HOST PREFERENCE OF PULSE BEETLES (*CALLOSOBRUCHUS SPP.*)AGAINST SELECTED PULSES

A.K. Sahoo* V.K. Koshta and G. Patel

Department of Entomology, College of Agriculture,
Indira Gandhi KrishiVishwavidyalaya, Raipur (C.G.) 492012
**Author for correspondence: aruns9285@gmail.com*

Abstracts: The host preferences of pulse beetles with eight pulses were made under laboratory conditions at the interval of different hours revealed that the green gram (*Vignaradiata*) was the most preferred while lentil (*Lenceesculentum*) least preferred. Lentil was comparatively less preferred for oviposition (83.33 eggs/100 g seeds). The developmental period (32.33 days), adult survival (79.33 %) and weight loss of grains (1.93%) was also less followed by pigeon pea.

Keywords: Host preference, pulse beetle, oviposition

INTRODUCTION

Pulses are excellent sources of proteins (20-40%), carbohydrates (50-60%) and are fairly good sources of thiamin, niacin, calcium and iron. One of the major constraints in production of pulses is the insect pests which inflict severe losses both in the field and storage. In India, over 200 species of insects have been recorded infesting various pulses (CABI, 2007). Among these, pulse beetle, *Callosobruchus spp.* is a major pest that causes serious damage and is cosmopolitan (Bhalla*et al.*, 2008). India is the largest pulse producing country, growing a variety of pulse crops with 33 per cent of world's area and 24 per cent of production (Shah and Agarwal, 2009). Pulses are an integral part of Indian dietary system due to their richness in protein and other important nutrient. They are known as poor man's meal as pulses are the cheapest source of dietary protein and valuable animal feed. The pulses have also played a vital role in the improvements of agricultural economy of the country occupying 68.32 million hectare area under cultivation and contribute 57.57 million tonnes to the food basket. India shares 35.2% area and 27.65% of the global production. Contribution of pulses in 1970 was 11.01 per cent and in 1999 where it was declined to 06.96 per cent with - 4.05 per cent in total food grain production in India and declined continuously during the last three decades (Chaturvedi and Ali, 2002) whereas it increased for rice and wheat. The massive built-up in population demands, extra food grain annually. On the basis of food characteristic demand system projection of pulses for the year 2010, 2015 and 2020 are 23.3, 27.0 and 30 million tonnes, respectively to the present yield of 15.23 million tons in 2003-2004 (Banerjee, 2005). One of the major constraints in storage of pulse is the damage and loss of seed viability due to the attack of pulse beetle, among which the pulse beetle is one of the major pests of pulse attacking wide range of legumes (Sharma, 1984). It causes about 50 per cent damage during storage in 3-4 months (Caswell, 1981). It is a cosmopolitan pest of storage legume seed and the infestation being in the field but causes serious damage to the seeds during storage (Dongre*et al.*, 1993). The damaged seed are unfit for consumption as well as for seed purpose. Bruchid inflate the weight loss and resulting in lower germination potential, pulse beetle is oligophagous and exhibits a high degree of specificity for its growth and development.

MATERIAL AND METHOD

The experiment was conducted at the laboratories of the Department of Agricultural Entomology, College of Agriculture, Indira Gandhi Agricultural University of Raipur , India. Raipur is situated in plains of Chhattisgarh at 21º 16'N latitude and 81º 16'E longitude with an altitude of 289.60 meter above mean sea level (MSL). Raipur comes under sub humid region, receiving an average rainfall of 1200-1400 mm out of which about 85 per cent during winter season (October-February). The place experiences a short mild winter, January being the coolest and dry hot summer, May being the hottest month. Soil surface temperature of this region crosses 60 C, air temperature touches to 48 C and humidity drops up to 3 to 4 per cent during summer season and mercury level drops to as 60 C during December and January.

