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Reaction of Greengram *(Vigna radiata L.)* OVT Entries Against Major Insect pests in *Rabi* Season

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ABSTRACT

Twelve OVT greengram entries and two released varieties as check were screened for three years, 2004, 2005 & 2006 in *rabi* season at Agricultural Research Station, Madhira, Khammam district for their reaction against different crop stage insect pests like galerucid / fleabeetle (*Madurasia sp*) thrips, *Spodoptera exigua* (from two leaf stage), *Spodoptera litura* (vegetative stage) and *Maruca* (reproductive stage). The data pooled over three years, revealed that the entries, MGG 295 (7.4), MGG 366 (7.8) and MGG 359 (8.3) recorded lesser fleabeetle damage. Minimum thrips population was recorded in the entries, MGG 367 (9.1), MGG 365 (9.6) and MGG 356 & 360 (10.0). *S. exigua* incidence from two leaf stage, ranged from 1.2 (MGG 357) to 2.1 (MGG 348). *S. litura* incidence was more at vegetative stage and ranged from 1.1 (MGG 362 & 364) to 1.8 (MGG 295 & MGG 348). *Maruca* pod borer infested the crop from bud initiation stage to maturity stage and its damage ranged from 11.6 (MGG 364) to 25.7% (MGG 356) and the entries, MGG 364 (11.6 %), MGG 365 (14.3%) and MGG 363 (14.6%) were found to be tolerant. The avoidable losses due to above pests were ranged from 19.6 to 36.1%. Significantly higher yields recorded in the entries MGG 360 (691 & 1009), MGG 356 (629 & 835) and MGG 357 (608 & 756), whereas the entries MGG 362 (436 & 563), MGG 361 (448 & 638) recorded lower yields when compared to the check varieties MGG 295 (504 & 712) and MGG 348 (505 & 711 Kg ha^{-1}) both in unprotected and protected conditions respectively.

Key words : Greengram, Galerucid beetle, Thrips, *Spodoptera*, Maruca.

The greengram is one of the most important pulse crops, due to its short duration, early maturity it can be grown through out the year and it fits well as sole or inter crop with redgram & maize in various parts of the country in *rabi* situation. In India, greengram occupies 32 lakh hectares area with 2059 kg ha^{-1} productivity and widely cultivated in *kharif, rabi* and rice-fallows (Nov - March). The low yield of greengram (295 Kg ha^{-1}) may be attributed to number of factors, among them ravage of insect pests is important and there are nearly 200 insect pests belonging to 48 families in coleoptera, diptera, hemiptera, hymenoptera, isoptera, lepidoptera, orthoptera, thysanoptera and 7 mites of order Acarina are attacking and inflict heavy losses at different growth stages in different agro climatic conditions (Lal and Sachan, 1987). The galerucid /flea beetle, *Madurasia obscurella* causes damage up to 20-60% as they chew small holes in the cotyledon leaves, giving shot hole appearance. Thrips, a vector of Pea nut bud necrosis virus in greengram (Sreekanth, 2002) was considered to be a major threat causing 40% yield loss. *S. exigua* is a serious pest on several field crops (Narayana, 2003) and *S. litura* was active from July – January (Gedia et al, 2007) and damage the crop by defoliation. *Maruca vitrata,* a serious and a hidden pest, completes its larval development inside the web formed by rolling & tying together leaves, flowers, buds and pods and the reduction in grain yield by *Maruca* is estimated to be 2.0-84%.

