Research Article

A study of the resistance of some sorghum germplasm to *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae)

Rashmi S Bhoge[1], Anju A Bhagat[2*]

[1]Department of Entomology, [2]Department of Statistics, MPKV, Rahuri, Maharashtra, INDIA.
Email: anju_bhagat @rediffmail.com

Abstract

An Experiment was conducted on some sorghum germplasm to determine their resistance to *Sitophilus oryzae* (L) as indicated by the numbers of adults emerging from similar initial infestation. Further experiment was conducted to determine differences and consequences of resistance to *Sitophilus oryzae* using selected sorghum germplasm. Differences in the numbers of emergent adults were highly significant within cultivars. Almost ten times more grain weight loss was recorded from the most susceptible (CSH-15 R) germplasm. The germplasm M-35-1 was found to be the least susceptible amongst all followed by RSLG-779,RSLG-848,RSLG-743 and RSLG-755 on the basis of least seed damage, seed weight loss and number of weevil adults emerged. CSH-15R was found to be most susceptible germplasm as more seed damage and grain weight loss was recorded in CSH15 R.

Keywords: Sorghum germplasm, Resistance, Sitophilus oryzae, Seed weight loss.

[*]**Address for Correspondence:**
Mrs. Anju A. Bhagat, Department of Statistics, MPKV, Rahuri, Maharashtra, INDIA.
Email: anju_bhagat @rediffmail.com
Received Date: 28/11/2014 Accepted Date: 08/12/2014

Access this article online

Quick Response Code:

Website: www.statperson.com

DOI: 13 December 2014

INTRODUCTION

Sorghum bicolor (L) Moench, popularly known as "Jawar" is one of the most important cereal crops in the world and is one of the four major food grains of our country. The grains are hardly ever consumed soon after harvest, they are stored under varying types of storage conditions and consumed over a considerable period of time after harvest. The home practices of storing sorghum are not satisfactory and quite often it is observed that grains are infested. The rice weevil, *Sitophilus oryzae* (L) (Coleoptera : Curculionidae) is an important storage pest of sorghum and other cereals in the tropical and subtropical regions of the world, where small scale farmers usually stores their sorghum grains in traditional structures with inadequate protection (Mills,1985). It has been found that the rice weevil infestation alone resulted in sorghum grain losses of 61.3% over a period of 5 months (Venkatrao *et al*, 1988). The weight loss in stored sorghum is caused by both larval and adult feeding, with major damage done by larvae developing in the grain. Besides causing grain loss weevil infestation reduces the quality and viability of seed as well as seedling vigour or due to contamination with insect exuviae and excreta and pre-desposes the seeds to attack by storage fungi. The presence of storage pest in the grain also reduces the commercial value of sorghum (Borikar and Tayade, 1979). Therefore, present study was undertaken to locate the resistance sources of sorghum against *Sitophilus oryzae*.

How to site this article: Rashmi S Bhoge, Anju A Bhagat. A study of the resistance of some sorghum germplasm to *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae). *International Journal of Statistika and Mathemtika* Nov 2014 to Jan 2015; 12(2): 109-112. http://www.statperson.com (accessed 15 December 2014).

MATERIALS AND METHODS

Seventy Sorghum germplasm obtained from All India Co-ordinated Sorghum Improvement Project Mahatma Phule Krishi Vidyapeeth, Rahuri were included for investigation. Experiment was carried out under laboratory condition during 2011-12 at Department of Entomology, Mahatma Phule Krishi Vidypeeth, Rahuri in Completely Randomized Design with three replications. The grains were cleaned of straw, chaff, light grains and other impurities before testing. All the grains were disinfected by keeping in the oven at 60^0c for 5 hours and then equilibrated to moisture content of 12.5 to 13.0 by placing in desiccators at 65% RH for days. The rice weevil culture was started by procuring adults from infested grain samples from All India Co-ordinated Sorghum Improvement Project, MPKV., Rahuri. To initiate the culture, healthy seed of sorghum was kept into 32 x 22.5 cm size cylindrical jar and ten pairs of adult weevils were isolated and released into jar. The top of jar was covered with muslin cloth secured firmly by rubber band. After emergence of new adults the weevils were introduced into sorghum seed kept in series of cylindrical jars for building up a homogenous population. These studies were conducted at 30^0c temperature and 80% relative humidity. 100 Sorghum grains of healthy and sound seeds of each germplasm were counted. These samples were transferred to plastic containers 150 g capacity. Thirty adults (1day old) of *Sitophilus oryzae* from container covered with muslin cloth fastened with rubber bands. The insects were placed for one week to lay eggs. After on week, insects were removed and discarded. The egg plugs were detected by staining the grain with acid fuschin as they are invisible under normal observations. The stain was prepared by mixing 50 ml glacial acetic acid in 950 ml of distilled water and adding 0.5 gm acid fuschin. The seeds were stained using acid fuschin to expose egg plugs and dried on tissue paper for 12 hours before examination. Above set with 100 grains after staining was kept as such and the grains were observed daily up to 80 days as suggested by Borikar and Tayade (1979) for emergence of adult.

