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Relative susceptibility of okra varieties/ hybrids to cotton leafhopper, *Amrasca biguttula biguttula* (Ishida) in Kangra valley of Himachal Pradesh

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Abstract

Present studies were conducted during 2005 and 2006 crop seasons on the relative susceptibility of okra varieties/hybrids to cotton leafhopper, *Amrasca biguttula biguttula* (Ishida) at two locations *viz.* experimental farm of Department of Entomology, CSK HPKV, Palampur and farmer's field in village Kachhiari (Kangra). Ten different varieties/hybrids of okra *viz.* Arka Anamika, Harbhajan, P-8, Panchaali, Parbhani Kranti, Pusa Makhmali, Shagun, Tulsi, Varsha Uphar and Pusa Sawani were evaluated against the pest. Pooled results of both years revealed that at both the locations varieties Tulsi and Varsha Uphar showed low level of pest infestation (5.1-10 nymphs/3 leaves) while a very hogh level of infestation (>20 nymphs/3 leaves) was observed on Pusa Sawani (check variety), Shagun and Pusa Makhmali.

Key words: Okra, susceptibility, *Amrasca biguttula biguttula*, Tulsi, Varsha Uphar, Pusa Sawani.

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) is an important warm season vegetable crop cultivated comprehensively in tropical and sub-tropical regions of the world. It is a short duration crop propagated through seeds, cherished for its tender and scrumptious green fruits used in curries, soups or in canned, dehydrated or frozen forms for off-season consumption. In Himachal Pradesh, the crop is grown during summer and rainy seasons in low and mid hills occupying an area of 357 hectare with an annual production of 4114 tons (Anonymous, 2005) which is much lower than that of many other states. One of the major rationales for low yield is the wide array of insect-pests that sabotage this crop right from germination till harvesting. Among these, cotton leafhopper, *Amrasca biguttula biguttula* (Ishida) is quite serious and one of the major restraining factors in okra cultivation (Mandal *et al.*, 2006a). The pest causes cupping, yellowing and bronzing of okra leaves under severe attack which shed prematurely affecting growth of the crop adversely (Mahal *et al.*, 1994). The losses in okra yield due to leafhopper have been reported to vary from 32.06 to 40.84 per cent (Singh and Brar, 1994).

At present, schedule based application of various insecticides are recommended for the management of different insect-pests. But, the injudicious use of synthetic chemicals to manage various pests is fraught with the tribulations of resistance, resurgence, secondary infestation, phyto-toxicity, toxicity to beneficial organisms, residues in food beyond the tolerance limits posing unwarranted health hazards to the consumers (Mandal *et al.*, 2006b). Although use of insecticides cannot be altogether omitted as they form the mainstay of pest management strategies, yet their role can indubitably be limited by utilizing safer techniques of pest management such as growing of pest tolerant/ resistant varieties.

The varietal resistance is an important component of IPM in crops such as okra, where fruits are picked at short intervals, hence, the spray of insecticides becomes not only uneconomical but hazardous also (Sardana and Dutta, 1989). It suppresses pest population with least disturbance to crop ecosystem and also reduces need for harmful pesticides that pollute the environment. However, a variety resistant to a pest at one place may become susceptible at another place. Keeping above facts into consideration, present study was conducted to study the comparative susceptibility of okra varieties/ hybrids against *A. biguttula biguttula* in Kangra valley of Himachal Pradesh.

Materials and Methods

The present investigation was carried out during 2005 and 2006 crop seasons at two locations in Himachal Pradesh *viz.* experimental farm of Department of Entomology, CSK HPKV, Palampur situated at an altitude of 1290 metres a.m.s.l. and farmer's fields in village Kachhiari (Kangra) situated at an altitude of 760 metres a.m.s.l. Okra (*A. esculentus*) crop was raised at

the two sites following all agronomic practices as recommended for the crop in the package of practices of the university (Anonymous 2005). The crop was sown in the first week of April at Kachhiari during 2005 and 2006 and first week of June and last week of May at Palampur during the respective seasons.

Ten varieties/ hybrids *viz.* Pusa Sawani (procured from Seed Production Unit, CSK HPKV, Palampur, H.P.), P-8 (Department of Vegetable Science, CSK HPKV, Palampur, H.P.), Pusa Makhmali (IARI Regional Station, Katrain, Kullu, H.P.), Tulsi (F_1) (Nunhems Seeds Pvt. Ltd., Hyderabad), Varsha Uphar F_1 (Durga Dass Hybrid Seeds Pvt. Ltd., Chandigarh), Panchaali F_1 (Century Seeds Pvt. Ltd., New Delhi), Parbhani Kranti (Nuziveedu Seeds Ltd., New Delhi), Arka Anamika (Nuziveedu Seeds Ltd., New Delhi), Shagun F_1 (Nunhems Seeds Pvt. Ltd., Hyderabad) and Harbhajan (Regional Horticulture and Forestry Research Station, Bhota, Hamirpur, H.P.) were evaluated for their relative susceptibility against *A. biguttula biguttula* under natural infestation conditions.