MATERIAL AND METHODS

Three field experiments with 12 greengram OVT entries and two released varieties as checks developed by the research station were conducted at Agricultural Research Station., Madhira, Khammam district during rabi season of 2004, 2005 & 2006. Experiments were laid out in Randomized Block Design with three replications. Each entry was sown in a plot of two rows of 4 m length, with 30 X10 cm spacing. Observations were recorded on five randomly selected plants for each entry in each replication from 10 days after germination of the crop for incidence of Galerucid beetle, Thrips, pod borers like Spodoptera & Maruca population / plant. Flea beetle damage in terms of shot holes/ two cotyledon leaves in two leaf stage only; thrips population was counted from two terminal leaves of each plant by tapping on white chart & *S. exigua* from two leaf stage & *S. litura* larvae/plant from vegetative stage up to harvest of the crop at weekly intervals. *Maruca* incidence was observed from flowering to pod maturity stage, for number of webs /plant & larvae /web, pod damage and pod damage at the time of harvest & converted to percent. The grain yield in Kg ha^{-1} data from both unprotected & protected experiments was recorded. Recommended package of practices were followed except plant protection measures. The data was subjected to the statistical analysis. The entries categorized as tolerant / moderately susceptible to *Maruca* damage based on the 1-9 scale as given below:

Scale	Pest incidence	Reaction
1	No damage	Resistant
3	< 10% Pod damage	Moderately Resistant
5	11 - 20% Pod damage	Tolerant
7	21 - 40% Pod damage	Moderately Susceptible
9	> 40 % Pod damage	Highly Susceptible

The mean and Standard deviation (S.D) of mean pest population & percent pod damage was computed. A preliminary classification of genotypes was done considering the mean values as suggested by Shivalingaswami and Balasubramanian (1992), which are as follows:

1. Promising /resistant entries with values less than mean – SD
2. Susceptible entries with the values between mean – SD and mean + SD
3. Highly susceptible entries with the values more than mean + SD

RESULTS AND DISCUSSION

Early crop stage pests:

Pooled data recorded over three years on fleabeetle, thrips & *Spodoptera exigua* incidence are presented in Table 1.

Fleabeetle:

Its incidence was noticed in two leaf stage only but not later the damage in terms of shot holes on two cotyledon leaves was ranged from 7.4 - 14.6. The entries MGG 295 (7.4), MGG 366 & MGG 348 (7.8) found to be tolerant, whereas, the entries MGG 362 (14.6), MGG 357 (14.3) and 358 (14.0) were found to be susceptible to flea beetle damage. The reason for lesser damage might be the new adults begin emerging in late July & early August which feed on the roots of available hosts and feeding may continue up to mid October. However, by mid September, most of the adults have usually entered a dormant, over-wintering stage and cooler micro environment also slow down the activity of flea beetle. The threshold of flea beetle is on average 25% damage of the cotyledon surface, contribute to reduced yield up to 20-60% and with heavy & continuous attacks, seedlings may wilt & die, may destroy the crop and resowing may be necessary, especially if the weather is hot and dry. Even though, there was significant difference in leaf damage by flea beetle, all the entries withstand the significant leaf area removal in the cotyledon stage and once the crop reaches, the trifoliate/ 4 leaf stage, the plants are usually well established and can out grow the feeding damage.

Thrips:

Thrips became persistent pest in greengram and its incidence was noticed from two leaf stage and population increased up to 45 DAS and then declined sharply. Raja Kumar *et al* (2007) observed minimum thrips population of 2 -39 / 15 terminal leaves. Pooled data of thrips population revealed that, there was a significant difference among the entries and it was ranged from 9.1 – 15.7 / two terminal leaves. The lowest population was recorded in the entries, MGG 367 (9.1), MGG 364 (9.6) and more population was recorded in the entries MGG 366 (15.7), MGG 348 (13.6) & MGG 363 (13.4) when compared to the check variety MGG 295 (10.5) . The results coincide with the findings of Kooner and Malhi (2004) who screened 30 summer mungbean genotypes and found SML 189, SML 346 and MG 414 as least susceptible to thrips. Chhabra and Kooner (1998) reported that out of 20 mungbean genotypes SML99 and SML100 were the most resistant and SML117 was the most susceptible to thrips damage they also reported that mungbean genotypes PIMS 2, PIMS 3, 12-333 at Badnapur, Co 3 at Coimbattore, ML 5, ML 337 at Durgapura are resistant to thrips and it was further investigated that non preferred & resistant entries did not support thrips multiplication and low content of free amino acids, total phenols, total mineral, total sugars, non reducing sugars, calcium, potassium and high content of carbohydrates were responsible for contributing resistance.

