

Studies on the Varietal Resistance of Bhendi (*Abelmoschus esculentus*) (L.) Moench) to the Leafhopper, *Amrasca* (= *Empoasca*) *devastans* (Dist.) (Homoptera : Jassidae)

1. Screening of Varieties under Field conditions

By

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ABSTRACT

Studies have been made on the varietal resistance of bhendi (*Abelmoschus esculentus* (L.) to the leafhopper *Amrasca devastans*. A total of twenty five varieties was screened under field conditions. The varieties A. E. 15, Pusa Sawani and A. E. 30 were found to be resistant to the leaf hopper. The leaf hopper incidence was more during the North-East monsoon season than during cold weather season.

The utility of an insect-resistant vegetable variety needs no emphasis in India where a sizeable area is under cultivation with different kinds of vegetables constantly facing depredations by heavy insect pest infestations. In view of the importance given to the vegetables and hazards involved in chemical control of pests on those crops, it has become imminent to seek for built-in protection by way of varietal resistance to the pest species wherever possible. Considerable work has been done on the resistance of cotton to the leafhopper *Amrasca devastans* in India (Hussain and Lal, 1940; Verma and Afzal, 1940; Afzal and Abbas, 1943; Afzal and Ghani, 1949, 1953; Annappan, 1960); *Empoasca fabae* (Harr.) in alfalfa and clover (Jewett, 1932), potato (Sleesman and Stevenson, 1941) and to *E. flavescens* (F.) in castor bean

varieties (Jayaraj, 1964). Bhendi or lady's finger is ravaged by many insects of which the leafhopper, *Amrasca devastans* is a serious pest. So far there is no published information available on the incidence of leafhoppers on bhendi varieties. Therefore, an attempt was made to screen twenty-five cultivated varieties of bhendi for the incidence of jassids and the observations are presented in this paper.

MATERIALS AND METHODS

Two field trials were conducted during 1968-69 in the Vegetable Farm of Agricultural College and Research Institute, Coimbatore, with 25 varieties raised in single row plots of ten plants each with a spacing of 60 cm within the row and 75 cm between the rows replicated thrice.

(i) *Population studies:* In each experiment eight weekly observations

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on adults and nymphs were made early in the morning, when the jassids are generally inactive, on three plants per variety at random in each replication. In each plant, three leaves, one each from the top, middle and bottom regions were examined. In early stages of the crop, the third, fourth and fifth leaves from the terminal end were selected, while in the later stages, the top leaf selected was third from the top, the middle medium in maturity and the bottom a well matured one. Thus, in all, a total of 27 leaves for nine plants were examined at a time for each variety. The observations were commenced 25 days after sowing and continued till the plants died of age or due to jassid injury.

(ii) *Hopperburn studies:* The hopperburn assessment was done only in the second experiment. When most of the plants had reached maturity, i. e., in the ninth and tenth week after sowing, the observations were made as described by Jayaraj (1966) by placing a glass plate, marked with square centimeter on the leaf surface and observing the leaf area affected. The hopperburn area was expressed as a percentage to the total leaf area. The third, fourth and fifth leaves from the terminal end were selected for the observation in view of development of maximum hopperburn symptoms. Nine plants in each variety were examined for hopperburn assessment.

## RESULTS AND DISCUSSION

The varieties examined and the data gathered are presented in Table 1.

The above data indicate that all the varieties were susceptible to the

attack of the leafhopper the range being 5.98 to 14.42. The variety A. E. 30 had the least mean infestation of 5.98 per plant unit, indicating a fair degree of resistance. The varieties A. E. 26 and A. E. 52 recorded a mean infestation of 12.73 and 14.42 respectively indicating that these are preferred by the leafhoppers. All other varieties were found to be intermediary between these categories. The level of population per plant was markedly greater in the first season with a mean of 13.38 leafhoppers as against 5.68 in the second season.

The data collected on the percentage of hopperburn indicate that the minimum (12.2%) hopperburn was observed in the resistant variety A. E. 30 while the maximum (61.6%) was found in the highly susceptible variety, A. E. 26. The tolerant variety A. E. 52 exhibited very low level of hopperburn similar to the resistant variety. The other varieties were intermediary with reference to the damage caused. It was noted that the incidence of jassids was very high during the North East Monsoon (August-October) season compared to cold weather season (November-January).

It has been noted that the nymphal population always outnumbered the adults on all the varieties (Table 2).

