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Screening of soybean genotypes against stem fly, *Melanagromyza sojae* (Zehntner)

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Abstract

To study the screening of nine soybean genotypes with one check variety (JS 20-29) were screened for resistance to stem fly, a trial was sown at the Experimental Field Department of Plant Breeding & Genetics J.N.K.V.V. Jabalpur (M.P.) during *Kharif* season 2014-15. To record the infestation of stem fly and tunnel in stem caused by its maggots, is taken by removal method i.e. 10 plants/plot were uprooted at randomly and split open vertically at 30 days and at maturity. Plant height and tunnel length were measured for calculating per cent stem tunneling. Among genotypes, JS 20-122 recorded the least per cent stem tunneling (4.67%) which was significantly superior to all other genotypes and check. The maximum per cent tunneling (20.82%) was observed in genotype JS 20-111. On the basis of incidence of stem fly, genotype JS 20-108 was found to be less susceptible and check variety JS 20-29 was highly susceptible.

Keywords: Soybean, Stem fly, Genotype, Plant infestation, Stem tunneling

1. Introduction

The soybean (*Glycine max* (L.) family Leguminaceae, sub-family Papilionaceae is major oilseed crop of Madhya Pradesh. For crop improvement field screening of genotypes to be evaluated it is raised in field under natural infestation.

Gupta *et al.*, (2004)^[2] Studied on stem fly (*Melanagromyza sojae*), incidence based on mean pest incidence, MACS-13, JS 84-200, JS 86-24, JS 81-1610 and JS 78-41 (14.3-15.7% damaged stem length) were resistant to stem fly.

Previously out of 80 soybean varieties, developed for cultivation in India, 14 varieties have showed resistant/tolerance to one of the other major insect-pests. These varieties were JS-80-21, JS-90-41, JS-93-05, MAUS-47, MACS-50, MAU-2, MAUS-32, Pusa-16, PNSA-20 and VL Soya-47. Joshi and Sharma, (2003)^[3]

Evaluation of forty one genotypes against the major pests and (defoliators and stem fly). Out of which ten genotypes were resistant high yielding, eight were resistant low yielding and twenty three genotypes categorized under susceptible low and high yielding. Singh *et al.*, (2007)^[9]

Whereas, the evaluation of fourteen medium-maturing soybean varieties in the field of Chhindwara, Madhya Pradesh, India, for their resistance to *Melanagromyza sojae* reported that none of the varieties was free from attack by the agromyzid, but JS 87-36 was the least susceptible and had the greatest grain yield, followed by JS-87 39, JS 87-27 and JS 87-1. Sharma *et al.*, (1994)^[7]

To get the knowledge about the performance of different genotypes with objective i.e. Screening of soybean genotypes against stem fly, *Melanagromyza sojae* (Zehntner) in field condition against stem fly so that their susceptibility or tolerance can be concluded a technical study was carried out.

2. Materials and Methods

In order to study the screening of soybean genotypes/varieties against stem fly a trial was sown at the Experimental Field, Department of Plant Breeding & Genetics, and JNKVV. Jabalpur (M.P.) during *Kharif* season 2014-15. All the recommended agronomic practices were followed to grow the crop.

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2.1 Details of experiment:-

- 1. Design : RBD
- 2. Replication : 04
- 3. No. of genotype : 9+1 (check)
- 4. Plot size : 5 m X 3.6 m
- 5. No. of rows/ plot : 08
- 6. Spacing (R x R) : 45 cm
- 7. Fertilizer : N 20, P₂O₅ 60, K₂O 20 kg ha⁻¹
- 8. Date of sowing : 11-07-2014

Table 1: Treatment details of genotypes

Treatment code	Genotypes
T ₁	JS-20-94
T ₂	JS-20-102
T ₃	JS-20-103
T ₄	JS-20-108
T ₅	JS-20-111
T ₆	JS-20-112
T ₇	JS-20-114
T ₈	JS-20-116
T ₉	JS-20-122
T ₁₀	JS-20-29(check)

