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Varietal screening of mungbean cultivars for resistance/tolerance against insect pest under Terai Agro ecological zone of West Bengal

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ABSTRACT

Varietal preference of insect pests on mungbean germplasm was monitored under field conditions at Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal during the year 2012-13. Five genotypes/lines of mungbean germplasm were screened against insect pest and the germplasms were categorized into resistant and susceptible depending upon severity of pest incidence. The differential responses of mungbean varieties to insect pests were determined and none of the genotype/line was found to be highly resistant to insect pest. During first season, Bireswar (WBM-34-1-1) had less susceptibility to the attack of aphid and thrips gave highest (558.79 kg/ha) grain yield followed by Sukumar (WBM-29) with grain yield of 547.47 k/ha. Same trend was observed in case of aphid and thrips incidence during second season of screening. Comparison of resistance among the five tested genotypes against whitefly showed that the lowest (0.23) number of whiteflies per leaf was observed in Sonali (B-1), lower than those of both Bireswar (WNM-34-1-1) and Sukumar (WBM-29), whereas, the highest (1.33/ leaf) was observed in Panna (B-105) during first season. Whereas, in second season lowest (0.65/ leaf) whitefly incidence was observed on Sonali (B-1). highest (1.83/ leaf) whitefly incidence was observed in Sukumar (WBM-29) followed by Panna (B-105) and Bireswar with 1.80 and 1.20 numbers per leaf, respectively. In case pod borer incidence, the lowest (0.03) and the highest (1.18) larval population were observed on cultivar Sonali (B-1) and Sukumar (WBM-29), respectively during first season. Whereas, during second season, among five varieties screened, highest (1.23/ plant) pod borer on Samrat (PDM 24-139) variety followed by Bireswar (WBM-34-1-1) and Panna (B-105) by recording pod borer incidence 0.93 and 0.73/ plant, respectively. Lowest (0.22/plant) pod borer incidence observed on Sukumar (WBM-29) variety. Highest (2.20/plant) predatory coccinellid beetle was observed on Bireswar (WBM-34-1-1) followed by Sonali (B-1) and Samrat (PDM 24-139) with 1.89 and 1.25 numbers per plant, respectively. Lowest (0.84/ plant) lady beetle was observed on Panna (B-105) variety during first season. Whereas, during second season highest

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(4.17/plant) predatory coccinellid beetle was observed on Sukumar (WBM-29) followed by Sonali (B-1) and Samrat (PDM 24-139) with 2.59 and 1.95 numbers per plant, respectively. Lowest (0.88/ plant) lady beetle was observed on Panna (B-105) variety. Bireswar (WBM-4-34-1-1) and Sukumar (WBM-29) is fairly resistant to almost all pest of moong. Beside this varieties, remaining were neither fully resistant. Samrat (PDM 24-139) was heavily infested by aphids and thrips, which gave poor (902.31 kg/ha) yield. Among the cultivars, the highest (1108.25 kg/ha) yield potential was obtained in Bireswar (WBM-4-34-1-1) and Sukumar (WBM-29) (1052.75 kg/ha). In contrast variety Panna (B-105) seed gave significantly lower yield (883.79kg/ha) in which Sonali (B-1) (B-1) and Samrat (PDM 24-139) (PDM 24-139) was nearer during second season. It can be concluded that insect pest infestation was strongly influenced by density of trichome on plant surface. Dense (30.0 and 33.50/cm^2) trichomes were observed on the leaves of Sukumar (WBM-29) during first and second seasons, respectively. While trichome density was lowest (13.5 and 18.0/cm^2) in Samrat (PDM 24-139) had relatively higher aphid incidence during first and second seasons, respectively.

