

Screening of Genotypes against Major Sucking Insect- Pests of Mothbean [*Vigna aconitifolia*] in Arid Region

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This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: Some genotypes of mothbean were screened for their comparative preference against jassids, whiteflies and thrips.

Materials and Methods: The experiment was laid out during *Kharif* season in Randomized Block Design with three Replications. Ten genotypes (viz., RMO-225, RMO-40, RMO-423, RMO-435, RMO-257, RMO-25, RMO-141, RMO-20-36, RMO-04-01-28 and RMO-28-80) were screened against major sucking insect pests which were replicated thrice.

Observations: The observations were recorded after two weeks of sowing at weekly intervals after two weeks of sowing. The pest populations were recorded on five randomly selected and tagged plants per plot in early hours when insect have minimum activity.

Results: The data revealed that none of the genotypes were found free from sucking insect pest attack. On the basis of peak population, the genotypes RMO-25 and RMO-141 were categorized as least preferred to jassids, whiteflies and thrips, whereas, RMO-435, RMO-225 and RMO-04-01-28 as highly preferred to jassids and whiteflies and RMO-435, RMO-225 and RMO-257 as highly resistant to thrips.

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Conclusion: It is well known that certain genotypes of crops are less attacked by a specific insect-pest than others because of natural resistance. In the integrated pest management programme, growing of varieties (RMO-25 and RMO-141) with less preference to sucking insect-pests is one of the most important tools without additional cost.

Keywords: Jassids, mothbean; population; resistant; thrips; varieties; whiteflies.

1. INTRODUCTION

Mothbean [*Vigna aconitifolia* (Jacq.) Marechal] also known as dew bean belongs to family Fabaceae, sub family Papilionaceae is one of the most important *Kharif* pulse crop for arid region of the country, because of high drought tolerance. It is considered to be originated from India. Though it is cultivated in China, India, Pakistan, Sri Lanka and United States of America. In India, it is mainly cultivated in the states viz., Rajasthan, Gujarat, Haryana, Maharashtra and Uttar Pradesh. A total of 9.26 lakh hectares and 2.77 lakh tonnes of Mothbean production was recorded in the country during the twelfth plan (2012-15) period: Area and production of moth bean has been highest in Rajasthan (96.75% and 94.49% respectively) followed by Gujarat (2.38% and 3.6% respectively). However, yield of Rajasthan (292 kg/ha) was below the National average productivity of (299 kg/ha) [1]. The mothbean bean seed contains about 10.30 per cent moisture, 25.66 per cent protein, 2.78 per cent fat, 0.41 per cent mineral matter, 3.90 per cent fiber and 61.76 per cent carbohydrate.

The whole grain is used as vegetable and it is also used for preparing snacks, papad, sweets, chat and mangori's (grind the mothbean seeds with water and then sun dried which are used as vegetable in Rajasthan). The green as well as dry plants make good quality fodder and are used as green manure crop which improves the soil fertility. Plants cover large area on the surface, conserve moisture and also protect the soil from erosion. Mothbean is mainly used as 'dal' and some other preparations. Green pods are used as vegetable. The mothbean crop is damaged at various stages of plant growth by number of insect-pests including Jassid, whitefly, thrips, black weevil, pulse beetle and white grubs are considered as major pests while termites, galerucid beetle, mites and surface grass hoppers are of minor nature [2,3]. among these jassids, whiteflies and thrips are major sap sucking insect pests which cause moderate to severe damage starting right from germination to maturity of the crop and bring considerable

decrease in yield [4,5]. Population of these insects are often seen on tender parts of the plant, particularly on leaves. The nymphs and adults of these insects suck the cell sap from leaves and tender parts of plant which leads to yellowing, deformation, wilting and ultimately drying of affected parts. They also act as vectors of different diseases on mothbean particularly yellow leaf vein mosaic by whitefly. Yield losses of mothbean reported in seed yield from 14 to 50 percent [6]. In order to prevent the loss caused by insects and to produce a quality crop, it is essential to manage the pest population below Economic threshold level. It is well known that certain genotypes of crops are less attacked by specific insect-pest than others because of natural resistance. In the integrated pest management programme, growing of resistant varieties against insect-pests is one of the most important tool without additional cost.

