Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.2988

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (6):** 976-980 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Effect of Pulse Beetle (*Callosobruchus maculates* L.) Infestation on Quality of Pigeonpea Seed

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Received: 17.05.2017 | Revised: 26.06.2017 | Accepted: 2.07.2017

ABSTRACT

The pulse beetle, Callosobruchus spp. is the major storage pest which attack and causes damage to almost all the pulses and affect the germination. Laboratory experiments were conducted to study the effect of Callosobruchus maculatus infestation on seeds of pigeonpea (var. SRG-09) at different days of interval (5, 10, 15 20, 25 and 30th days) at the temperature of 30^{0}C and 65 per cent relative humidity. The results of the experiments showed that the number of days of exposure is directly proportional to the level of insect attack. The early stage larvae did not cause much damage to the seed initially. The damage level of seeds was increasing as larva grows inside. The larva was observed in 80 per cent of the seeds on 10th day. Cent per cent infestation of seeds was observed on 20th, 25th day with larvae or pupae and on 30th day with adults. It was also observed that no seed was infested in control with any stage of the insect. The increase in moisture content was observed to the tune of 23.50 per cent due to infestation of larval / pupal stage of bruchid on 30th day. Vigour index also decreased significantly when the seeds were exposed more number of days and it was 61.5 on 30th day.

Key words: *Pulse Beetle. Callosobruchus, Pigeonpea, Infestation, Germination*

INTRODUCTION

Basic input for crop production is seed. To maintain required plant population and seed yield per unit area, use of healthy seed plays a vital role in pulses. Because of highly proteinacious nature of pulse seed, which suffer badly due to attack of biotic organisms and also natural deterioration during storage. Among the pulses, pigeonpea plays important role as, it is grown as a staple food in most of the countries. Pigeonpea is cultivated in more than 25 countries worldwide, it holds sixth rank in context of production as compared to other pulses. Major Pigeonpea producing countries include India, Africa and Central America. Among these, India is dominating in production of 85 per cent of the total world production i.e. 12-15 million tonnes and pigeonpea constitutes around 20% followed by Myanmar and Malawi. It is grown around 4.3 million hectares area in the world, out of which India again dominating in area covering with 85% i.e 3.73 million hectares.

Cite this article: Raghavendra, D. and Loganathan, M., Effect of Pulse Beetle (*Callosobruchus maculates* L.) Infestation on Quality of Pigeonpea Seed, *Int. J. Pure App. Biosci.* **5(6):** 976-980 (2017). doi: http://dx.doi.org/10.18782/2320-7051.2988

The pulse beetle, *Callosobruchus* spp. is the major storage pest which attack and causes damage to almost all the pulse crops such as pigeonpea, cowpea, lentils, greengram and blackgram[5,6,8,12,14] and affects quality of seeds badly[9]. There are three species *viz.*, *Callosobruchus maculates, C. chienensis* and *C. analis* are commonly found in India among the five species of *Callosobruchus*[11]. Among these, *C. maculates* is a field carry over pest and is the most serious that hastens the deterioration of rate of seed during storage. The larvae of this pest bore into pulse seed which make unsuitable for human consumption, viability for replanting and also for production of sprouts[1,5,6,7,12,13]. Damage to seed is estimated around 93.33 per cent in different pulse crops.

By keeping above points in view, an experiment was conducted to test the effect of *C. maculates* on deterioration of quality of pigeonpea seed during storage.

MATERIALS AND METHODS

The culture of bruchid beetle, *C. maculates* was maintained on pigeonpea at temperature of 30^0C and 65% relative humidity in the storage entomology laboratory at IICPT, Thanjavur. The rearing procedure of insects was followed as that of Giga and Smith[3]. Freshly harvested, dried (10% moisture) and healthy pigeonpea (var. SRG-09) seeds were procured from farmer's field. The collected seeds were exposed to *C. maculates* for 24h inside the insect cage for egg laying. The seeds with egg were taken out and kept in environmental chamber at 30^0C and 65% relative humidity. The experiment was replicated four times and 20 seeds were used for each replication. The seed infestation and germination percentage were carried out at 5, 10, 15, 20, 25, 30 days interval. Control was maintained without exposing seeds to insects for egg laying. The observations were made on parameters *viz*., seed infestation with different stages of insects, changes in the moisture content, germination, root and shoot length and seedling vigour index. The data obtained were analysed statistically in a completely randomized design as per Gomez and Gomez[4].