The screening was done for two seasons at both the locations. The seeds of these ten varieties/ hybrids were sown in the fields in plots of size 3m x 2m with a row to row and plant to plant spacing of 60 cm x 15 cm, respectively. The experiment was conducted in randomized block design and replicated thrice. In order to assess the level of infestation of *A. biguttula biguttula*, population counts of nymphs were made on 3 randomly selected leaves per plant (5 plants per plot) from upper, middle and lower canopy as per the procedure adopted by Singh and Kaushik (1990) at weekly interval. Data were expressed in the form of mean of 5 observations recorded during the peak infestation period of the pest and analyzed using standard statistical procedures (Gomez and Gomez, 1984).

Results and Discussion

During 2005 crop season at Palampur, lowest mean population of 8.20 leafhopper nymphs per 3 leaves was observed on the variety Tulsi (Table 1). It however, was statistically equivalent to the population observed on Varsha Uphar variety *i.e.* 8.68 leafhopper nymphs per 3 leaves but significantly different from other varieties. Variety Pusa Sawani harboured highest population of leafhopper nymphs *i.e.* 23.9 per 3 leaves and was significantly susceptible to the rest of the varieties. The remaining varieties revealed intermediate population range varying from 11.69 (Arka Anamika) to 19.47 nymphs (Shagun) per 3 leaves.

A slightly lower population of *A. biguttula biguttula* was observed during 2006 crop season on all the varieties (Table 1). Variety Tulsi and Varsha Uphar again proved least susceptible with mean leafhopper population of 6.40 and 6.64 nymphs per 3 leaves, respectively. On the other side, Pusa Sawani was the most susceptible with a population of 21.03 nymphs per 3 leaves. Following the trend of 2005, an intermediate population range of 9.75 to 18.25 nymphs per 3 leaves was recorded on remaining seven varieties *viz.*, Arka Anamika, Parbhani Kranti, Panchaali, Harbhajan, P-8, Pusa Makhmali and Shagun.

Data depicted in Table 1 revealed that at Kachhiari, during 2005, variety Tulsi proved to be the least susceptible registering the lowest mean population of *A. biguttula biguttula* nymphs per 3 leaves (8.41) being significantly superior to the rest of the varieties, followed closely by Varsha Uphar (11.11/3 leaves). The highest mean population of 25.00 nymphs was observed on variety Pusa Sawani, followed by Shagun with mean population of 21.04 nymphs per 3 leaves. The other varieties *viz.* Arka Anamika, Panchaali, Parbhani Kranti, Harbhajan, P-8 and Pusa Makhmali harboured intermediate population counts of 14.13, 14.41, 14.93, 17.24, 17.59 and 20.69 nymphs per 3 leaves, respectively.

In the year 2006, an almost analogous trend was observed at Kachhiari (Table 1). The pest abundance was however, lower in 2006 crop season compared to 2005 on all the varieties except Tulsi which although harboured slightly higher mean leafhopper population than 2005 (8.64 nymphs /3 leaves), yet was at first position showing least population of the pest and significantly superior over other varieties. Pusa Sawani was once again rated as the most susceptible with mean leafhopper count of 23.77 nymphs per 3 leaves. The remaining varieties showed intermediate population range of 10.72 (Varsha Uphar) to 20.08 (Pusa Makhmali)

Table 1. Relative susceptibility of okra varieties/ hybrids to cotton leafhopper, *A. biguttula biguttula*

Variety/hybrid	Mean Nymphs/3 Leaves		Mean Nymphs/3 leaves	
	Palampur		Kachhiari	
	2005	2006	2005	2006
Arka Anamika	11.69 (3.53)	9.75 (3.27)	14.13 (3.87)	13.19 (3.72)
Harbhajan	15.39 (4.03)	14.22 (3.88)	17.24 (4.25)	16.75 (4.19)
P-8	15.69 (4.07)	14.48 (3.91)	17.59 (4.29)	16.87 (4.21)
Panchaali	12.41 (3.63)	11.09 (3.46)	14.41 (3.91)	13.45 (3.76)
Parbhani Kranti	11.93 (3.56)	10.91 (3.44)	14.93 (3.97)	13.73 (3.80)
Pusa Makhmali	18.00 (4.34)	15.25 (4.02)	20.69 (4.64)	20.08 (4.57)
Shagun	19.47 (4.51)	18.25 (4.37)	21.04 (4.68)	20.32 (4.59)
Tulsi	8.20 (3.01)	6.40 (2.70)	8.41 (3.03)	8.64 (3.05)
Varsha Uphar	8.68 (3.10)	6.64 (2.75)	11.11 (3.45)	10.72 (3.39)
Pusa Sawani	23.92 (4.97)	21.03 (4.69)	25.00 (5.08)	23.77 (4.95)
CD (P=0.05)	0.15	0.23	0.15	0.18