The host preference of pulse beetle (*Callosobruchus sp.)* on various legumes, a host preference apparatus was prepared using thermacol. The apparatus was designed in such a way that all the legumes were placed at equal distance from the centre. In case of legumes eight different types of pulses were tested namely chickpea, desi (*Cicerarietinum* L.), black gram (*Vignamungo*), chickpea, kabuli (*Cicerarietinum*L.), pea (*Pisumsativum*Linn.), lentil (*Lenceesculentum*), green gram (*V. radiata*), rajma (*Phaseolusvalgaris*) andpigeon pea (*Cajanuscajan* L.). Ten pairs of newly emerged adult insects were selected from the stock culture and released in the center of the apparatus. The insects were allowed to move freely to their choice. After release of insects the apparatus was covered with muslin cloth and kept

undisturbed. The observations were recorded after 12, 24, 48 and 72 hours. The experiment was repeated 4 times. Observation based on number of adults, ovipositional preference, mean development period, per cent adult survival and per cent weight loss of grains in different pulses was recorded.
Per cent weight loss of grain was calculated by using formula, as detailed below.

$$\text{Per cent weight loss of grains} = \frac{\text{UND} - \text{DNU}}{\text{U}\left(\text{ND} + \text{NU}\right)} \times 100$$

Where,
ND = Number of damaged grains, D =Weight of damaged grains,
NU = Number of undamaged grains, U = Weight of undamaged grains

RESULT AND DISCUSSION

A couple of experiments were conducted on different types of legumes namely chickpea desi (*Cicerarietinum* L.), black gram (*Vignamungo*), chickpea kabuli (*Cicerarietinum*L.), pea (*Pisumsativum*Linn.), lentil (*lenceesculentum*), green gram (*V. radiatae*), rajma (*Phaseolusvalgaris*) andpigeon pea. During the investigation the observations were recorded at different hour interval (Table 1)

Host preference after release of 12 hours

Host preference studies on various legumes were undertaken after the release of 12, 24, 48 and 72 hours of pulse beetle at the center. After 12 hours release of ten pairs insects, minimum number (1.00) of adult beetle was observed on lentil. It was at par with pea (1.75), chickpea (D) (1.75) and rajma (2.00) respectively followed by black gram (2.75) and chickpea (K) (3.00). However, the maximum number (4.00) of adults was counted on green gram and at par with pigeon pea (3.75). It is quite evident that green gram and pigeon pea were the most preferred legumes for pulse beetle.

Host preference after release of 24 hours

Release of beetles after 24 hours on various legumes, minimum population (1.25) was observed on lentil. It was at par with chickpea (D) (1.25), rajma (1.50) and chickpea (K) (2.00), respectively. Beetles population was highest (5.50) on the most preferred host green gram amongst various legumes, followed by pigeon pea (3.25).

Host preference after release of 48 hours

Release of beetles after 48 hours on various legumes, the most (5.75) preferred host was observed on green gram as compared to rest of the tested hosts. However, the least (1.25) preferred host was lentil, which was significantly at par with rest of the tested hosts except pea (2.75).

Host preference after release of 72 hours

Beetles were released after 72 hours on various legumes. There was minimum population (1.25) observed on lentil. It was significantly at par with chickpea (D) (1.50), rajma (2.00), chickpea (K) (2.00) and pea (2.25) respectively. Beetles population was highest (5.25) on the most preferred host green gram amongst various legumes, followed by pigeon pea (3.0).
The present finding were in agreement with **Mehta and Chandel (1990)** who reported that beetles preferred least on lentil and most on green gram. **Sodozai*et al.* (2003)** reported that lentil was least preferred by the pulse beetle with lowest fecundity (26.6 eggs) whereas pea possessed highest fecundity (51.2 eggs). However, shortest developmental period (19.2 days) was recorded on green gram and longest (23.2 days) on pea**. Kar (2007)** reported that black gram was the most preferred (4.3 adults) but green gram was found best for development (35 days).
The results on the host preference of pulse beetle recorded are presented in Table 2. The criteria for the host preference studies considered were ovipositional preference, adult survival, length of the developmental period and weight loss of the grains.

Ovipositional preference

The mean number of eggs laid on the test pulses ranged from 83.33 to 125.67 egg/ 100 g seeds. Among the selected pulses, the lentil recorded significantly the lowest of 83.33 eggs /100 g seeds which was on par with pigeon pea (88.00 eggs / 100 g of seeds) as against the highest number of eggs observed in green gram(125.67 eggs /100 g of seeds) and black gram (114.67 eggs/100 g of seeds).

Developmental period

The mean developmental period ranged from 29.33 to 36.00 days in different pulses. Green gram, black gram, chickpea (D) and pigeon pea recorded significantly the lowest developmental period of 29.33, 29.67, 31.33 and 31.67 days, respectively and were on par with each other. Whereas, rajma recorded a maximum of 36.00 days developmental period followed by pea (32.67 days) and lentil (32.33 days).