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INTRODUCTION

Conventionally, pulses have been an important constituent of Indian diet. Affluent in protein (22-24%) and essential amino acids, they are consumed in various ways in different regions of the country. Mungbean [*Vigna radiata* (L.) Wilczek] is an imperative summer food legume in humid and sub-humid countries of the world. Greengram is cultivated throughout the year in all cropping seasons due to its short duration and suitability to crop rotation and crop mixtures. As *Kharif* season is becoming uncertain to get the greengram crop due to climatic changes, it is grown as sole crop in water retentive heavy soils during *Rabi* (September to December) and cultivated as relay crop in *Kharif* rice fallows during late *Rabi* (December - February). During summer, it is grown as a sole crop with adequate irrigation facilities. There are 64 species of insects attacking on mungbean crop and among them sucking pests and lepidopterans are the most notorious one (Lal, 1985), More than twelve species of insect pests were found to infest mungbean among them aphid, jassid, whitefly, thrips, pod borers and riptortus bugs are important. These sucking insect pests includes whiteflies, jassids and thrips (Khattak *et al*., 2004). The low productivity in greengram may be attributed to factors like limited varietal improvement, low resilience to soil moisture stress, pest infestation etc., among them, ravage of insect pests is important. Among the sucking pests and lepidopterans are the most notorious pests. Serious concern to the greengram farmers of West Bengal, which cause damage mainly at vegetative and reproductive phases of the crop. Because of its extensive host range and destructiveness, they became a persistent pest in pulses particularly on greengram, as it is available throughout the year in different seasons / situations. Hence, exploitation of host plant resistance, an economically viable genotypes measure against insect pests has become imperative to find out resistance source with higher yield.

At present day, management of insect pest has largely been relied on chemical control. However, the demands for clean and ecologically sound control envisages, careful planning for rationalizing the insecticides interventions. Development of resistant varieties is an ideal component against buildup of pest population at no additional cost, compatible with other methods of pest control and free from control pollution. Various biophysical and biochemical characters of the plants play an important role by providing resistance against this pest. However, literature on role of these biophysical and biochemical parameters imparting resistance towards different mungbean genotypes against insect pest is scanty. Therefore, the present study was undertaken to find out the role of different morphological and biochemical properties of the plants on the incidence of the pests, if any, and the results reported herein.

MATERIAL AND METHODS

The field experiments were conducted in the agriculture research field at Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar and West Bengal during the year 2012-13. Five varieties, (Sonali (B-1)), Bireswar (WBM-4-34-1-1), Samrat (PDM 24-

139), Sukumar (WBM-29) and Panna (B-105) commonly cultivated in this region were selected for evaluations against different pests of moong were sown on two different season (December, 2012 to April, 2013) and (February to May, 2013). Ten plants were selected from each plot randomly and one or two branches per plant were taken for the tagging. Weekly observation of insect pest on each of the tagged branch was taken. The seeds were sown on 3rd week in December in a plot size of 2m × 3m with the spacing of 20 cm × 40 cm, respectively in Randomized Block Design (RBD). Ten randomly selected plants of each row were taken at regular intervals. In case of small insect species (aphid, whitefly, thrips), feeding on twigs, leaves and flowers population were counted, respectively but in case of predatory population (lady bird beetle) were recorded in number of plant basis after appearance of the pest till harvest of the crop. Three plant parameters, *viz*., plant height, leaf area index (LAI) and trichome density were studied for their role in expression of varietal reaction to major insect pests of mungbean. The plant height of ten randomly selected from each plot were measured from the ground level to the tip of the plant 45 days after sowing at 15 days interval and was expressed in centimeters with the help of a regular scale. Trichome density was measured and expressed in number per cm^2. Five randomly selected for the leaves / plot were used to estimated for the leaf hair density using white card board cutting on 0.5 cm^2 area to counting hair density with the help of Binocular. Trichome density was evaluated in one leaf, collected monthly, from the apical part of the canopy of 10 plants/ plantation. The preparation of slides and counting of trichomes were made by Leite (2000). The leaves of each line were cut into bits of 0.5× 0.5 cm and number of trichomes present on the epidermis of these bits were counted and then length was measured under a binocular microscope (10 × 100x) (Nikon SMZ-10A). Leaf area index were recorded with the help of LAI meter. In addition to these, the content of chlorophyll in leaves as biochemical parameter was also evaluated. Fifteen leaves per plot were randomly selected for used to estimate the chlorophyll content using chlorophyll meter SPAD 502 at 10:00 hours on clear sunny day.

