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Effect of Insect Infestation (*C. Chinesis*) on the Physio-Chemical Properties of Green Gram (*Vigna Radiata* L. Wilzeck) During Storage

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INTRODUCTION

The legumes are rich in protein and form a major constituents of diets of masses in developing countries like India. They are all the more important because consumption of animal protein except milk is still a religious and social taboo. Legumes are grown widely throughout Asia, harvested twice a year and stored normally in jute bags and bins or in dark cemented store rooms. The post harvest handling and storage losses upto 8.5% of the total production (Anon, 1989) are quite common. During storage, legumes deteriorate qualitatively as well as quantitatively due to various physio-chemical and biological factors like temperature, humidity, storage structures, micro-organisms, fungi, insects rodents and birds. The insect *(Callosobruchus chinensis)* is the major cause of weight loss, lower germination and quality deterioration of stored legumes (Singh and Sharma, 1981). So the present study was planned to evaluate the effect of insect infestation on physio-chemical properties of green gram during storage.

MATERIAL AND METHODS

Green grams was procured from the local market of Palampur, Himachal Pradesh.

Insect Culture: The pulse beetles (*C. chinensis*) were obtained from the department of Entomology, College of Agriculture CCS HAU, Hisar and were released in 500g sample in a container covered with muslin cloth. The cultured sample was stored at 28±2°C and 75±2% RH.

Sample Preparation: Green gram grains were cleaned manually to get rid of dust and other foreign materials. The samples weighting 750 g each were placed in triplicate in plastic air tight containers of 2 kg capacity. Eighty pulse beetles (3-4 days old) irrespective of sex were released into each containers, covered with lids and kept at room temperature for six months. Grains were observed at monthly interval. The grains along with containers were deep frozen for 72 hours to kill the developing and adult insects. The insects debris and frass were removed manually and samples were stored in regrigerator till further analysis. Uninfected control samples were analyzed for comparison.

Chemical Analysis: The density of the samples was measured by transferring 100 weighed grains in a cylinders containers known quantity of water. The change in water level was noted. The formula W/V was used for calculating density, where W stands for weight for grains and V for volume i.e. rise in water level. The weight change of the pulse was observed by weighing the samples after removing the frass weighing and insect fragments. Per cent grains with embedded larvae of *C. chinensis* were calculated by soaking 1000 grains over-night. Each grains was dissected with fine blade and number of grains containing larvae were expressed in percentage.

Moisture, ash, crude fiber, crude fat and crude protein contents in the grains were determined according to AOAC (1980). Energy value was determined by chromic oxide methods (O'Sher and Mayure, 1962). The non protein nitrogen (NPN) values were estimated according to the method of Kapoor et al. (1975). The extraction of uric acid was carried by the method of AOAC (1980) and for estimation method of O' Sher (1971) was used. The fat free samples were used for methionine estimation by the method of Gupta and Das (1954) and McCarthey and Parlle (1959). The data were subjected to analysis of variance and correlation matrix according to Snedecor and Cochran (1968).

RESULT AND DISCUSSION

Original weight of samples was 750g, which increased during first two months of storage and decreased significantly thereafter (Table 1). After six month of storage, there was 43.70% decrease

in weight.Initial increase in weight was due to presence of larval and pupal stages within the grains. After three months, the adult insects emerged out of the grains after consuming endosperm resulting in loss of weight. Weight volume ratio (density) and embedded larvae percentage first increased significantly for three months, and later started decreasing. The decrease was significant (P<0.05), maximum being after sixth month of storage. As the storage period increased, more adult insects emerged out of the grains after consuming endosperm part leaving behing more grains with holes. This resulted in the decrease in physical parameters and increased damage (92%) due to holes and embedded larvae in the grains. Vimala and Pushpamma (1983), Modgil and Mehta (1994) have also reported decreased in weight and density.