Seed Infestation test

In this method, seeds were soaked in water for 2h for easy splitting to check the infestation and the stage of the insect present inside the seed from 5 to 30 days with 5 days interval., The seeds were slowly split opened using needle and observed the stage of the insect present inside.

Per cent infestation was calculated using the formula,

$$\text{Per cent infestation} = \frac{\text{No. of seeds infested}}{\text{No. of seeds used}} \times 100$$

Germination test

Germination test was carried out as per ISTA rules[2]. In this method the germinations were observed for 7 days.

Per cent germination was calculated using the formula,

$$\text{Per cent germination} = \frac{\text{No. of seeds germinated}}{\text{No. of seeds used}} \times 100$$

Root and shoot length

Root and shoot length of the pigeon pea seedlings was measured 7 days after germination for all the seedlings.

Vigour index

Seedling vigour index was calculated by,

VI = Length of seedling X Germination percentage

RESULTS AND DISCUSSION

The observations and results of the experiments showed that the number of days of exposure and per cent seed infestation is directly proportional to the level of insect attack (Table 1). The early stage larvae did not cause much damage to the seed initially. The damage level of seeds was increasing as larva grows inside. The larva was observed from 5^{th} day onwards which is about 23.80 per cent. It was continued with larval infestation with 80 per cent on 10^{th} day. The larvae or pupae was present in 95 per cent of seeds on 15^{th} day of storage. Cent per cent infestation of seeds was observed on 20^{th}, 25^{th} day with larvae or pupae and on 30^{th} day with adults. It was also observed that no seed was infested in control with any stage of the insect.

There was drastic increase in the moisture content as and when the infestation

starts. The highest of 23.5 per cent moisture content was observed on the 30th day where as 10 per cent was recorded on the day of egg laying. Control has maintained the moisture content till 30th day with slight increase from 10 per cent to 10.5 per cent. The results were confirmed with the similar reports by Patro *et al*[10].

The germination of pigeon pea seeds was high in the fresh grain which was 95 per cent in control. There was a reduction after infestation and it was 77.50 per cent on 5th day of infestation. The germination per cent was recorded as 62.50, 55.00, 52.50 and 22.50 on 10th, 15th, 20th and 25th day respectively. The insect infestation reduced the germination to 7.5 per cent on 30th day of infestation.

The highest root length with 19.10 cm was recorded in the seedlings of healthy seeds followed by 15.57 cm in the seedlings of seed on 5th day of infestation. The lowest root length of 2.07 cm was recorded in the seedlings of seed on 30th day of infestation, remaining showed moderate root length (Table 1). It was observed that the similar trend in shoot length as in the root length. The lowest length of 6.12 cm was recorded in the seedlings of seed on 30th day of infestation and highest with 20.60 cm in healthy seedlings. The seedling vigour index has reduced significantly from 10, 15, 20, 25 and 30th day (Table 1).

The results also revealed that all the infestation leads to deterioration of pigeon pea seed, affecting germination and loss of vigour. The pigeon pea seeds germinate even after insect infestation when the infestation is other than germ portion but with lesser vigour in that germinated seedling with 61.5 on 30th day of germination. Similarly, the root as well as shoot length are less and seedlings could not with stand. It is very clear that the pigeonpea seeds infested with pulse beetle will not be suitable for seed even though the germ portions are not damaged.

Table 1: Effect of *C. maculatus* on seed deterioration and germination of Pigeonpea

Days	Seed infestation (%)	Moisture content (%)	Germination (%)	Root length (cm)	Shoot length (cm)	Seedling length (cm)	Vigour Index
5th day	23.8 (5.4)	10.9 (3.8)	77.5 (9.3)	12.35	16.20	28.55	2212.6
10th day	80.0 (9.4)	11.3 (3.9)	62.5 (8.4)	10.95	15.40	26.35	1646.9
15th day	95.0 (10.2)	14 (4.2)	55.0 (7.9)	7.80	13.13	20.30	1116.5
20th day	100.0 (10.5)	15.4 (4.4)	52.5 (7.7)	5.80	11.73	17.53	920.1
25th day	100.0 (10.5)	17.8 (4.7)	22.5 (5.2)	4.10	9.38	13.48	303.2
30th day	100.0 (10.5)	23.5 (5.3)	7.5 (3.2)	2.08	6.30	8.20	61.5
Control	0.0 (0.5)	10 (3.7)	95 (10.2)	19.10	20.60	39.70	3771.5
Sem±	**2.3**	**0.35**	**4.34**	**0.51**	**0.89**	**1.04**	
CD (0.05)	**6.9**	**1.0**	**13.1**	**1.5**	**2.7**	**3.2**	

*Observations based on mean values of four replications.