Spodoptera exigua:

infested the crop from two leaf stage onwards and damaged the cotyledon leaves by scraping them (Sekhar et al., 1994). The larval population was

Table 1. Reaction of greengram entries to early crop stage insect pests in rabi.

Entry	Fleabeetle damage (Holes /Pl)				Thrips terminal leaves^{-1}				*S. exigua* larvae plant^{-1}		
	2004	2005	2006	Mean	2004	2005	2006	Mean	2005	2006	Mean
MGG 356	8.0	10.6	8.4	9.0	6.5	11.8	11.6	10.0	1.0	1.6	1.3
MGG 357	10.0	12.3	6.3	14.3	3.5	16.3	11.4	10.4	1.0	1.4	1.2
MGG 358	10.0	12.5	5.4	14.0	3.9	17.3	11.9	11.0	1.0	1.9	1.5
MGG 359	8.0	10.9	6.1	8.3	4.4	14.0	12.3	10.2	1.0	2.3	1.7
MGG 360	12.0	14.6	9.2	11.9	3.4	14.3	12.2	10.0	1.2	2.2	1.7
MGG 361	14.0	17.4	7.4	12.9	2.3	17.3	11.1	10.2	1.2	1.1	1.2
MGG 362	18.0	20.4	5.5	14.6	6.1	19.0	12.7	12.6	1.2	2.7	2.0
MGG 363	8.0	12.3	6.3	8.9	8.7	19.0	12.6	13.4	1.0	2.6	1.8
MGG 364	8.0	11.0	6.5	8.5	5.7	16.6	11.7	11.3	1.0	1.7	1.4
MGG 365	10.0	12.4	5.4	9.3	4.1	13.0	11.7	9.6	1.0	1.7	1.4
MGG 366	8.0	10.9	4.4	7.7	3.9	21.7	21.5	15.7	1.0	1.5	1.3
MGG 367	9.1	12.3	6.0	9.1	4.0	11.5	11.9	9.1	1.0	1.9	1.5
MGG 295©	8.0	10.3	4.0	7.4	8.7	11.0	11.9	10.5	2.0	1.9	2.0
MGG 348©	8.0	9.3	6.0	7.8	9.1	19.3	12.3	13.6	2.0	2.2	2.1
SEm ±	0.25	0.21	0.53	0.21	0.03	0.11	0.21	0.07	0.12	0.21	
CD (5%)*	0.72	0.62	1.54	0.6	0.07	0.32	0.61	0.21	0.36	0.61	
CV(%)	4.3	2.9	14.8	3.7	2.9	1.2	2.9	1.2	18.3	18.8	

*Significant

Table 2. Reaction of greengram entries to pod borers and yield performance.

Entry	*S. litura*		Maruca infestation			Mean of three years Yield (Kg ha^{-1})		
	Egg Mass Plant^{-1}	Larvae per Plant	Webs per Plant	Larvae per Web	% Pod damage	Unpro-tected	Pro-tected	% Avoidable Losses
MGG 356	0.4	1.2	1.05	0.97	25.7	629	835	24.7
MGG 357	0.4	1.2	1.02	0.88	17.3	608	756	19.6
MGG 358	0.1	1.3	1.11	1.07	22.5	599	854	29.9
MGG 359	0.3	1.6	1.11	1.27	19.8	586	842	30.4
MGG 360	0.1	1.3	1.55	1.43	18.9	691	1009	31.5
MGG 361	0.1	1.3	1.50	1.33	18.2	448	638	29.8
MGG 362	0.1	1.1	0.95	0.86	18.4	436	563	22.6
MGG 363	0.1	1.2	1.26	1.36	14.6	514	724	29.0
MGG 364	0.1	1.1	1.56	1.48	11.6	572	822	30.4
MGG 365	0.1	1.2	0.39	1.37	14.3	461	721	36.1
MGG 366	0.2	1.3	0.93	0.97	21.1	574	767	25.2
MGG 367	0.1	1.2	0.92	0.89	24.1	531	696	23.0
MGG 295©	0.3	1.8	1.27	1.24	22.3	504	712	29.2
MGG 348©	0.3	1.8	1.28	1.23	24.0	505	711	29.0
SE m ±	0.04	0.09	0.08	0.58	1.1	32.3	18.9	
CD (5%)*	0.12	0.27	0.24	0.17	3.2	94	55	
CV (%)	15.6	12.4	11.7	8.6	9.7	7.9	5.4	