2. METHODS AND MATERIALS

A field experiment was conducted at Agronomy Farm, College of Agriculture, Bikaner (Rajasthan) during *Kharif* 2010. The experiment was laid out in Randomized Block Design (RBD) with ten genotypes, each replicated thrice. The seeds of these genotypes were sown in the plots measuring 3.0 x 2.7 m² having row to row and plant to plant distance of 30 cm and 10 cm, respectively.

All recommended package of practices were followed from time to time to raise the crop successfully. Ten genotypes viz., RMO-225, RMO-40, RMO-423, RMO-435, RMO-257, RMO-25, RMO-141, RMO-20-36, RMO-04-01-28 and RMO-28-80 were sown for their screening against major sucking insect-pests.

2.1 Observations

The crop was kept under constant observation for appearance of pests, two weeks after sowing of crops. The observations were recorded at weekly intervals. The pest populations were recorded on five randomly selected and tagged

plants per plot in early hours (Before 8 AM), when insect had minimum activity. The details regarding population count of each insect-pest has been described below:

2.1.1 Jassid (*Empoasca motti* Pruthi)

The population of jassids was recorded by counting both nymphs and adults as per method described by [7]. In the initial stage of crop, counting of jassids was done on whole plant and in later stage on the six leaves i.e. two each from top, middle and bottom of each tagged plant.

2.1.2 Whitefly (*Bemisia tabaci* Gennadius)

The population of whitefly was counted visually on whole plant in the initial stage and on six leaves i.e. two each from top, middle and bottom of each tagged plant in later stage. For counting the whitefly population, the leaf was held at the petiole by thumb and forefinger and twisted until the entire under side of leaf was clearly visible [8].

2.1.3 Thrips (*Caliothrips indicus* Bagnall)

The thrips population (nymphs) was counted visually with the help of magnifying lens on whole plant in the initial stage and in later stage on the six leaves i.e. two each from top, middle and bottom of each tagged plant.

The data obtained on jassids, whitefly and thrips population from the experimental field was transformed into $\sqrt{x + 0.5}$ [8] and subjected to statistical analysis (analysis of variance).

3. RESULTS AND DISCUSSION

In the present investigation, on the basis of peak population, the genotypes RMO-25 and RMO-141 were categorized as less preferred to jassids, whiteflies and thrips, whereas, RMO-435, RMO-225 and RMO-04-01-28 as highly preferred to jassid and whitefly and RMO-435, RMO-225 and RMO-257 as least resistant to thrips.

3.1 Jassid, *Empoasca motti* Pruthi

The infestation of jassids started 4 weeks after sowing in all the genotypes screened. The mean data indicated that on initial stage of crop, jassid population ranged from 1.93 to 3.70 per six leaves. During this stage minimum jassid population was observed on genotype RMO-141

(1.93 jassids/plant) followed by RMO-25 (2.00 jassids/plant) and RMO-20-36 (2.20 jassids/plant) which were found significantly superior over rest of the genotype. The maximum population jassid was observed on genotype RMO-435 (3.70 jassids/plant) followed by RMO-225 (3.47 jassids/plant), RMO-04-01-28 (3.20 jassids/plant), however, RMO-435 was statistically at par with RMO-225 but differed significantly from RMO-04-01-28. The jassid population was 3.00, 3.00, 2.93 and 2.80 on RMO-257, RMO-423, RMO-40 and RMO-28-80, respectively, and all these genotypes were statistically at par with each other. The infestation of jassids increased gradually and reached to its peak in the third week of September. At this stage the mean jassid population ranged from 8.93 to 15.00 per plant. The minimum jassid population observed on genotype RMO-25 (8.93 jassids/plant) followed by RMO-141 (9.47 jassids/plant) and RMO-20-36 (10.00 jassids/plant), however, all these genotypes were statistically at par with each other. The maximum jassid population observed on genotype RMO-435 (15.00 jassids/plant) followed by RMO-225 (14.00 jassids/plant) and RMO-04-01-28 (13.75 jassids/plant) and were found statistically at par with each other and significantly inferior to rest of the genotypes. The genotypes viz., RMO-28-80 (10.47 jassids per six leaves), RMO-40 (10.73 jassids), RMO-423 (11.00 jassids) and RMO-257 (11.13 jassids) were statistically at par and were ranked in middle order of infestation. After reaching peak, the population of jassid declined and persisted upto first week of October. The mean jassid population at all the intervals (7 observations) ranged from 4.57 to 6.92 per plant. The minimum infestation was observed on genotype RMO-25 (4.57 jassids/plant) followed by RMO-141 (4.87 jassids/plant) and RMO-20-36 (5.17 jassids/plant) and were found statistically at par with each other. The maximum jassid population was observed on RMO-435 (6.92 jassids/plant) followed by RMO-225 (6.57 jassids/plant) and RMO-04-01-28 (6.56 jassids/plant) and were statistically at par. Rest of genotypes viz., RMO-28-80 (5.52 jassids/plant), RMO-40 (5.72 jassids/plant), RMO-423 (6.00 jassids/plant) and RMO-257 (6.02 jassids/plant) were ranked in middle order of infestation and were statistically at par with each other.

