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Genetic Correlation Studies among Different Indices for Resistance to Bruchid Infestation (*Callosobruchus maculatus* F.) using Stabilized Lines (F7 families) of Inter-Specific Cross between Cowpea X Rice Bean

Venkatesh Bondade and Sanjeev K. Deshpande*

Department of Genetics and Plant Breeding, University of Agricultural Sciences, Dharwad-580005, Karnataka, India

**Corresponding author*

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A B S T R A C T

Cowpea, [*Vigna unguiculata* (L.) Walp.] also known as blackeye pea, southern pea and lobia is one of the most important food legumes in the semi-arid tropics. With an average of 25% protein (on dry weight basis) in its seeds and tender leaves, cowpea is a major source of protein. In storage, *Callosobruchus maculatus* F. also called cowpea beetle, cowpea weevil or bruchid, is regarded as the most important and common pest of cowpea both in Africa and Asia. All *vigna* crops except rice bean are susceptible to bruchids. So in the present study genetics correlation on some of the different susceptibility indices for bruchid resistance in discussed. The indices like infestation per cent is positively correlated with moisture content, actual weight loss, number of bruchids emerged and per cent damage but negatively correlated with yield. Even moisture content, actual weight loss, number of bruchids emerged and per cent damage is negatively correlated with yield. The cowpea seeds permitting lower moisture content and least number of bruchids emerged will lead to lower per cent seed damage and lesser weight loss.

Introduction

Cowpea [*Vigna unguiculata* (L.) Walp.] is an important indigenous legume providing dietary protein, minerals, carbohydrates, fats, vitamins and income to many poor people in Africa, Asia, and central and South America (Popelka *et al.*, 2004). Its protein content ranges from 24.7–33.1% with low anti-nutritional factors (Rangel *et al.*, 2003). Globally, more than 12.32 million hectares of cowpea are harvested, 98.1% being from Africa (FAO, 2016). However, cowpea production in these producing countries is limited by insect pest attacks (Beck and Blumer, 2007). In storage, cowpea weevil *Callosobruchus maculatus* (Coleoptera: Chrysomelidae) is the most destructive pest

(Deshpande *et al.,* 2011). The insect females deposit their eggs on seed coat, and the larvae penetrate the cotyledons where they develop by consuming the energy reserves of cotyledons, reducing both the quantity and quality of seeds, making them unfit for planting, marketing and human consumption (Ali *et al.,* 2004). Adult emergence occurs after 25-30 days (Oliveria *et al.,* 2009).

In Sub-Saharan Africa, chemical control using insecticides is a common practice used by the majority of farmers to minimize losses due to bruchid infestations (Olakojo *et al.,* 2007). However, the method is expensive, pose health hazards to farmers and consumers and their continuous use can lead to development of insecticide resistant bruchids (Boyer *et al.,* 2012). The use of resistant genotypes offers a promising alternative control method to the hazardous pesticides for the management of *C. maculatus*, especially where huge quantities of grains are involved (Dahiwal and Arora, 2003). In the present study, correlation studies of few important parameters like infestation per cent, moisture content, actual weight loss, number of adult bruchids emerged and per cent seed damage has been interpreted.

Materials and Methods

The experiment was conducted during *kharif* 2018 at Botanical garden, Department of Genetics and Plant Breeding, University of Agricultural Sciences, Dharwad. The F_6 population generated earlier between cross DC 615 (Susceptible) × Rice bean (Resistant) was used for the present study. About 440 F_6 families were selfed and advanced to F_7 generation. Based on yield per se top 100 F_7 progenies were selected and used in the present study. Two checks of cowpea such as DC 15 (Moderately resistant check) and DCS 47-1 (susceptible check) and two rice bean germplasm (RBHP-38 and IC18563) were also used as check.

The percentage infestation was calculated by using following formula;

Infestation (%) = Number of seeds with emergent holes/Total number of seeds observed ×100

Results and Discussion

The top 10 resistant F_7 segregants are given in the Table 1. The results revealed that, F_7: 78-1-1 segregant recorded least per cent bruchid infestation (12.24 %). Among the rice bean resistant germplasm lines RBHP-38 and IC18563 recorded zero per cent infestation, the variety DC 15 exhibited infestation of 26.53 per cent and considered as moderately resistant and DCS 47-1 reported 68.98 per cent infestation, regarded as moderately susceptible. The results were in accordance with Vishwas and Deshpande (2018).

Considerably least number of bruchids emerged in F_7 lines *viz*., F_7: 78-1-1 and F_7: 59-3-1. These two F_7 lines exhibited the number of bruchids emerged with 12 and 13 adults, respectively (Table 1). As far as checks are concerned, IC18563 and RBHP-38 had 0.00 number of bruchids adult emergence whereas, DC15, DCS47-1 and DC 615 showed 21.00, 34.00 and 68.00 adults emerged, respectively after 45 days of infestation. Similar results were also found by Deshpande and Umesh (2018).