Mean of five observations
Figures in parentheses are square root transformed values

nymphs per 3 leaves. Based on the pooled leafhopper nymphal population for 2 seasons *viz.* 2005 and 2006, the mean rating of very low, low, moderate, high and very high was given to the different varieties at both the locations (Table 2). At Palampur, varieties Tulsi and Varsha Uphar (5.1-10.0 nymphs/3 leaves) were rated as ones harbouring low population of the pest while Pusa Sawani (> 20.0 leafhopper nymphs per 3 leaves) was categorized in the mean rating of very high population. This category included Shagun and Pusa Sawani. Remaining varieties were given the mean rating of moderate (Arka Anamika, Parbhani Kranti, Paanchali) and high population (Harbhajan, P-8, Pusa Makhmali, Shagun) based on the pooled leafhopper count *i.e.* 10.1-15.0 and 15.1-20.0 per 3 leaves, correspondingly.

Table 2. Reaction of okra varieties/hybrids to cotton leafhopper, *A. biguttula biguttula*

Mean rating	Mean* Nymphs/ 3leaves	Varieties (Pooled data)	
		Palampur	Kachhiari
Very low	<5.0	--	--
Low	5.1-10.0	Tulsi, Varsha Uphar	Tulsi
Moderate	10.1-15.0	Arka Anamika, Panchaali, Parbhani Kranti	Varsha Uphar, Arka Anamika, Panchaali, Parbhani Kranti
High	15.1-20.0	Harbhajan, P-8, Pusa Makhmali, Shagun	Harbhajan, P-8
Very high	>20.0	Pusa Sawani	Pusa Makhmali, Shagun, Pusa Sawani

*Mean of five observations

At Kachhiari, Tulsi was included in the category of low population followed by Varsha Uphar, Arka Anamika, Panchaali and Parbhani Kranti which were included in the category of moderate population. High leafhopper population was observed on Harbhajan and P-8 while those falling in the leafhopper count of more than 20.0 nymphs per 3 leaves (Pusa Makhmali, Shagun, Pusa Sawani) were given the mean rating of very high population.

Variation in morphological characters as well as biochemical components must have contributed to differential response of varieties (Dhaliwal and Arora, 2003) to leafhoppers. Teli and Dalaya (1981) reported that Pusa Sawani showed lower hair density (3.80/25mm^2) on leaf lamina as compared to other varieties and was more preferred for oviposition by leafhoppers thus corroborating the present results. The existing findings are also supported by those of Bhat (1999) who

observed Varsha Uphar and Arka Anamika to be less preferred by leafhopper (6-10/okra leaf) as compared to Shagun and Parbhani Kranti (15-20/leaf). He has ascribed more trichome length (0.57-0.80 mm) and trichome density (13.63-21.36/cm^2) in less preferred varieties (Varsha Uphar, Arka Anamika) responsible for providing resistance against leafhoppers by impeding feeding, oviposition and adult emergence.

Among the different biochemical components, varieties of okra having higher tannins, phenols, epicuticular waxes, silica, potassium and lower moisture, proteins and total sugars in leaves have been reported to be resistant to leafhoppers (Singh and Taneja, 1989; Kaur *et al.*, 1996). Comparatively lower proteins (12.81-13.21%), moisture (64.15-69.22%) and sugar content present in leaves of Arka Anamika and Varsha Uphar and more proteins (16.40-18.52%), moisture (78.00-89.20%) and sugars in leaves of Parbhani Kranti, P-8, Pusa Sawani and Shagun (Reddy *et al.*, 1997; Bhat, 1999) are accountable for the relative resistance and susceptibility of these varieties to leafhopper.

The susceptibility of Pusa Makhmali and Harbhajan varieties to okra leafhoppers has been previously quoted in the literature (Sandhu *et al.*, 1974; Gill *et al.*, 1997). High level of susceptibility to leafhopper reported in Pusa Sawani is in consonance with the work of Hooda *et al.* (1997), Sharma and Sharma, (1998) and Kumar and Singh (2002).

Conclusion

It was inferred that variety Tulsi followed by Varsha Uphar showed lower levels of leafhopper infestation at both the locations during both the seasons, thus proving least susceptible to the pest. These varieties can, therefore, be included in IPM programme of okra crop for effective management of *A. biguttula biguttula.*

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