RESULTS AND DISCUSSION

During first season, among the five test genotypes, Mungbean variety Bireswar (WBM-34-1-1) had significantly lowest number (1.12/ 10 cm twig) of aphid population as compared to the other tested varieties. Variety Sukumar (WBM-29) with 1.35 number aphids per 10 cm twig ranked second in its resistance (Table 1). Variety Panna (B-105) Sonali (B-1) and Samrat (PDM 24-139) with 3.13, 3.26 and 5.30 aphid/10 cm twig, respectively, showed susceptibility to aphids as compared to Bireswar (WBM-34-1-1) and Sukumar (WBM-29). The last before mentioned two susceptible varieties were not significantly different to each other in the per 10 cm twig aphid population.

All the testing varieties carried a lowest to a very few thrips population /leaf, however, varieties showed significant difference to each other, which reflected their resistance and low or non- resistant ability against thrips (Table 1). Samrat (PDM 24-139), Panna (B-105) and Sonali (B-1) with 2.21, 1.93 and 1.58 thrips/leaf, respectively, were the most susceptible varieties. Bireswar (WBM-34-1-1) variety with 0.27 thrips/leaf was the most resistant. Mungbean variety Sukumar (WBM-29) had fewer (0.48 thrips/leaf) as statistically similar with Bireswar (WBM-34-1-1).

In case of whitefly incidence among five genotypes tested highest (1.33/ leaf) incidence was observed in Panna (B-105) followed by Samrat (PDM 24-139) and Bireswar (WBM-34-1-1)by recording 1.23 and 0.80/ leaf, respectively. Lowest (0.23/ leaf) whitefly incidence was observed on Sonali (B-1).

Among five varities screened highest (1.18/ plant) pod borer recorded on Sukumar (WBM-29) variety followed by Bireswar (WBM-34-1-1) and Samrat (PDM 24-139) by recording pod borer incidence 0.55 and 0.33/ plant, respectively. Lowest (0.03/plant) pod borer incidence observed on Sonali (B-1) variety. Highest (2.20/ plant) predatory coccinellid beetle was observed on Bireswar (WBM-34-1-1) followed by Sonali (B-1) and Samrat (PDM 24-139) with 1.89 and 1.25 numbers per plant, respectively. Lowest (0.84/ plant) lady beetle was observed on Panna (B-105) variety.

Comparing the yield production, mungbean variety Bireswar (WBM-34-1-1) with 558.79 kg/ha ranked first followed by Sukumar (WBM-29), Samrat (PDM 24-139), Sonali (B-1)and Panna (B-105) with 547.47, 418.83, 405.84 and 392.79 kg/ha, respectively. The high yield of Bireswar (WBM-34-1-1) and Sukumar (WBM-29) was mainly attributed to the low attack of sucking insect pests because of their resistant abilities. These results are in

Table 1: Evaluation of some moong varieties against insect pest, predatory coccinellids and physio-chemical properties of the plants during 1st season