RESULT AND DISCUSSION

The observations recorded on the average number of eggs laid on 100 seeds of different germplasm of *Sorghum bicolor* are presented in Table 1 and indicated marked variation for oviposition on all germplasm by the weevils. However, among the germplasm tested, M-35-1 was least preferred (7.00 eggs) for oviposition and found significantly superior as compared to the rest of germplasm, except RSLG-755 which showed 11.00 eggs per 100 seeds. The germplasm RSLG-848 (12.50eggs/100 seeds), RSLG-779 (16.50 eggs/100 seeds) and RSLG-743 (17.00 eggs/100 seeds) were next preferred for oviposition and statistically at par with each other which had shown good resistance to *Sitophilus oryzae*. Percent adult emergence ranged from 2.5 (M-35-1) to 36.00 (RSLG 611). The highest % adult emergence was found in RSLG-611 (36.00) followed by germplasm CSH 15 R (35.00 % adult emergence), RSLG-737 (33.00), RSLG-704 (32.00) and RSLG-756 (29.00). The statistical analysis of the data indicated that all the germplasm tested, suffered weight loss due to feeding of *S. oryzae*. The average percent loss in grain weight was lowest (1.49 %) in the germplasm RSLG 743, thought the germplasm viz; RSLG 848 (1.62 %), RSLG 779(1.63 %), M-35-1 (1.73 %) and RSLG 755 (2.32 %) were statistically at par with it. The significantly highest percent loss in grain weight was observed in the germplasm CSH -15R (20.44%). The germplasm viz; RSLG 611 (14.68%), RSLG 704 (14.90%), RSLG 737 (14.91%) and RSLG 756 (15.89%). Almost 10 times more grain weight loss was recorded for the most susceptible (CSH-15 R) germplasm. There was considerable variation among sorghum varieties with respect to seed weight loss. These differences in the susceptibility of sorghum germplasm indicate the inherent ability of a particular germplasm to resist *Sitophilus oryzae* attack. Resistant in the stored sorghum to *Sitophilus oryzae* attack has been attributed to physical factors. It was also indicated that extent of damage depends upon the number of emerged adults and duration of life cycle. These results are in agreement with Abraham (1991) in maize. Similar observations indicating significant weight loss was directly related with seed damage. It was also inferred that the weight loss in seed strongly indicates the nutritional requirement of *Sitophilus oryzae* adults for sustained feeding to cause sufficient amount of loss in sorghum. The minimum grain infestation to the extent of 2.15 percent was noticed in the germplasm M-35-1, which was significantly lower than rest of germplasm, except RSLG 779 (2.45 %), RSLG 848(2.47 %), RSLG 743 (3.42 %) and RSLG 755 (4.27 %) which were statistically at par with it. These germplasm showed resistance against *Sitophilus oryzae*. The significantly highest grain infestation was exhibited in the germplasm CSH -15R (22.50%) which was found as the most susceptible among all seventy germplasm. The significantly highest percent loss in grain weight was observed in the germplasm CSH -15R (22.50%) except RSLG 737 (20.45 %) which was statistically at par with it. The germplasm viz; RSLG 611 (19.31 %), RSLG 704 (18.41 %) and RSLG 756 (17.92 %) which were next to observe weight loss and at par with each other. Minimum grain weight loss in these germplasm was attributed to the least ovipositional preference and adult emergence.