The proportion of nymphal population to the total leafhopper infestation was found to be closely associated with the phenomenon of resistance and susceptibility of bhendi to jassid incidence. Ghani *et al* (1945) reported that the nymphal population of *Amrasca devastans* on cotton increased

TABLE 1. Population of leafhoppers per plant and hopperburn damage on bhendi varieties. [Figures in parentheses are sine values]

No.	Variety	Population		Mean	Hopperburn percentage	Remarks
		N. E. Monsoon Season	Cold weather Season			
<b>SUSCEPTIBLE</b>						
1.	A. E. 26	20.42	5.02	12.73	61.6 [51.7]	No antibiosis, no tolerance, population medium to high; high hopperburn damage
2.	A. E. 17	18.04	6.91	12.48	43.1 [41.0]	
3.	A. E. 68	16.81	5.27	11.04	53.1 [46.8]	
4.	A. E. 33	16.81	5.75	11.28	55.6 [48.2]	
5.	A. E. 104	12.32	3.82	8.08	60.3 [50.9]	
6.	A. E. 9	10.93	5.24	8.09	41.4 [40.1]	
7.	A. E. 51	10.93	6.70	8.82	46.7 [43.1]	
8.	A. E. 11	10.66	6.00	8.34	56.1 [48.5]	
9.	A. E. 38	10.48	3.97	7.23	45.5 [42.4]	
10.	A. E. 18	8.19	5.04	6.61	50.0 [45.0]	
11.	A. E. 27	7.93	5.58	6.76	56.5 [48.7]	
<b>TOLERANT</b>						
12.	A. E. 52	22.90	5.93	14.42	23.8 [29.2]	Low non-preference and antibiosis, leading to medium incidence; low hopperburn damage
13.	A. E. 75	18.92	3.55	11.24	33.7 [35.5]	
14.	A. E. 91	17.41	6.53	11.97	37.6 [37.8]	
15.	A. E. 35	17.08	6.30	11.69	41.0 [39.8]	
16.	A. E. 37	15.49	5.61	10.55	38.9 [38.6]	
17.	A. E. 34	13.94	6.04	9.99	38.9 [38.6]	
18.	A. E. 22	13.41	8.58	11.00	39.6 [39.0]	
19.	A. E. 7	12.66	4.84	8.75	38.3 [38.2]	
20.	A. E. 77	11.85	5.46	8.66	37.4 [37.7]	
21.	A. E. 39	10.31	4.18	7.25	32.0 [34.4]	
22.	A. E. 72	9.77	8.10	8.94	40.6 [39.6]	
<b>RESISTANT</b>						
23.	A. E. 15	13.43	6.29	9.87	18.6 [25.5]	Low incidence due to non-preference and high antibiosis; low hopperburn damage
24.	Pusa Sawani	7.13	5.64	6.39	25.5 [30.3]	
25.	A. E. 30	6.53	5.43	5.98	12.2 [20.4]	
<b>MEAN</b>		13.38	5.68			

Difference between seasons significant at 1% probability level

C. D. [P=0.05] 0.81

Difference between varieties significant at 1% probability level

C. D. [P=0.05] 2.86

Interaction between seasons and varieties significant at 1% probability level

C. D. [P=0.05] 4.05

Difference between varieties for hopperburn significant at 1% probability level

C. D. [P=0.05] 3.41

TABLE 2. Population of nymphs and adults per plant on bhendi varieties  
A. VARIETY

No.	Variety	Nymphs	Adults	No.	Variety	Nymphs	Adults
SUSCEPTIBLE				TOLERANT			
1.	A. E. 26	21.26	4.18	15.	A. E. 35	20.37	3.01
2.	A. E. 17	21.36	3.52	16.	A. E. 37	17.75	8.36
3.	A. E. 68	18.22	3.86	17.	A. E. 34	16.70	3.29
4.	A. E. 33	20.05	2.51	18.	A. E. 22	18.52	3.48
5.	A. E. 104	13.69	2.46	19.	A. E. 7	16.13	2.04
6.	A. E. 9	14.07	2.11	20.	A. E. 77	14.89	2.42
7.	A. E. 51	15.23	2.40	21.	A. E. 39	11.91	2.58
8.	A. E. 11	14.42	2.25	22.	A. E. 72	15.01	2.86
9.	A. E. 38	11.93	2.52				
10.	A. E. 18	11.41	1.82				
11.	A. E. 27	11.51	2.01				
12.	A. E. 52	23.49	5.34	23.	A. E. 15	16.48	3.24
13.	A. E. 91	21.28	2.67	24.	Pusa Sawani	10.84	1.94
14.	A. E. 75	18.68	3.80	25.	A. E. 30	9.78	2.18