Varieties	Pest population				Coccinellids / plant	Physico-chemical properties				Yield kg/ha
	Aphid/ 10 cm twig	Thrips/ flower	Whitefly/ leaf	Pod borer /plant		Chlorophyll (mg/cm^2)	Plant height (cm)	Trichome density ($0.5\ cm^2$)	LAI (mm)	
Sonali (B-1)	3.26 (1.93)*	1.58 (1.42)*	0.23 (0.84)*	0.03 (0.76)*	1.89 (1.54)*	37.25 (37.41)**	15.95(4.02)*	24.75 (29.47)*	119.00	405.84
Bireswar (WBM-34-1-1)	1.12 (1.26)	0.27 (0.86)	0.80 (1.13)	0.55 (1.04)	2.20 (1.60)	45.75 (42.53)	21.00 (4.58)	20.25 (26.26)	125.25	558.19
Samrat (PDM 24-139)	5.30 (2.39)	2.21 (1.63)	1.23 (1.30)	0.33 (0.99)	1.25 (1.30)	38.75 (38.30)	18.00 (4.27)	13.50 (21.06)	112.50	418.83
Sukumar (WBM-29)	1.35 (1.38)	0.48 (0.97)	0.65 (1.06)	1.18 (1.26)	1.08 (1.23)	37.50 (37.57)	16.25 (4.02)	30.00 (33.28)	110.50	547.47
Panna (B-105)	3.13 (1.87)	1.93 (1.54)	1.33 (1.31)	0.05 (0.89)	0.84 (1.14)	36.50 (37.13)	18.75 (4.27)	20.00 (26.42)	127.50	392.79
S.E.±	0.147	0.326	0.274	0.295	0.434	10.69	1.03	7.88	80.06	38.80
C.D. (P=0.05)	0.453	0.149	0.089	0.995	0.141	3.470	0.334	2.558	25.985	119.56

*Values in parenthesis are square root transformed values x+0.5, **Parenthesis value are angular transformed values

accordance with the results of other research workers.

Previous workers like Chhabara and Kooner (1991); Sahoo and Hota (1991) and Chhabra and Kooner (1993 and 1994) have evaluated mungbean cultivars against their resistance to insect pests and screened a large numbers of mungbean genotypes for resistance/ susceptibility against sucking pests. Naqvi *et al*. (1995) has tested 10 genotypes of mungbean against insects and found only two cultivars, M-8-20 and M-1030 resistant against insects compared to others. Nadeem *et al.* (2014) reported that comparison of resistance among ten tested genotypes against whitefly showed that the lowest number of whiteflies per leaf (3.7±1.20) was observed in MH 3153, lower than those of both checks, whereas, the highest (11±1.53) was observed in MH 34143. Number of thrips per leaf was observed the lowest (4±1.00) and the highest (12.3±0.67) in cultivar MH 3153 and MH 34143, respectively. Similar population trend of jassid was observed with per leaf population of 1.2 and 3.3, the highest and the lowest in MH 3153 and AZRI 2006, respectively. MH 3153 gave the highest yield (438.7 g/plot) with 129 and 161 per cent increase over check 1 and check 2, respectively. It can concluded that, genotypes which showed the highest resistance against the sucking pests.

On the basis of results, it can be concluded that variety Bireswar (WBM-34-1-1) had less susceptibility to the attack of aphid and thrips gave highest grain yield followed by Sukumar (WBM-29) during first season.

During second season, among the five test genotypes, highest (6.25/10 cm twig) aphid incidence was recorded on Samrat (PDM 24-139) followed by Panna (B-105) and Sonali (B-1) with 5.75 and 4.94 numbers per 10 cm twig, respectively (Table 2). Lowest (1.76/ 10 cm twig) aphid infestation was observed in the Bireswar (WBM-34-1-1) variety. In the case of thrips incidence same trend was observed in case of aphid infestation. Highest (7.21/flower) thrips incidence was recorded on Samrat (PDM 24-139) followed by Panna (B-105) and Sonali (B-1) by recording thrips population of 6.81 and 5.46/ flower, respectively). Lowest (1.86/ flower) thrips infestation was observed in the Bireswar (WBM-34-1-1) variety. In case of whitefly incidence among five genotypes tested highest (1.83/ leaf) incidence was observed in Sukumar (WBM-29) followed by Panna (B-105) and Bireswar by recording 1.80 and 1.20/ leaf, respectively. Lowest (0.65/ leaf) whitefly