*Significant

Table 3. Grouping of entries based on Mean + S.D values for pest infestation.

	Mean	S.D	Mean - S.D	Mean + S.D	Promising Entries	Highly Susceptible Entries
Fleabeetle	10.27	2.56	7.70	12.82	MGG 295 ©	MGG 361, 358,357,362
Thrips	11.26	1.81	9.45	13.07	MGG 367	MGG 363, 348,366
S. exigua	1.58	0.29	1.29	1.87	MGG 361,357	MGG 362, 295,348
S. litura	1.33	0.49	0.84	1.82	—	All
Maruca Webs Plant^{-1}	1.14	0.30	0.84	1.44	MGG 365	MGG361, 360, 364
Maruca larvae Plant^{-1}	1.17	0.21	0.96	1.38	MGG 362,357,367	MGG 360,364
Percent Pod damage	19.5	3.96	15.54	23.46	MGG 364,365,367	MGG348, 367, 356
Avoidable losses	27.9	4.14	23.76	32.04	MGG 357,362,367	MGG 365
Unprotected Yield (Kg ha^{-1})	547	71.33	476	618	MGG 360,356 (High Yielders)	MGG362, 361,365 (Poor Yielders)
Protected Yield (Kg ha^{-1})	760	105	655	865	MGG 360 (High Yielder)	MGG362, 361(Poor Yielders)

ranged from 1.2 to 2.1. The entries MGG 362 & MGG 295 (2.0) and MGG 363 (1.8) were shown more larval population. The entries MGG 361 & MGG 357 found to be promising against *S. exigua.* The chemical constituents, the probable absence of feeding stimulants or the presence of feeding inhibitors and their concentration could have contributed such variations (Srinivasamurthy et al., 2006) in the varieties for responsible for resistance. It needs further investigation.

Spodoptera litura:

The results on larval incidence pooled over three years are presented in Table 2. Its incidence was noticed from active vegetative stage and damaged the crop by defoliation. The entries MGG 356 and MGG 357 showed significantly higher egg masses (0.4 / Plant) compared to others. The larval population ranged from 1.1 – 1.8. No entry escaped from the *S. litura* damage. Though the entries MGG 356 & 357 offered for oviposition, the entries not permitted larval growth as they recorded lesser larvae (1.2/plant). The reason might be, the total phenol concentration, reached to the highest level at 45 DAS and afterwards started declining, but in some mungbean genotypes like SML 70, A -124/1 and A 300 its concentration remained significantly higher during 30-60 DAS (Garain et al. 2004). Anathakrishnan et al., (1990) opined that phenolic substances like resorcinol, gallic acid and phloroglucinol affected the nutritional indices, survival and growth of *H. armigera.*

***Maruca vitrata* :**

The incidence of *Maruca* increased progressively from flowering to advanced pod formation stage and then gradually decreased towards the pod maturity and crop maturity stages. The maximum infestation was observed at maximum pod formation stage. These observations coincide with the findings of Krishna et al (2006). All the entries showed significant difference in respect of the number of webs/plant, larvae / web and percent pod damage which ranged from 0.39 - 1.56, 0.86-1.48 and 11.6- 25.7% respectively. (Table.2)