Based on mean of peak jassid population observed during the crop season, the variability of resistance in mothbean genotypes was recorded ascending order as RMO-25 < RMO-

141 < RMO-20-36 < RMO-28-80 < RMO-40 < RMO-423 < RMO-257 < RMO-04-01-28 < RMO-225 < RMO-435 (Table 1). In the present investigation, the RMO-25 and RMO-141 were observed highly resistant to the attack of the jassid, get supported by the findings [9]. The present findings were in agreement with earlier finding who reported that RMO-40 and RMO-257 as moderately susceptible [10]. However, RMO-225 and RMO-435 as highly susceptible supports the present findings. RMO-435 also reported as highly susceptible by [11].

3.2 Whitefly, *Bemisia tabaci* (Gennadius)

The population of whitefly increased gradually and reached at its peak in the 3rd week of September. The mean whitefly population ranged from 7.73 to 17.27 per plant. The minimum whitefly population was recorded on genotype RMO-141 (7.73 whiteflies/plant) followed by RMO-25 (8.67 whiteflies/plant) and RMO-28-80 (8.88 whiteflies/plant) and these were found statistically at par and significantly superior over rest of genotypes with regard to their degree of infestation. The maximum whitefly population was recorded on genotype RMO-225 (17.27 whiteflies/plant) followed by RMO-435 (15.50 whiteflies/plant) and both were statistically at par and significantly inferior to rest of the genotypes. The genotypes which ranked in middle order of infestation include RMO-20-36 (10.93 whiteflies/plant), RMO-423 (11.00 whiteflies/plant), RMO-40 (11.07 whiteflies/plant), RMO-257 (12.00 whiteflies/plant) were statistically at par. After the peak period of infestation the population of whitefly gradually declined and persisted upto first week of October. The mean whitefly population as revealed by all the observations ranged from 3.39 to 7.14 per plant. The minimum infestation was observed on genotypes RMO-141 (3.39 whiteflies/plant) followed by RMO-25 (3.73 whiteflies/plant) and RMO-28-80 (4.13 whiteflies/plant) and these were statistically at par.

The maximum whitefly population was observed on RMO-225 (7.14 whiteflies/plant) followed by RMO-435 (6.70 whiteflies/plant) and both were found statistically at par with each other. Rest of genotypes viz., RMO-20-36 (4.51 whiteflies/plant), RMO-423 (4.95 whiteflies/plant) and RMO-40 (4.99 whiteflies/plant), RMO-257 (5.45 whiteflies/plant) and RMO-04-01-28 (5.74

whiteflies/plant) ranked in middle order of infestation.

Based on mean of peak whitefly population and mean of all the observations taken during the crop season, the variability of resistance in mothbean genotypes in ascending order was RMO-141 < RMO-25 < RMO-28-80 < RMO-20-36 < RMO-423 < RMO-40 < RMO-257 < RMO-04-01-28 < RMO-435 < RMO-225 (Table 2). In the present investigation, the mothbean genotypes RMO-141 and RMO-25 were found highly resistant to the attack of the whitefly which was in agreement with that it has also been reported that RMO-141 harbor significantly less whitefly population [12]. The results of present investigation also corroborate with that reported RMO-423 and RMO-40 as moderately resistant [10] and RMO-225 was reported as highly susceptible [13].