Table 2: Evaluation of some moong varieties against insect pest, predatory coccinellids and physio-chemical properties of the plants during 2nd season

Varieties	Pest population					Physico-chemical properties				
	Aphid/ 10 cm twig	Thrips/ flower	Whitefly/ leaf	Pod borer /plant	Coccinellids/ plant	Chlorophyll (mg/cm^2)	Plant height (cm)	Trichome density ($0.5\ cm^2$)	LAI (mm)	Yield kg/ha
Sonali (B-1)	4.94 (2.29)	5.46 (2.41)	0.65 (1.06)	0.67 (1.05)	2.59 (1.73)	25.00(29.25)	20.50(4.50)	28.75(32.36)	94.75	896.50
Bireswar (WBM-34-1-1)	1.76 (1.49)	1.86 (1.53)	1.20 (1.27)	0.93 (1.18)	1.40 (1.36)	39.00 (38.56)	26.25(4.93)	23.50(28.58)	105.25	1108.25
Samrat (PDM 24-139)	6.25 (2.57)	7.21 (2.76)	0.83 (1.13)	1.23 (1.29)	1.95 (1.54)	44.00 (41.36)	24.75 (4.93)	18.00 (24.68)	96.75	902.31
Sukumar (WBM-29)	1.86 (1.53)	1.54 (1.41)	1.83 (1.50)	0.22 (0.83)	4.17 (2.13)	21.50 (27.44)	22.75 (4.58)	33.50 (35.32)	115.75	1052.75
Panna (B-105)	5.75 (2.48)	6.81 (2.67)	1.80 (1.49)	0.78 (1.11)	0.88 (1.15)	29.50 (32.66)	24.00 (4.92)	19.17 (25.80)	98.25	883.79
S.E.±	0.532	0.467	0.421	0.328	0.505	11.828	0.974	8.426	61.51	48.25
C.D. (P=0.05)	0.172	0.152	0.136	0.106	0.164	3.838	0.316	2.734	19.96	148.68

*Values in parenthesis are square root transformed values x+0.5, **Parenthesis value are angular transformed values

incidence was observed on Sonali (B-1). Among five varieties screened highest (1.23/ plant) pod borer on Samrat (PDM 24-139) variety followed by Bireswar (WBM-34-1-1) and Panna (B-105) by recording pod borer incidence 0.93 and 0.73/ plant, respectively. Lowest (0.22/plant) pod borer incidence observed on Sukumar (WBM-29) variety. Highest (4.17/plant) predatory coccinellid beetle was observed on Sukumar (WBM-29) followed by Sonali (B-1) and Samrat (PDM 24-139) with 2.59 and 1.95 numbers per plant, respectively. Lowest (0.88/ plant) lady beetle was observed on Panna (B-105) variety.

In varietal evaluation it was prove that Bireswar (WBM-34-1-1) and Sukumar (WBM-29) were fairly resistant almost all pest of moong. Beside this variety, remaining were neither fully resistant. Samrat (PDM 24-139) was heavily infested by aphid and thrips, which gave poor yield. Among the cultivars, the highest (1108.25 kg/ ha) yield potential was obtained in Bireswar (WBM-4-34-1-1) followed by Sukumar (WBM-29) with grain yield of 1052.75 kg/ha during second season were mainly attributed to the low attack of sucking insect pests because of their resistant abilities. Khattak *et al*. (2004) has screened five mungbean varieties *viz*., NM 92, NM-98, NM-121-125, M-1 and NCM-2009 against sucking pests, whiteflies, jassid and thrips. It was observed that whitefly, jassid and thrips population was comparatively lower on NM-92 and NM-98 which enables to get higher yield compared to other tested varieties. Present study was, therefore, carried out to screen eight advance genotypes of mungbean for their resistance against sucking insect pests under field conditions.

