVEY:

With the increase in storage periods, the per cent loss in grain weight increased from 1.2 % during June – July to 4.7 % during January – February (Table 5).

During June – July, the highest loss of 2.4 % was recorded in zone III and minimum of 0.2 % in zone I. During September – October, a maximum loss of 6.1 % was observed in zone IV and a minimum of 1.2 % in zone I. During January – February, a maximum loss of 7.9 % in zone III and minimum of 1.6 % was observed in zone I.

Table 5: Per cent loss in grain weight during different surveys

Zone	Survey		
	1st	2nd	3rd
I	0.2	1.2	1.6
II	0.8	2.9	2.6
III	2.4	5.0	7.9
IV	1.4	6.1	6.5
Mean	1.2	3.8	4.7

RELATIONSHIP BETWEEN GRAIN DAMAGE AND LOSS IN WEIGHT:

An index showing units of grain damage for one unit of loss in weight was computed.

The indices which were obtained by dividing the per cent grain damage by per loss in weight had been shown in Table 6. The overall index for the state worked out 2.9 during June- July with a variation of 1.7 to 4.0 in different zones and 3.1 during September-October with a variation of 2.7 to 3.2 in different zones and 2.9 for January-February with a variation of 2.4 to 3.3. Thus it may be concluded that if the grain damage was 2.9 the loss in weight was one per cent.

Table 6: Relationship between grain damage and loss in weight (Units of grain damage for 1 unit of loss in weight).

Survey	Zone				
	I	II	III	IV	Mean for state
1st	3.0	2.7	1.7	4.0	2.9
2nd	3.0	2.7	3.0	3.2	3.1
3rd	2.4	3.0	2.8	3.3	2.9

CONCLUSION

Thus in the state as a whole, in stored chickpea C. chinensis was the major insect pest during storage. The grain damage was rated the highest during January- February (13.75 %) and lowest during June- July (3.05 %). It was 11.43 % during

September- October. The loss in weight was 4.7 % during January- February, 3.8 % during September- October and 1.2 % during June- July. During the period of maximum infestation, in January- February, the grain damage was maximum in zone III (21.9 %) followed by zone IV (21.3 %), II (7.9 %) and I (3.8 %). Loss in weight was 7.9 % in zone III, 6.5 % in zone IV, 2.6 % in zone II and 1.6 % in zone I. A maximum of 85.0 % surveyed villages had grain damage during September- October and lowest of 66.3 % during June- July. During January- February none of the village was found free from insect attack in zone III and IV. The grain damage in the samples, from different farmers ranged 0 – 86.0 % during January- February in weight, in the state.

REFERENCES

Anonymous. 2011. Agricultural Statistics at a Glance, 2010-2011. Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of. India, New Delhi.

Dass,S. 1977. Study of insect pests in rural storage structures of Haryana and estimation of quantitative and qualitative losses caused by them. Ph.D. Thesis. Haryana Agricultural University, Hisar.

Deniel, V.A., Rajan, P., Sanjeevayappa, K.V., Srivasan, S.K. and Swaminathan, M. 1977. Effect of insect infestation on the chemical composition and protein efficacy ratio of proteins of kaffir corn and green gram. Indian J. Nutr., **14**: 38-42.

Mookherjee, P.B., Jotwani, M.G., Yadav, T.D. and Sircar, P. 1970. Studies on the incidence and extent of damage due to insect-pests in stored seed. II. Leguminous and vegetable seeds. Indian J. Ent. **32** (4): 350-355.

Pokharkar P.K. and Mehta D.M. 2011. Biology of pulse beetle, callosobruchus chinensis in stored chickpea. Progressive Agriculture, **11** (1): 34-36.

Raghvani, B.R. and Kapadia M.N. 2003. Efficacy of different vegetable oils as seed protectants of pigeon pea against Callosobruchus maculatus (Fab.). Indian J. Plant Prot. **31**: 115-118.

Raina, A.K. 1971. Observation on bruchids as field pests of pulses. Indian J. Ent. **33** (3): 194-197.

Rajan, P., Sanjeevayappa, K.V., Daniel, D.A., Jayaraj, A.P. and Swaminathan, M. 1975. Effect of insect infestation on the chemical composition and nutritive value of maize and cowpea, Indian J. Nutr. Dietet., **12**: 325-332.

Rao, N.V., Nuggerhalli, R.N., Pingale, S.V., Swaminathan, M. and Subramanyam, V. 1960. Effect of insect infestation on stored field bean (Dolichos lablab) and black gram (Phaseolus mungo). Food Sci., **9**: 79-82.

Rathore, Y. S. and Sharma, V. 2002. Management of Bruchid Infestation in Pulses. In: Masood, A., Chaturvedi, S. K. and Gurha, S. N. (Eds.), Proceeding of National Symposium on Pulses for Sustainable Agriculture and Nutritional Security. Pp- 111-124.

Sarwar, M., Ahmad, N., Sattar, M., and Tofique, M. 2005. Evaluating the Seed's Reaction of Certain Chickpea Genotypes against the Action of Pulse Beetle, Callosobruchus analis L. (Bruchidae: Coleoptera). Pakistan J.l of Seed Technology, **1** (6), 14-21.

Shaheen, F.A. 2006. Integrated management of pulse beetle, Callosobruchus Chinensis L.(Coleoptera: Bruchidae) attacking stored Chickpea. Ph.D. thesis, University of Arid Agriculture, Rawalpindi.