To record the infestation of stem fly and tunnel in stem caused by its maggots, is taken by removal method i.e. 10 plants/plot were uprooted randomly at 30 days after sowing and at maturity. Plant height and tunnel length were measured for calculating per cent stem tunneling. Observations on plant infestation percent and tunnel damage percent were recorded in accordance to procedure given by (Patel, 2013) [4]

2.2 Per cent tunnel damage calculated by

$$\text{Tunnel damage \%} = \frac{\text{Length of tunnel}}{\text{plant height}} \times 100$$

2.3 Statistical analysis

Data recorded on various aspects were tabulated and subjected to statistical analysis by using the techniques of the analysis of variance. Treatments significance was tested by 'F' test. When 'F' test showed significant difference between the treatments mean values, was further tested for critical difference (CD) at 5% level of significance.

The plant infestation data and stem tunneling data were subjected to statistical analysis after arc sign transformation.

Table 2: Plant infestation and stem tunneling due to stem fly in different soybean genotypes.

Sr. No.	Genotypes	30 DAS*		At maturity**	
		Plant Infestation (%)	Stem tunneling (%)	Plant Infestation (%)	Stem tunneling (%)
1.	JS 20-94	20.00 (26.92)	2.32 (9.63)	90.00 (71.56)	12.95 (21.05)
2.	JS 20-102	25.00 (30.33)	2.85 (10.47)	75.00 (60.00)	9.72 (18.15)
3.	JS 20-103	25.00 (30.33)	5.85 (14.54)	70.00 (56.79)	14.97 (22.71)
4.	JS 20-108	0.00 (4.05)	0.00 (4.05)	60.00 (50.77)	9.22 (17.66)
5.	JS 20-111	20.00 (26.92)	6.12 (14.89)	75.00 (60.00)	20.82 (27.13)
6.	JS 20-112	30.00 (33.52)	7.95 (16.85)	65.00 (53.73)	9.37 (17.76)
7.	JS 20-114	25.00 (30.33)	5.25 (13.81)	90.00 (71.56)	16.47 (23.89)
8.	JS 20-116	10.00 (18.91)	0.75 (6.29)	75.00 (60.00)	8.65 (17.05)
9.	JS 20-122	40.00 (39.52)	5.40 (14.60)	60.00 (50.77)	4.67 (12.39)
10.	JS 20-29 (check)	20.00 (26.97)	2.07 (9.10)	100.00 (90.00)	16.30 (23.81)
	SEm±	3.48	0.71	7.03	2.41
	CD at %	10.16	2.07	20.51	7.05

- *Figures in parenthesis are x+0.5 angular transformed value.
- ** Figures in parenthesis are arcsin transformed value
- DAS- Days after sowing

Table 3: Analysis of Variance – Plant infestation at 30 DAS

Source of Variation	DF	Sum of Squares	Mean Squares	F-Calculated	Significance
Replication	3	147.422			
Treatment	9	3760.24	417.804	8.597	0.00001
Error	27	1312.139	48.598		
Total	39	5219.801			

Table 4: Mean Standard errors and C.D.

Treatment	Character 1	
	Mean	S.E.
1	26.92	0
2	30.07	3.15
3	30.07	3.15
4	4.05	0
5	26.92	0

6	33.22	3.637
7	30.07	3.15
8	12.918	8.867
9	39.52	0
10	26.92	0
C.D.	10.168	
SE(m)	3.486	
SE(d)	4.929	
C.V.	26.743	

Table 5: Analysis of Variance – Stem tunneling at 30 DAS

Source of Variation	DF	Sum of Squares	Mean Squares	F-Calculated	Significance
Replication	3	0.222			
Treatment	9	633.844	70.427	34.797	0
Error	27	54.646	2.024		
Total	39	688.713			

Table 6: Mean Standard errors and C.D.

Treatment	Character 1	
	Mean	S.E.
1	9.675	0.045
2	10.5	0.586
3	14.59	0.235
4	4.05	0
5	14.883	0.569
6	16.865	0.682
7	13.865	0.325
8	5.733	1.682
9	13.738	0.353
10	9.185	0.567
C.D.	2.075	
SE(m)	0.711	
SE(d)	1.006	
C.V.	12.581	

Table 7: Analysis of Variance – Plant infestation at maturity

Source of Variation	DF	Sum of Squares	Mean Squares	F-Calculated	Significance
Replication	3	2,552.31			
Treatment	9	6,055.79	672.866	3.403	0.00648
Error	27	5,339.21	197.748		
Total	39	13,947.30			

Table 8: Mean Standard errors and C.D.