3.3 Thrips, *Caliothrips indicus* Bagnall

The minimum population of thrips was recorded on genotypes RMO-25 (1.33 thrips/plant) followed by RMO-141 (1.55 thrips/plant) and both were at par and also inferior to rest of genotypes. The maximum population of thrips was recorded on genotype RMO-435 (3.27 thrips/plant) followed by RMO-225 (3.07 thrips/plant) and RMO-257 (3.07 thrips/plant) and these genotypes were statistically at par with each other and also inferior to rest of the genotypes. The genotypes viz., RMO-28-80 (1.93 thrips/plant) RMO-20-36 (2.07 thrips), RMO-40 (2.20 thrips), RMO-04-01-28 (2.47 thrips) and RMO-423 (2.87 thrips) ranked in middle order of infestation. The infestation of thrips increased gradually and reached at its peak in the 3rd week of September. During this period the mean thrip population ranged from 6.27 to 13.93 per plant. The minimum population of thrips was observed on genotype RMO-141 (6.27 thrips/plant) followed by RMO-25 (6.87 thrips/plant) and RMO-28-80 (7.07 thrips/plant) and all these genotypes were at par in their degree of infestation. The genotype RMO-28-80 was also found at par with RMO-20-36 (7.47 thrips/plant). The maximum thrips population was observed on genotype RMO-435 (13.93 thrips/plant) followed by RMO-225 (13.50 thrips/plant) and RMO-257 (12.90 thrips/plant) and were at par with each other. The genotypes viz., RMO-20-36 (7.47 thrips/plant), RMO-423 (9.00 thrips/plant), RMO-40 (9.07 thrips/plant), RMO-423 (9.60 thrips/plant) and RMO-04-01-28 (9.73 thrips/plant) ranked in middle order of

Table 1. Population of jassid, *E. motti* on different genotypes of mothbean

S. No.	Varieties/ Genotypes	Mean jassid population per six leaves at weekly interval							Mean
		26.08.10	02.09.10	09.09.10	16.09.10**	23.09.10	30.09.10	06.10.10	
1.	RMO-225	3.47 (1.99)*	7.50 (2.83)	8.93 (3.07)	14.00 (3.81)	7.40 (2.81)	4.67 (2.27)	0.00 (0.71)	6.57 (2.66)
2.	RMO-40	2.93 (1.85)	5.87 (2.52)	7.73 (2.87)	10.73 (3.35)	6.67 (2.68)	5.00 (2.35)	1.13 (1.28)	5.72 (2.49)
3.	RMO-423	3.00 (1.87)	6.27 (2.60)	8.00 (2.92)	11.00 (3.39)	7.00 (2.74)	5.20 (2.39)	1.53 (1.43)	6.00 (2.55)
4.	RMO-435	3.70 (2.05)	7.73 (2.87)	9.53 (3.17)	15.00 (3.94)	8.13 (2.94)	4.33 (2.20)	0.00 (0.71)	6.92 (2.72)
5.	RMO-257	3.00 (1.87)	6.33 (2.61)	8.47 (2.99)	11.13 (3.41)	7.13 (2.7)	5.07 (2.36)	1.00 (1.22)	6.02 (2.55)
6.	RMO-25	2.00 (1.58)	5.00 (2.34)	6.47 (2.64)	8.93 (3.07)	4.93 (2.33)	3.47 (1.99)	1.20 (1.30)	4.57 (2.25)
7.	RMO-141	1.93 (1.56)	5.53 (2.46)	6.73 (2.69)	9.47 (3.16)	5.47 (2.44)	3.67 (2.04)	1.27 (1.33)	4.87 (2.32)
8.	RMO-20-36	2.20 (1.64)	5.67 (2.48)	6.93 (2.73)	10.00 (3.24)	5.93 (2.54)	3.80 (2.07)	1.67 (1.47)	5.17 (2.38)
9.	RMO-04-01-28	3.20 (1.92)	7.20 (2.77)	8.60 (3.02)	13.75 (3.77)	7.27 (2.79)	5.00 (2.34)	0.87 (1.17)	6.56 (2.66)
10.	RMO-28-80	2.80 (1.82)	5.80 (2.51)	7.33 (2.80)	10.47 (3.31)	6.27 (2.60)	4.67 (2.27)	1.33 (1.35)	5.52 (2.45)
	SEM	0.03	0.04	0.05	0.08	0.05	0.03	0.02	0.05
	CD (5 %)	0.08	0.12	0.14	0.21	0.15	0.10	0.07	0.15