*Figures in within () are square root transformed values.

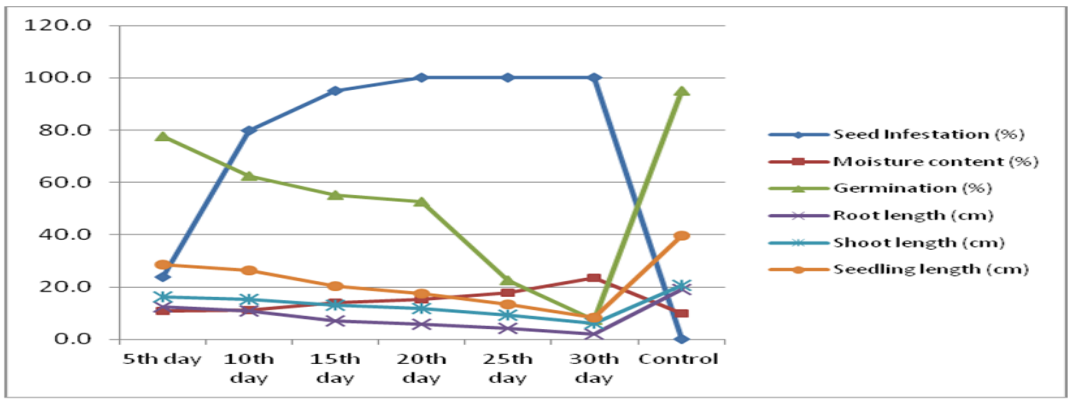

Fig. 1: Effect of *C. maculates* seed infestation on seed deterioration in pigeonpea

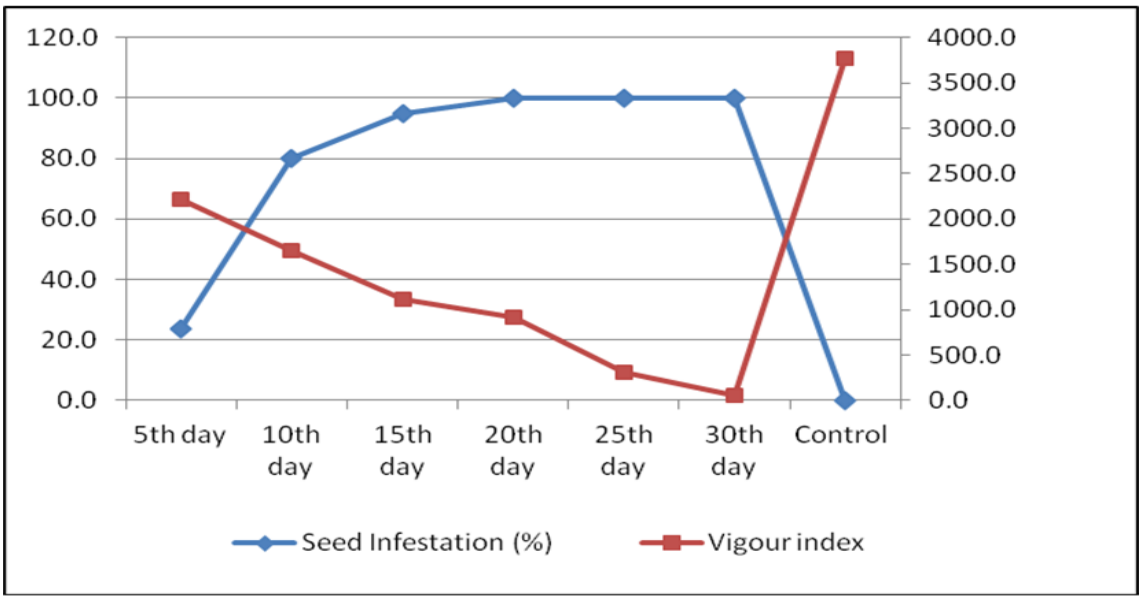

Fig. 2: Effect of *C. maculates* seed infestation on seedling vigour in pigeonpea

CONCLUSION

The results revealed that all the infestation leads to deterioration of pigeonpea seed, affecting germination and loss of vigour. The pigeon pea seeds germinate even after insect infestation when the infestation is other than germ portion but with lesser vigour in that germinated seedling with 61.5 on 30th day of germination. Similarly, the root as well as shoot length are less and seedlings could not with stand. It is very clear that the pigeonpea seeds infested with pulse beetle will not be suitable for seed even though the germ portions are not damaged.

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