Least weight loss in these germplasm was directly related to the least percent grain infestation. These results are in agreement with findings of Baimaiyi *et.a*l (2007) and Reddy *et. al* (2002) in sorghum.

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Source of Support: None Declared
Conflict of Interest: None Declared

Table 1: Oviposition, Adult emergence, % loss in grain weight and % grain infestation by *Sitophilus oryzae*

Sr. No.	Name of Germplasm	No. of eggs laid /100 seeds	% adult emergence of s. oryzae	% loss in grain wt.	% grain infestation
1	RSLG 552	38.50	15.00 (22.79)	03.47 (10.68)	05.16 (13.090
2	RSLG 554	28.00	16.50 (23.90)	04.75 (12.52)	08.30 (16.73)
3	RSLG 557	43.00	21.50 (27.61)	04.42 (12.10)	06.12 (14.29)
4	RSLG 558	30.00	11.50 (19.82)	04.38 (12.05)	07.64 (16.05)
5	RSLG 575	54.00	22.00 (27.94)	04.49 (12.24)	06.08 (14.09)
6	RSLG 592	38.00	19.50 (26.18)	05.38 (13.43)	07.34 (15.70)
7	RSLG 594	52.00	27.50 (31.63)	03.85 (11.30)	05.58 (13.62)
8	RSLG 601	48.00	15.50 (23.18)	03.97 (11.38)	05.44 (13.45)
9	RSLG 606	22.00	12.50 (20.70)	06.40(14.62)	11.02 (19.43)
10	RSLG 607	49.00	20.50 (26.92)	04.35 (12.04)	06.79 (15.11)
11	RSLG 609	31.50	13.00 (21.12)	08.04 (05.94)	10.04 (18.42)
12	RSLG 611	69.00	36.00 (36.86)	14.68 (22.52)	19.31 (26.02)
13	RSLG 612	47.00	25.50 (30.32)	03.65 (11.05)	06.46 (14.71)
14	RSLG 623	43.50	17.00 (24.31)	06.85 (15.16)	10.98 (19.34)
15	RSLG 625	31.00	14.50 (22.38)	09.89 (15.46)	11.49 (19.78)
16	RSLG 626	21.00	12.50 (20.70)	08.00 (16.42)	13.00 (21.13)
17	RSLG 628	44.00	23.00 (28.65)	05.89 (13.98)	07.70 (16.08)
18	RSLG 630	61.00	26.00 (30.62)	07.39 (15.75)	08.14 (16.57)
19	RSLG 635	38.50	15.50 (23.23)	03.64 (11.00)	07.60 (16.00)
20	RSLG 639	34.00	20.50 (26.92)	03.55 (10.81)	08.82 (17.24)
21	RSLG 642	43.00	21.50 (27.61)	03.26 (10.38)	07.27 (15.64)
22	RSLG 644	36.50	14.50 (22.38)	05.84 (13.95)	08.11 (16.53)
23	RSLG 652	43.00	14.50 (22.38)	04.16 (11.72)	06.96 (15.26)
24	RSLG 664	31.00	17.50 (24.72)	04.67 (12.45)	08.53 (16.95)
25	RSLG 704	76.50	32.00 (34.44)	14.90 (22.70)	18.41 (25.36)
26	RSLG 708	52.00	24.00 (29.33)	06.51 (14.76)	07.33 (15.68)
27	RSLG 711	41.00	20.50 (26.92)	03.28 (10.41)	07.73 (16.16)
28	RSLG 730	32.00	11.00 (19.35)	04.29 (11.88)	07.53 (15.92)
29	RSLG 732	25.50	15.50 (23.18)	05.25 (13.23)	08.96 (17.36)
30	RSLG 735	28.00	19.50 (26.20)	09.09 (12.31)	07.83 (16.27)
31	RSLG 737	68.00	33.00 (35.06)	14.91 (22.70)	20.45 (26.88)
32	RSLG 739	58.00	26.00 (30.65)	04.95 (12.80)	09.22 (17.65)
33	RSLG 743	17.00	10.50 (18.90)	01.49 (06.97)	03.42 (10.66)