*Figures in parentheses are $\sqrt{(x + 0.5)}$ values

** Peak population of jassid

Table 2. Population of whitefly, *B.tabaci* on different genotypes of mothbean

S. No.	Varieties/ Genotypes	Mean whitefly population per six leaves at weekly interval							Mean
		26.08.10	02.09.10	09.09.10	16.09.10**	23.09.10	30.09.10	06.10.10	
1.	RMO-225	2.47 (1.72)*	6.40 (2.63)	11.00 (3.39)	17.27 (4.22)	8.67 (3.03)	4.20 (2.17)	0.00 (0.71)	7.14 (2.76)
2.	RMO-40	2.07 (1.60)	4.33 (2.20)	6.87 (2.71)	11.07 (3.25)	6.87 (2.71)	3.27 (1.94)	0.47 (0.98)	4.99 (2.34)
3.	RMO-423	2.13 (1.62)	4.07 (2.14)	6.60 (2.66)	11.00 (3.39)	6.80 (2.70)	3.20 (1.92)	0.87 (1.17)	4.95 (2.33)
4.	RMO-435	2.40 (1.70)	6.40 (2.63)	10.47 (3.31)	15.50 (4.00)	8.07 (2.93)	4.07 (2.14)	0.00 (0.71)	6.70 (2.68)
5.	RMO-257	2.27 (1.66)	5.07 (2.36)	7.07 (2.75)	12.00 (3.54)	7.33 (2.80)	3.87 (2.09)	0.53 (1.01)	5.45 (2.44)
6.	RMO-25	1.07 (1.25)	3.07 (1.89)	4.47 (2.23)	8.67 (3.03)	4.47 (2.23)	3.00 (1.87)	1.33 (1.35)	3.73 (2.06)
7.	RMO-141	1.13 (1.28)	2.93 (1.85)	4.00 (2.12)	7.73 (2.87)	3.93 (2.11)	2.93 (1.85)	1.07 (1.25)	3.39 (1.97)
8.	RMO-20-36	1.27 (1.33)	4.00 (2.12)	6.00 (2.55)	10.93 (3.38)	5.80 (2.51)	3.60 (2.02)	0.00 (0.71)	4.51 (2.24)
9.	RMO-04-01-28	2.33 (1.68)	5.13 (2.37)	7.33 (2.80)	13.13 (3.69)	7.40 (2.81)	3.73 (2.06)	1.13 (1.28)	5.74 (2.50)
10.	RMO-28-80	1.20 (1.30)	3.80 (2.07)	5.67 (2.48)	8.88 (3.06)	5.60 (2.47)	3.07 (1.89)	0.67 (1.08)	4.13 (2.15)
	SEM	0.02	0.03	0.05	0.08	0.06	0.04	0.03	0.06
	CD (5 %)	0.07	0.10	0.16	0.24	0.18	0.11	0.08	0.18