Data present in Table 2 shows significant (P<0.05) changes in the proximate composition of stored grains. As the storage period increased, a significant (P<0.05) increase in proximate composition was observed. The increase in moisture content was due to increase in insect population and their excreta. Increased insect population produced more water as a result of their metabolic activity, which further increased seed moisture. The increase in moisture content can also due to seed activity and respiration. Similar results have been reported by other workers (Daniel et al., 1977; Shehnaz and Theophilluis, 1975; and Swaminathan, 1977). Increase in ash, crude fat and crude fiber might be due to consumption of endosperm protein of legume by bruchide, there by leaving behind husk which is rich in these constituents (Gupta et al., 1984; Khurb, 1981; Shehnaz and Theophilluis, 1975; Modgil and Mehta, 1994). Increase in crude protein (Table 2) was probably due to in increase in NPN and uric and also due to presence of insect fragments and body parts inside the grains.

The negligible amount of uric acid found in control samples increased to manifolds in the grain stored for six months with increased insect population. It is worth noting that the uric acid is one of the end products of protein metabolism in insects (Pixton, 1965; Swaminathan, 1977). With increase in storage period true protein values decreased Table 2. The decrease might be due to higher NPN substances produced by insects and contribution of these in estimation of crude protein. Uric acid is also considered as an index of the insect population density and well related to Kernal damage (Gupta et al., 1984; Swaminathan, 1977). The increments in the uric acid level of stored green gram are of significant importance from the hygienic, nutritional and acceptability point of view and also the gout causing potential of the infested legumes

Table 1: Physical properties of *(C. chinensis)* effectcd green gram stored for six months (n=3)

Atributes	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*CD%*
Weight	750	763.00	753.00	696.00	599.67	466.67	442.23	1.26
% Embedded Larvae	0.00	28.33	49.33	63.67	50.00	34.67	21.67	2.62
Density [wt(g)/vol(ml)]	1.84	1.90	1.94	1.87	1.82	1.70	1.59	0.02

Table 2 : Chemical properties of the *(C. chinensis*) effected green gram stored for six months (n=3).

Component	*Control*	*Storage period (months)*						*CD*
		1	*2*	*3*	*4*	*5*	*6*	*(P<0.05)*
Moisture%	10.14	11.25	12.75	13.38	14.05	14.40	17.76	0.35
Ash%	3.24	3.33	3.89	4.00	4.36	5.21	5.85	0.34
Crude fat %	1.35	1.38	1.42	1.58	1.63	1.74	1.89	0.04
Crude fiber %	3.94	4.28	5.33	6.37	7.02	7.77	8.51	0.15
Crude protein %	21.23	24.16	26.47	28.82	32.39	35.49	38.65	1.16
NPN %	0.00	0.60	0.88	1.48	2.23	3.07	3.88	0.16
True protein %	21.23	21.01	20.95	19.60	18.45	16.35	14.39	1.23
Energy (K cal/100g)	338.00	327.00	315.00	307.00	291.00	280.00	266.00	5.17
Methionine (mg/100g)	305.72	285.52	275.50	241.33	230.16	213.85	197.73	10.40
Uric acid (mg/100g)	0.00	233.90	664.7	1189.7	1451.1	2288.80	3039.80	25.76

(Swaminathan, 1977; Passmore and Eastwood, 1987).

Decrease in methionine content was significant at each storage interval. The loss was to the extent of 31.48 per cent after sixth month of storage Methionine is one of the ten amino acids required by insects for their growth. So, decrease in methionine may by related to its consumptions by insects for their growth and population built up.

As the storage period increased, there was increase in insect population resulting in a decrease in calorific value. The maximum loss was observed after six months storage. This might be due to consumption of endosperm part rich in carbohydrates, which contributes as major portion in the legumes.

CONCLUSION

Insect infection resulted in quantitative and quantitative losses in green gram stored for six months, legumes also becomes unhygienic due to presence of insects excreta. Higher amount of uric acid in stored legumes might induce gout in the consumers. Nutritive value of infested green gram is reduced. Therefore, consumption if infested legumes must be discouraged.

KEY WORDS Green Gram. Non Protein Nitrogen. Uric Acid. Insect Infestation.

ABSTRACT The present study was conducted to evaluate the physico-climate changes in insect infested green gram stored for six months. With increase in storage period, insect infestation increased resulting in a decrease in weight, density, embedded larvae (%) true protein and methionine contents, while all other components viz. moisture, ash, crude, fiber, crude protein, curd fat, non-protein nitrogen and uric acid contents increased. The changes in these parameters were significant as compared to control samples and were the highest at the end of six months storage period.

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