Treatment	Character 1	
	Mean	S.E.
1	80.193	9.807
2	64.028	10.369
3	60.86	10.899
4	51.335	6.989
5	64.028	10.369
6	53.938	3.167
7	76.72	7.667
8	63.745	9.247
9	51.053	4.945
10	90	0
C.D.	20.511	
SE(m)	7.031	
SE(d)	9.944	
C.V.	21.44	

Table 9: At par calculation

Treatment	Treatment value	C.D.	Summation
T9	51.053	20.511	71.564
T4	51.335	20.511	71.846
T6	53.938	20.511	74.449
T3	60.86	20.511	81.371
T8	63.745	20.511	84.256
T2	64.028	20.511	84.539
T5	64.028	20.511	84.539
T7	76.72	20.511	97.231
T1	80.193	20.511	100.704
T10	90	20.511	110.511

At par

T9	T4	T6	T3	T8	T2	T5	T7	T1	T10
51.02	51.33	53.93	60.86	63.74	64.02	64.02	76.72	80.19	90

Table 10: Analysis of Variance – Stem tunneling at maturity

Source of Variation	DF	Sum of Squares	Mean Squares	F-Calculated	Significance
Replication	3	295.304			
Treatment	9	763.573	84.841	3.625	0.00447
Error	27	631.953	23.406		
Total	39	1,690.83			

Table 11: Mean Standard errors and C.D.

Treatment	Character 1	
	Mean	S.E.
1	21.015	1.152
2	17.45	3.192
3	22.23	3.298
4	16.935	3.147
5	26.758	3.123
6	17.125	3.064
7	23.643	2.463
8	16.498	2.793
9	11.245	3.239
10	23.743	1.213
C.D.	7.057	
SE(m)	2.419	
SE(d)	3.421	
C.V.	24.603	

Table 12: At par calculation

Treatment	Treatment value	C.D.	Summation
T9	11.245	7.057	18.302
T8	16.498	7.057	23.555
T4	16.935	7.057	23.992
T6	17.125	7.057	24.182
T2	17.45	7.057	24.507
T1	21.015	7.057	28.072
T3	22.23	7.057	29.287
T7	23.643	7.057	30.7
T10	23.743	7.057	30.8
T5	26.758	7.057	33.815

At par

T9	T8	T4	T6	T2	T1	T3	T7	T10	T5
11.24	16.49	16.93	17.12	17.45	21.01	22.23	23.64	23.74	26.75

3. Results and Discussion

Nine genotypes with one check variety (JS 20-29) are tested for relative field resistance against stem fly. None of the genotypes was found free from stem fly infestation. Evaluation of seventy soybean genotypes against the stem fly, *Melanagromyza sojae* in a field. None of the genotypes were

highly resistant. Thirty nine genotypes were moderately resistant with percentage tunneling ranging from 28.90 to 41.70 percentage DS93-P-40-3 recorded the lowest percentage tunneling (28.90%) and DS90-2-1 was highly susceptible to stem fly with 68.5% tunneling damage. Sekhar *et al.*, (2000) [6].