Further, dense (30.0 and 33.50/cm^2) trichomes were observed on the leaves of Sukumar (WBM-29) during first and second seasons, respectively. While trichome density was lowest (13.5 and 18.0/cm^2) in Samrat (PDM 24-139) had relatively higher aphid incidence during first and second seasons, respectively (Tables 1 and 2). A significant negative correlation was observed between trichome density and borer incidence (Table 2). High trichome density might be imparting the physical barrier for the borers rendering their non-preference over the low trichomes genotypes. Similar observations were also documented by Halder *et al*. (2006) who observed significant ($P<0.05$) negative correlation between trichome density in pods and pod borer infestation and damage severity in mungbean. Earlier, Sharma and Singh

(2010) reported a significant negative correlation between trichome density and borer incidence in okra from Rajasthan. Trichome-based resistance against aphids has been reported in wild Solanum species (Gibson, 1971; Tingey and Laubengayer, 1981 and Lapointe and Tingey, 1984 and 1986). Whitefly, thrips and aphid host preference of about six tomato varieties, demonstrated that the variety which has a high density of glandular trichomes will decrease the egg laying and feeding of *B. tabaci* nymphs (Setiawati, 2009).

Highest (45.75 mg/cm^2) chlorophyll content was observed in Bireswar (WBM-34-1-1) followed by Samrat (PDM 24-139) and Sukumar (WBM-29) by recording 38.75 and 37.50 mg/cm^2, respectively. Lowest (36.50 mg/cm^2) chlorophyll content was observed in Panna (B-105) variety during first season. Whereas in second season, highest (44.0 mg/cm^2) chlorophyll content was observed in Samrat (PDM 24-139) followed by Bireswar (WBM-34-1-1) and Panna(B-105) by recording 39.0 and 29.5mg/cm^2, respectively. Lowest (25.0 mg/cm^2) chlorophyll content was observed in Sonali (B-1) variety.

During first season highest (115.75 mm) LAI was observed in Sukumar (WBM-29) variety followed by Bireswar (WBM-34-1-1) and Panna (B-105) with LAI of 105.25 and 98.25 mm, respectively. Lowest (94.25mm) LAI content was observed in Sonali (B-1) variety. Whereas, highest (127.50 mm) LAI was observed in Panna (B-105) variety followed by Bireswar (WBM-34-1-1) and Sonali (B-1) by recording 125.25 and 119.0 mm, respectively. Lowest (110.50mm) LAI content was observed in Sukumar (WBM-29) variety during second season.

Highest (26.25 cm) plant height was observed in Bireswar (WBM-34-1-1) followed by Samrat (PDM 24-139) and Panna (B-105) with 24.75 and 24.0 cm height, respectively. Lowest (15.95 cm) plant height was observed in Sonali (B-1) variety during first season. Same trend of plant height was observed during second season also. Highest (21.0 cm) plant height was observed in Bireswar (WBM-34-1-1) followed by Panna (B-105) and Samrat (PDM 24-139) with 18.75 and 18.0 cm height, respectively. Lowest (15.95 cm) plant height was observed in Sonali (B-1) variety.

Conclusion :

Whereas, mungbean varieties, Bireswar (WBM-34-1-1) and Sukumar (WBM-29) showed comparatively better resistant cultivars regarding low mean population of sucking pest as compared to other tested varieties. Results of the present findings lead towards a conclusion that among the tested cultivars, Bireswar (WBM-34-1-1) was found least affected by sucking insects and gave the higher yield followed by Sukumar (WBM-29).

REFERENCES

Chhabra, K.S. and Kooner, B.S. (1991). Source of resistance in mungbean against insect pests and yellow mosaic virus. *Leg. Res.*, **14** (4): 175-184.

Chhabra, K.S. and Kooner, B.S. (1993). Response of some promising mungbean genotypes towards whitefly, jassids and mungbean yellow mosaic virus. *J. Insect Sci.*, **6** (2) : 215-218.