Adult survival

The mean adult survival on test pulses ranged from 77.67 to 91.00 per cent. Significantly the lowest adult survival of 77.67, 79.33 and 82.67 per cent was registered on rajma, lentil and pea, respectively and were on par with each other. Significantly the highest

survival was recorded on green gram (91.00%) followed by black gram (90.33%), pigeon pea (86.67%) and chick pea (K) (82.67%).

Weight loss of grains

The loss in grain weight among different pulses ranged from 1.82 to 4.02 per cent. Rajma recorded significantly the lowest weight loss of 1.82 per cent which was on par with lentil 1.93 (%) as against the highest weight loss recorded on green gram (4.02%) followed by black gram (3.82%).

Green gram and black gram possess smooth skinned seed texture and are bigger in size. This might have encouraged the beetles to prefer more for egg laying, larval development and weight loss. The present findings are true with reports of Girish*et al.* (1974) where the oviposition and developmental period of pulse beet on few stored pulses beetle seems to be guided by smoothness of seed coat and size of the grain.Mehta and Chandel (1990) who reported that beetles preferred least on lentil and most on green gram.Sodozai*et al.* (2003) reported that lentil was least preferred by the pulse beetle with lowest fecundity (26.6 eggs) whereas pea possessed highest fecundity (51.2 eggs). However, shortest developmental period (19.2 days) was recorded on green gram and longest (23.2 days) on pea. Bhaduria and Jakhmola (2005) reported that the losses due to seed damage was maximum in green gram (55.4%) followed by gram [chickpea] (11.1%) and pea (8.8%). Kar (2007) reported that black gram was the most preferred (4.3 adults) but green gram was found best for development (35 days).

The present conclusively documents that green gram and black gram were most preferred hosts. For pulse beetle, lentil was less preferred for oviposition and recorded prolonged developmental period (32.33 days), adult survival (79.33 %) and weight loss of grains (1.93%) which was followed by pigeon pea.

Table 1: The host preference of *Callosobruchussp*. on various legumes on the basis of adults orientation

Treatments	**Average number of pulse beetle on different hours**			
	12 hours	**24 hours**	**48 hours**	**72 hours**
Lentil	1.00 (1.22)	1.25 (1.32)	1.25 (1.32)	1.25 (1.32)
Pea	1.75 (1.50)	2.50 (1.73)	2.75 (1.80)	2.25 (1.66)
Chickpea (D)	1.75 (1.50)	1.25 (1.32)	1.75 (1.50)	1.50 (1.41)
Rajma	2.00 (1.58)	1.50 (1.41)	1.50 (1.41)	2.00 (1.58)
Black gram	2.75 (1.80)	2.75 (1.80)	2.50 (1.73)	2.75 (1.80)
Green gram	4.00 (2.12)	5.50 (2.45)	5.75 (2.50)	5.25 (2.40)
Chickpea (K)	3.00 (1.87)	2.00 (1.58)	2.00 (1.58)	2.00 (1.58)
Pigeonpea	3.75 (2.06)	3.25 (1.94)	2.50 (1.73)	3.00 (1.87)
SEM±	0.14	0.12	0.15	0.14
C.D. at 5%	**0.40**	**0.35**	**0.43**	**0.40**

Table 2: Host preference of pulse beetle, *Callosobruchus spp.* on selected pulses

Treatments	*No. of eggs laid per 100 g seeds	*Developmental period (Days)	**Adult survival (%)	**Weight loss of grains (%)
Lentil	83.33 (9.15)e	32.33 (5.7)b	79.33 (62.96)	1.93 (7.97)
Pea	104.33 (10.24)	32.67 (5.76)	82.67 (65.40)	2.53 (9.15)
Chickpea (D)	102.00 (10.12)	31.33 (5.64)	86.33 (68.33)	3.21 (10.31)
Rajma	88.00 (9.4)de	36.00 (6.04)	77.67 (67.81)	1.82 (7.75)
Black gram	114.67 (10.73)	29.67 (5.49)	90.33 (72.05)	3.82 (11.27)
Green gram	125.67 (11.38)a	29.33 (5.46)	91.00 (72.53)	4.02 (11.56)
Chickpea (K)	104.31	32.62	82.67	2.53

	(10.24)	(5.76	(65.40)	(9.15)
Pigeonpea	93.33 (9.68)d	31.67 (5.67)	86.67 (68.70)	3.33 (10.51)
SEM±	0.13	0.07	1.38	0.18
C.D. AT 5%	0.38	0.21	4.16	0.55

Parentheses are square root transformed value
**Parentheses are arc sign transformed value

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