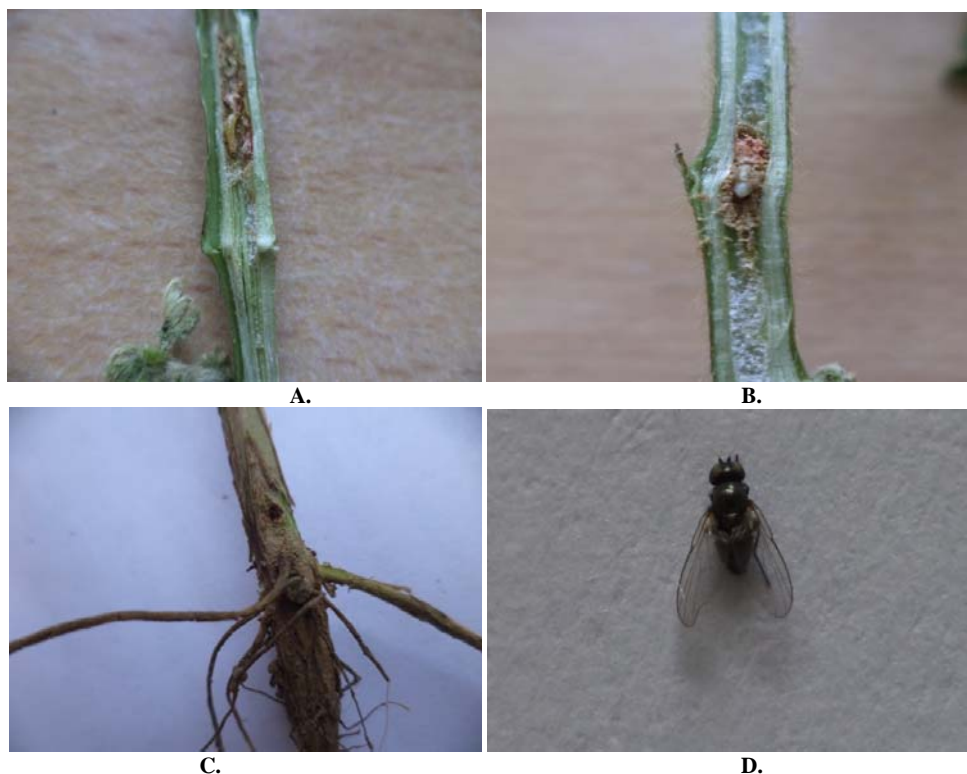


Plate 1: Different stages of stem fly attacking soybean plant and its damage symptoms. (a) Maggot of stem fly, (b) Pupa inside stem, (c) Exit-hole & (d) Adult of stem fly

3.1 Plant infestation

The per cent plant infestation in different genotypes varied from 0 to 40% at 30 DAS and 60 to 100 % at maturity. It is interesting to note that JS 20-108, was superior recording less plant infestation initially at 30 days and at maturity also (0 and 60% respectively). Whereas, at 30 DAS JS-20-122 (40%) and at maturity JS-20-29 (check) (100%) was found to be inferior in this respect recording higher plant infestation.

Venkataravanappa, (1996) [10] screened soybean varieties against *M. sojae*, among these, few varieties viz., JS-89-43, JS-SH,-41, JS-SH -1310 and JS-87-59 (normal duration) and JS-87-50 and JS-87-59 (early duration) were moderately resistant.

Evaluation of forty-four genotypes of soybean against *Melanagromyza sojae* (Diptera: Agromyzidae) during Kharif 1996 at Sehore and reported that one genotype was highly resistant, two resistant, 17 moderately resistant, 19 slightly resistant, three susceptible and two highly susceptible to *M. sojae*. Dubey *et al.*, (1998) [11]

3.2 Stem tunneling

The present finding showed that stem tunneling due to stem fly at 30 DAS and at maturity differed significantly among the

genotypes and varied from 0 to 7.95% and 4.67 to 20.82% respectively. Among the genotypes JS 20-108, JS 20-116 and JS 20-122 to JS 20-116 showed less susceptibility against stem fly at 30 DAS as well as at maturity (0 to 0.75% and 4.67 to 8.65% tunneling respectively). Whereas genotypes JS 20-112 (7.95%) at 30DAS, JS 20-111(20.82%) at maturity were found highly susceptible.

The maximum per cent plant damage was recorded in JS 78-78 and JS 78-67. Least stem tunneling was recorded in JS-72-185 and maximum in Ankur. Shrivastava and Shrivastava, (1987) [8]

During the previous evaluation of soybean cultivars for their major insect pest which was carried out at Parbhani. Stem length tunneled due to stem fly (*Melanagromyza sojae*) varied from 5.87 to 14.07%. The highest stem length tunneling was recorded in JS (SH)-9246(14.07%) and the lowest in NRC-37 (5.86%). Salunke *et al.*, (2002) [5]

Similar types of varietal equations were previously documented by other workers (Gupta *et al.*, 2004 and Singh *et al.*, 2007) [2, 9] however, varieties in their study were different to that of my genotypes. Hence, there is no information available to compare the present findings.