34	RSLG 751	26.00	18.50 (25.47)	04.93 (12.78)	08.43 (16.84)
35	RSLG 755	11.00	03.00 (09.83)	02.32 (08.72)	04.27 (11.86)
36	RSLG 756	75.00	29.00 (32.58)	15.89 (23.40)	17.92 (25.05)
37	RSLG 763	28.00	11.00 (19.35)	05.22 (13.18)	10.46 (18.86)
38	RSLG 764	37.00	15.00 (22.77)	04.84 (12.66)	07.42 (15.75)
39	RSLG 765	52.00	18.50 (25.47)	03.22 (10.34)	07.48 (15.89)
40	RSLG 766	54.00	24.50 (29.66)	04.19 (11.77)	06.45 (14.71)
41	RSLG 767	27.50	14.50 (22.35)	05.97 (14.14)	07.36 (15.72)
42	RSLG 779	16.50	06.00 (14.13)	01.63 (07.36)	02.45 (08.99)
43	RSLG 781	42.50	21.00 (27.27)	03.34 (10.47)	05.41 (13.43)
44	RSLG 788	41.00	25.00 (29.99)	04.22 (11.77)	06.37 (14.79)
45	RSLG 790	30.00	17.00 (24.34)	04.69 (12.60)	09.18 (17.65)
46	RSLG 823	45.00	21.50 (27.62)	08.09 (16.47)	09.95 (18.40)
47	RSLG 830	52.00	23.50 (28.99)	05.24 (13.16)	07.02 (15.40)
48	RSLG 842	43.50	19.50 (26.20)	07.43 (15.75)	08.12 (16.53)
49	RSLG 844	47.00	22.00 (27.96)	04.87 (12.69)	06.37 (14.58)
50	RSLG 848	12.50	08.00 (16.40)	01.62 (07.25)	02.47 (09.03)
51	RSLG 851	37.00	18.50 (25.47)	03.26 (10.38)	04.87 (12.69)
52	RSLG 856	31.00	10.50 (19.35)	03.51 (10.75)	06.45 (14.71)
53	RSLG 863	38.00	16.50 (23.94)	04.25 (11.84)	07.48 (15.89)
54	RSLG 866	39.50	15.50 (23.18)	06.43 (14.06)	09.33 (12.80)
55	RSLG 869	47.50	22.50 (28.31)	03.25 (10.37)	10.09 (18.53)
56	RSLG 886	25.00	12.00 (20.27)	08.34 (16.74)	10.65 (19.04)
57	RSLG 893	37.50	26.50 (30.97)	03.50 (10.73)	07.02 (15.67)
58	RSLG 914	29.00	11.00 (19.35)	03.06 (10.05)	07.93 (18.09)
59	RSLG 925	61.50	26.50 (30.97)	04.69 (12.45)	09.74 (18.17)
60	M-35-1	07.00	02.50 (09.05)	01.73 (07.49)	02.15 (08.42)
61	P.Maulee	32.50	11.50 (19.78)	3.48 1(0.70)	07.53 (15.94)
62	P.Swati	49.50	22.00 (27.95)	03.55 (10.78)	08.78 (17.20)
63	P.Chitra	33.50	14.50 (22.38)	04.35 (12.02)	08.36 (16.78)
64	P.Amruta	47.00	25.50 (30.30)	09.19 (17.59)	10.36 (18.76)
65	Selection-3	57.00	26.50 (30.47)	07.75 (16.16)	08.95 (17.40)
66	Yashoda	46.00	23.50 (28.53)	06.98 (15.29)	10.59 (19.00)
67	Vasudha	36.00	22.00 (27.96)	03.32 (10.66)	05.31 (13.30)
68	Anuradha	37.50	16.00 (23.57)	02.78 (09.58)	09.94 (15.26)
69	CSH-15-R	73.00	35.00 (36.25)	20.44 (26.86)	22.50 (28.31)
70	CSV-22	48.50	19.00 (25.83)	05.99 (14.10)	07.79 (16.19)
71	SE $^{\pm}$	01.92	00.89	00.65	00.82
72	CD at 5 %	05.43	02.52	01.85	02.33