Yield is most important character and the genotypes showing minimum bruchid infestation and high yield *per se* are desirable. Among checks the moderately susceptible variety DCS47-1 has shown 22.80 grams per plant and DC15 registered 26.18 grams per plant and DC 615 yielded 19.23 grams per plant, both the rice bean checks RBHP-38 and IC18563 had registered 15.05 and 13.05 grams per plant, respectively. Among top 10 segregants F_7: 59-3-1 and F_7: 78-1-1 exhibited

higher yield as well as minimum bruchid infestation (Table 1).

Bruchids infest the seeds by making emergent holes on the surface of the seeds by their larvae. This infestation is positively and significantly correlated with moisture content (0.90*), the moisture content invites the bruchids to feed on carbohydrates, proteins and other dry matter present in the seed. The similar results were also found by Deshpande *et al.,* (2011).

Where they found that the moisture content was positively correlated with bruchid infestation. The infestation was also positively and significantly correlated with actual weight loss, number of bruchids emerged and per cent seed damage, (0.81*, 0.84* and 0.46*, respectively) (Table 2).

All this depicts, that the moisture content invites the bruchids and increases the number of bruchids emerged and causes higher infestation per cent, which in turn increases the per cent seed damage and weight loss due to bruchid attack.

All theses parameters reduces the yield of the plant (-0.20*, significantly and negatively correlated). The results were in accordance with Deshpande *et al.,* (2011). Where actual weight loss, number of bruchids emerged and per cent seed damage were found positively correlated with infestation. Even Miesho (2018), Amusa *et al.,* (2013), Amusa *et al.,* (2014) and Padmavathi *et al.,* (2016) found the same results.

Moisture content is positively correlated with actual weight loss, number of bruchids emerged and per cent seed damage, 0.81*, 0.90* and 0.50* respectively (Table 2). Moisture content present in the seed makes it less hard for the bruchid infestation and invites the bruchids and causes more seed damage and increased seed weight loss. Deshpande *et al.,* (2011) also found positive correlation between moisture content and weight loss and seed damage. Similar results were reported by Kapila and Rajni (1989) in pea; Talekar and Lin (1992) in mung and black gram; Muhammad Hussain *et al.,* (1997) in mungbean varieties.

Number of bruchids emerged is positively correlated with per cent seed damage, 0.48* and actual weight loss is positively correlated with number of bruchids emerged and per cent damage, 0.83* and 0.44*, respectively.

The higher number of bruchids emerged is responsible for higher per cent seed damage by eating all the vital parts of the seeds and results in weight loss of the seeds. The results were in accordance with Amusa *et al.,* (2014). Where the per cent weight loss is positively correlated with per cent emergence and per cent seed damage, 0.49** and 0.76**, respectively.

Padmavathi *et al.,* (2016) also found that the adult emergence and weight loss is positively correlated (0.78*) in Lentil. Deshpande *et al.,* (2011) also found the same results depicting positive correlation between actual weight loss and total adult emergence (0.45*).

The results of correlation analysis between different susceptibility parameters to *C. maculatus* was indicated that Infestation per cent, moisture content, actual weight loss, number of bruchids emerged and per cent damage were positively and significantly ($P<0.005$) correlated. This suggests that seeds permitting lower moisture content and least number of bruchids emerged will lead to lower per cent seed damage and lesser weight loss.

Table.1 Bruchid infestation per cent among the top 10 resistant and stabilized F_7 lines derived from Cowpea x Rice bean crosses

Sl. No.	Segregants	Per cent bruchid infestation	Number of bruchids emerged	Average yield (gram/plant)
1	78-1-1	12.24	12.00	24.75
2	59-3-1	14.29	13.00	25.17
3	27-1-2	14.29	14.00	17.95
4	247-2-1	16.73	14.00	21.47
5	71-2-1	18.37	14.00	24.50
6	30-2-2	18.37	15.00	19.25
7	16-2-2	18.37	15.00	24.91
8	14-1-2	20.41	16.00	18.36
9	41-1-2	20.41	16.00	20.24
10	27-1-1	20.41	16.00	23.10
Cowpea Checks				
1	DC15	26.53	21.00	26.18
2	DCS47-1	68.98	34.00	22.80
Ricebean Checks				
3	RBHP-38	0.00	0.00	15.05
4	IC18563	0.00	0.00	13.05

Table.2 Genetic correlation studies among important traits for bruchid resistance using stabilized lines (F7 families) of inter-specific cross between Cowpea x Rice bean

	Infestation per cent	Moisture content	Actual weight loss	Number of bruchids emerged	Per cent damage	Yield per plant
Infestation per cent	1.00	0.90*	0.81*	0.84*	0.46*	-0.20*
Moisture content		1.00	0.81*	0.90*	0.50*	-0.19*
Actual weight loss			1.00	0.83*	0.44*	-0.16*
Number of bruchids emerged				1.00	0.48*	-0.19*
Per cent damage					1.00	-0.13*
Yield per plant						1.00

*: Significance at 5% , **: Significance at 1%

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