*Figures in parentheses are $\sqrt{(x + 0.5)}$ values

** Peak population of whitefly

Table 3. Population of thrips, *C. indicus* on different genotypes of mothbean

S. No.	Varieties/ Genotypes	Mean thrips population per six leaves at weekly interval							Mean
		26.08.10	02.09.10	09.09.10	16.09.10**	23.09.10	30.09.10	06.10.10	
1.	RMO-225	3.07 (1.89)	5.73 (2.50)	9.70 (3.19)	13.50 (3.74)	7.33 (2.80)	3.87 (2.09)	0.00 (0.71)	6.17 (2.58)
2.	RMO-40	2.20 (1.64)	4.67 (2.27)	6.00 (2.55)	9.07 (3.09)	6.20 (2.59)	3.07 (1.89)	1.27 (1.33)	4.64 (2.27)
3.	RMO-423	2.87 (1.83)	4.93 (2.33)	7.00 (2.74)	9.60 (3.18)	6.80 (2.70)	3.53 (2.01)	0.00 (0.71)	4.96 (2.34)
4.	RMO-435	3.27 (1.94)	5.93 (2.54)	10.33 (3.29)	13.93 (3.80)	7.73 (2.87)	4.13 (2.15)	0.00 (0.71)	6.48 (2.64)
5.	RMO-257	3.07 (1.89)	5.13 (2.37)	9.50 (3.16)	12.90 (3.66)	7.07 (2.75)	3.60 (2.02)	0.87 (1.17)	6.02 (2.55)
6.	RMO-25	1.33 (1.35)	2.93 (1.85)	5.20 (2.39)	6.87 (2.71)	4.93 (2.33)	2.40 (1.70)	0.93 (1.20)	3.51 (2.00)
7.	RMO-141	1.55 (1.43)	3.07 (1.89)	5.07 (2.36)	6.27 (2.60)	4.60 (2.26)	2.13 (1.62)	1.00 (1.22)	3.38 (1.97)
8.	RMO-20-36	2.07 (1.60)	4.27 (2.18)	6.33 (2.61)	7.47 (2.82)	5.73 (2.50)	3.20 (1.92)	1.47 (1.40)	4.36 (2.20)
9.	RMO-04-01-28	2.47 (1.72)	4.73 (2.29)	7.00 (2.74)	9.73 (3.20)	6.47 (2.64)	3.27 (1.94)	1.67 (1.47)	5.05 (2.36)
10.	RMO-28-80	1.93 (1.56)	4.07 (2.14)	5.73 (2.50)	7.07 (2.75)	5.33 (2.42)	2.73 (1.80)	1.07 (1.25)	3.99 (2.12)
	SEM	0.03	0.04	0.05	0.07	0.06	0.04	0.03	0.05
	CD (5 %)	0.10	0.13	0.16	0.20	0.17	0.11	0.08	0.16

*Figures in parentheses are $\sqrt{(x + 0.5)}$ values

** Peak population of thrips

infestation. After the peak period of infestation the population of thrips declined and persisted upto first week of October. The mean thrips population at all the intervals ranged from 3.38 to 6.48 per plant. The minimum infestation was observed on genotypes RMO-141 (3.38 thrips/plant) followed by RMO-25 (3.51 thrips/plant) and RMO-423 (3.99 thrips/plant) and these were statistically at par in harbouring the thrips population. The maximum thrip population was observed on RMO-435 (6.48 thrips/plant) followed by RMO-225 (6.17 thrips/plant) and RMO-257 (6.07 thrips) and all these genotypes were comparable with each other. Rest of genotypes viz., RMO-20-36 (4.36 thrips/plant), RMO-40 (4.64 thrips/plant), RMO-423 (4.96 thrips/plant) and RMO-04-01-28 (5.05 thrips/plant) were ranked in middle order of infestation.

Based on mean of peak thrips population and mean of all the observations taken during the crop season, the variability of resistance in mothbean genotypes in ascending order was RMO-141 < RMO-25 < RMO-28-80 < RMO-20-36 < RMO-40 < RMO-423 < RMO-04-01-28 < RMO-257 < RMO-225 < RMO-435 (Table 3). The present findings corroborate with results of who reported RMO-423, RMO-40 as moderately susceptible against thrips [9]. However, Bairwa reported RMO-435 as least resistant against thrips [11]. The mothbean variety RMO-257 as highly susceptible as it was moderately susceptible in the present investigation [10].

4. CONCLUSION

It is well known that certain genotypes of crops are less attacked by a specific insect-pest than others because of it may be natural resistance. Genotypes RMO-25 and RMO-141 were categorized less infestation to major sucking insect pests (jassids, whiteflies and thrips) which might be include in the integrated pest management programme as growing of resistant or less preferable varieties against insect-pests and found one of the most important tools without additional cost.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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