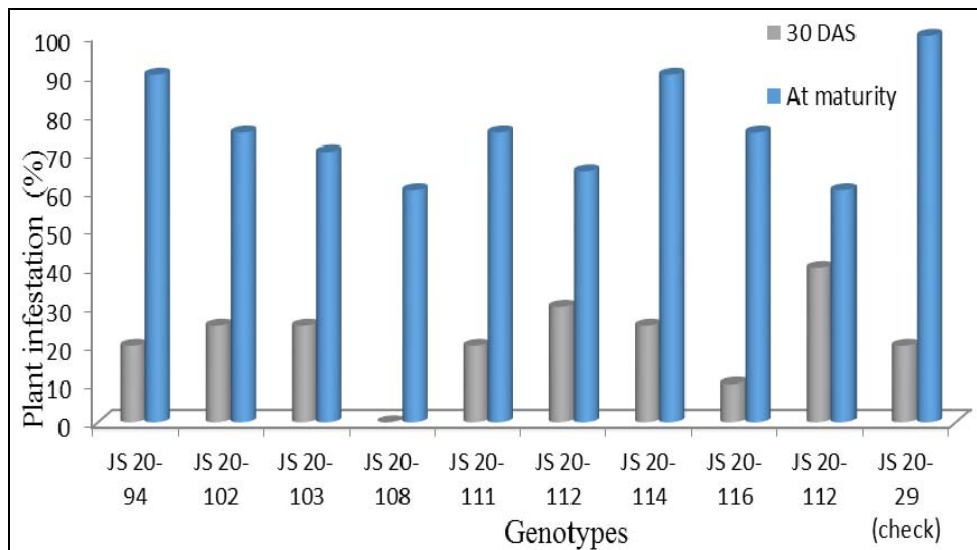


Fig 1: Percent plant infestation due to stem fly in soybean genotypes

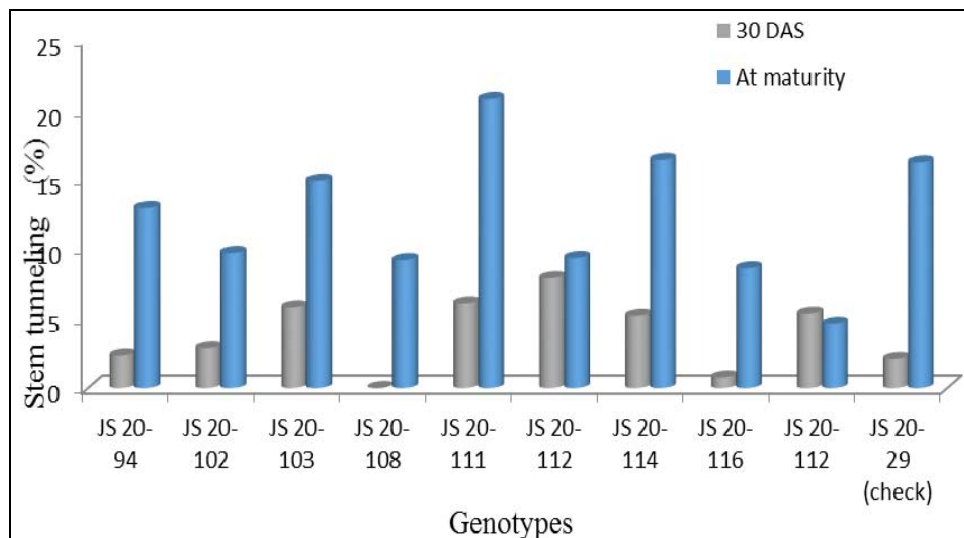


Fig 2: Percent stem tunneling due to stem fly in soybean genotypes

4. Conclusion

On the basis of incidence of stem fly, genotype JS 20-108 was found to be less susceptible and check variety JS 20-29 was highly susceptible against stem fly.

5. Acknowledgement

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