The lesser number of *Maruca* webs were recorded in the entries MGG 365 (0.39), MGG 367 (0.92) and MGG 366 (0.93); lower larval population was recorded in the entries MGG 362 (0.86), MGG 357 (0.88), MGG 367 (0.89), whereas entries MGG 364 (1.48), MGG 360 (1.43) & MGG 365 (1.37) recorded more infestation when compared to the check varieties MGG 295 (1.27 & 1.24) and MGG 348 (1.28 & 1.23) webs & larvae respectively. The entry MGG 365 recorded lesser webs (0.39/plant) but more larval population (1.37/ web) with lesser percent pod damage (14.3%), though the entry MGG 364 recorded maximum *Maruca* infestation, it recorded minimum pod damage (11.59%), these findings coincide with the findings of Dreyer *et al* (1994) who reported low seed damage despite heavy flower infestation.

Regarding pod damage, it was ranged from 11.6 -25.7% and the entries MGG 364 (11.6%), MGG 365 (14.3) and MGG 363 (14.6%) recorded minimum pod damage among eight tolerant entries, whereas the entries MGG 356 (25.7%), MGG 367 (24.1%), MGG 348 (24.0%), MGG 358 (22.5%), MGG 295 (22.3%) and 366 (21%) were found to be moderately susceptible to *Maruca* as per 1-9 scale. An infestation level of two *Maruca* larvae per plant was enough to detect differences in flower & pod damage, grain yield between infested and uninfected plants. *Maruca* damage to major plant parts severely affects the productivity of food legumes wherever the insect has achieved pest status. The reduction in grain yield by maruca is estimated to be 9 – 84 % (Vishakanthaiah and Jagadeesh Babu, 1980).

Yield Performance:

There was significant difference among the entries and grain yield was significantly higher under protected conditions and ranged from 436 – 691 & 563 - 1009 Kg ha^{-1} both in unprotected & protected conditions respectively. The entries MGG 360 (691 & 1009), MGG 356 (629 & 835) and MGG 357 (608 & 756) were found to be high yielders, whereas the entries MGG 362 (436 & 563), MGG 361 (448 & 638), and MGG 365 (461 & 721) recorded lower yields in both the conditions. The percent avoidable losses due to above pests were ranged from 19.6 (MGG 357) to 36.1% (MGG 365). Anantha kumari *et al* (2006) reported that the avoidable losses in redgram grain yield were lowest in resistant varieties ICPL 332 (21.4%) , ICPL 84060 (23.6%) and ICPL 187-1 (29%) compared to susceptible ICPL 87 (87.2%) variety. (Table 2).

The susceptible entry MGG 356 recorded higher yields; the reason might be the preference of pod borers for feeding the flowers & pods of plants having high protein content. Sahoo and Patnaik (2003) found that there was significant positive correlation with the total sugars, amino acid and protein content but inverse relationship with phenol content of seeds & pod coat of susceptible redgram varieties to pod borers. Allelochemicals play behaviorally as well as physiologically vital role in pest management strategy. The proportion of presence of allelochemicals in plants is one of the important selection factors by insects to accept them as host plants (Maxwell and Jennings, 1980).

Overall performance:

By grouping the entries based on mean & SD values, the entry MGG 367 found to be promising as against thrips and *Maruca*, whereas MGG 363 found to be promising against *Maruca* pod damage but susceptible to thrips. Though, the entries MGG 361 & 357 promising against *S. exigua* but highly susceptible to flea beetle damage and poor yielders. The entries, MGG 360 & MGG 356 were found to be high yielders but susceptible to Maruca infestation. No entry was found to be free from *S. litura* infestation.

The levels of resistance to pests in the tested entries are very poor to moderate and this has necessitated the need for selecting genotypes with multiple resistance, greater ability to tolerate or recover from the pest damage (Sharma et al., 2005). The resistant genotypes identified were very poor in yield. Thus these resistant entries can not be exploited directly but can be used in resistant breeding programme to identify the source of resistance or can be released for regular cultivation against endemic / problematic areas.

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