Chhabra, K.S. and Kosoner, B.S. (1994). Reaction of some promising mungbean genotypes towards whitefly, jassid and yellow mosaic virus. *Pest Manag. Eco. Zool.*, **2** (1): 11-14.

Gibson, R.W. (1971). Glandular hairs providing resistance to aphids in certain wild potato species. *Ann. Appl. Biol.*, **68** : 113–119.

Halder, Jaydeep, Sanwal, S.K., Rai, Ajeet Kumar, Rai, A.B., Singh, B. and Singh, B.K. (2015). Role of physico-morphic and biochemical characters of different okra genotypes in relation to population of okra shoot and fruit borer, *earias vittella* (noctuidae: lepidoptera). *Indian J. Agric. Sci.*, **85** (2): 278–282.

Khattak, G.S.S., Saeed, I. and Shah, S.A. (2008). Breeding high yielding and disease resistant mungbean [*Vigna radiata* (L.)Wilczek] genotypes. *Pak. J. Bot.*, **40**:1411-1417.

Khattak, M.K., Ali, S. and Chishti, J.I. (2004). Varietal resistance of mungbean (*Vigna radiata* L.) against whitefly (*Bemisia tabaci* genn.), jassid (*Amrasca devastans* dist.) and thrips (*Thrips tabaci* lind.). *Pak. Entomol*., **26**(1) : 9-12.

Lal, S.S. (1985). A review of insect pests of mungbean and their control in India, *Tropi. Pest Mgmt.*, **31**: 105-114.

Lapointe, S.L. and Tingey, W.M. (1984). Feeding response of the green peach aphid (Homoptera: Aphididae) to potato glandular trichomes. *J. Econ. Entomol.*, **77** : 386–389.

Lapointe, S.L. and Tingey, W.M. (1986). Glandular trichomes of *Solanum neocardenasii* confer resistance to green peach aphid (Homoptera: Aphididae). *J. Econ. Entomol.*, **79** : 1264–1268.

Leite, G.L.D. (2000). Fatores que influenciam a intensidade de ataque de moscabranca em tomateiro. 2000. 46 f. *Tese* (*Doutorado em Entomologia*) *Universidade Federal de Viçosa, Viçosa, MG.*

Nadeem, S., Hamed, M., Asghar, M.J., Abbas, G. and Saeed, N.A. (2014). Screening of mungbean [*Vigna radiate* (L.) Wilczek] genotypes against sucking insect pests under natural field conditions. *Pakistan J. Zool.,* **46** (3) : 863-866.

Naqvi, S.H., Talpur, M .A., Khan, Rustamani, Mand, M. and Hussain, T. (1995). Relative resistance of mungbean [*Vigna radiata* (L.) Wilczek], varieties to whitefly and yellow mosaic virus. Proceed. XIV *Pak. Cong. Zool.,* **14** 15-17 April, Islamabad, Pakistan, **15** : 247-251.

Sahoo, B.K. and Hota, A.K. (1991). Field screening of greengram germplasm against insect pest and disease complex. *Madras Agric. J.,* **78** (1-4) : 84-86.

Setiawati, W., Adiarto, B.K. and Gunaeni, N. (2009). Preference and infestation pattern of *Bemisia tabaci* (Genn) on some tomato varities and its effect on gemini virus infestation. *Indonesian. J. Agric. Sci*., **2** (1) : 57-64.

Sharma, B.N. and Singh, S. (2010). Biophysical and biochemical factors of resistance in okra against shoot and fruit borer, *Indian J. Entomol.,* **72**(3): 212–216.

Tingey, W.M. and Laubengayer, J.E. (1981). Defense against the green peach aphid and potato leafhopper by glandular trichomes of *Solanum berthaultii*. *J. Econ. Entomol.,* **74** :721–725.