B]	Periods	Nymphs	Adults
	1	1.01	0.45
	2	11.67	1.01
	3	11.67	1.34
	4	16.46	2.00
	5	27.76	3.96
	6	25.83	5.15
	7	24.72	6.01
	8	16.70	3.10
C]	Seasons		
	I	22.46	4.26
	II	9.85	1.49

Differences between nymphs and adults significant at 1% probability level	C. D. [P=0.05]	0.81
Differences between varieties significant at 1% probability level	C. D. [P=0.05]	2.86
Interaction between nymphs and adults and varieties significant at 1% probability level	C. D. [P=0.05]	4.05
Differences between periods significant at 1% level	C. D. [P=0.05]	1.62
Interaction between nymphs and adults and periods significant at 1% probability level	C. D. [P=0.05]	2.29
Differences between seasons significant at 1% probability level	C. D. [P=0.05]	0.81
Interaction between seasons and nymphs and adults significant at 1% probability level	C. D. [P=0.05]	1.14

up to an age of 35-40 days, depending on the variety and then decreased. In the present study also, it has been noted that the population of leafhopper increased up to fifth week and then decreased in the 6, 7 and 8th weeks which is in conformity with the above report.

In assessing the susceptibility or otherwise of a variety, the quantum of damage exhibited and the population were considered as criteria. In classifying the varieties based on these criteria, those which showed hopperburn of less than 20 per cent with low population of up to 10 per plant unit were grouped as 'resistant', 21 to 50 per cent damage with medium population of 10 to 15 per plant unit as 'tolerant' and 51 per cent and above hopperburn with medium to high incidence of 10 to 20 and above per plant unit as 'susceptible' varieties. This classification was based on a similar pattern of classification of castor varieties susceptible to *Empoasca flavescens* adopted by Jayaraj (1967).

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#### REFERENCES

- AFZAL, M. and M. ABBAS. 1943. Cotton Jassid (*Empoasca devastans* Dist.) in the Punjab. V. A note on the characters of the plant associated with jassid resistance. *Indian J. Ent.* 5 : 41-51.
- AFZAL, M., M. ABBAS and GHANI, M. A. 1949. Studies on the cotton jassid (*Empoasca devastans* Dist.) in the Punjab. XI. Effect of agronomic factors on the incidence of jassid attack. *Pakistan J. Sci. Res.* 1 : 41-62.
- AFZAL, M., M. ABBAS and M. A. GHANI. 1953. Cotton Jassids in the Punjab. *Sci. Monogr. Pakistan Ass. Advanc. Sci.* 2 : 102.
- ANNAPPAN, R. S. 1960. Breeding for jassid resistance - a few findings. *Indian Cott. Gr. Rev.* 14 : 501-8.
- GHANI, M. A., M. AFZAL and D. A. NANDA. 1945. Studies on cotton jassid (*Empoasca devastans* Dist.) in the Punjab. VII. Age of leaf and jassid susceptibility. *Proc. Indian Acad. Sci.* 22 : 219-29.
- HUSSAIN, M. A. and K. B. LAL. 1940. The bionomics of *Empoasca devastans* Dist. on some varieties of cotton in the Punjab. *Indian J. Ent.* 2 : 123-26.
- JAYARAJ, S. 1964. Investigations on the mechanism of resistance in castor (*Ricinus communis* L.) to the castor leafhopper, *Empoasca flavescens* (F.) (Jassidae : Homoptera) Unpub. Doctoral Thesis, Univ. Madras.
- JAYARAJ, S. 1966. Influence of sowing times of castor varieties on their resistance to the leafhopper, *Empoasca flavescens* (F.) (Homoptera. Jassidae) *Entomologia exp. appl.* 9 : 359-69.
- JAYARAJ, S. 1967. Studies on the resistance of castor plants (*Ricinus communis* L.) to the leafhopper *Empoasca flavescens* (F.) (Homoptera : Jassidae). *Z. aug. Ent.* 59 : 117-26
- \*JEWETT, H. H. 1932. The resistance of certain red clovers and alfalfas to the leafhopper injury. *Ky. Agr. Expt. Sta. Bull.* 329 : 155-72.
- SLEESMAN, J. P. and F. J. STEVENSON. 1941. Breeding a potato resistant to the potato leafhopper. *Amer. Potato. J.* 18 : 290-299.
- VERMA, P. M. and K. AFZAL. 1940. Studies on the cotton jassid *Empoasca devastans* Dist. in the Punjab. I. Varietal susceptibility and development of the pest on different varieties of cotton. *Indian J. agric. sci.* 10 : 911-26.
- \* Original not seen.