SHORT COMMUNICATION

FIELD SCREENING OF DIFFERENT VARIETIES OF TOMATO AGAINST FRUIT BORER, *HELICOVERPA ARMIGERA* (HUBNER)

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Abstract: A field experiment was undertaken at research farm of Raj Mohini Devi College of Agriculture and Research Station Ambikapur, Surguja of Indira Gandhi Krishi Vishwavidyalaya Raipur (Chhattisgarh) during 2016-17 on twelve tomato varieties on fruit borer, *Helicoverpa armigera* (Hub.). Tomato varieties *viz.* JK Ratan, JK. 25, JK Nandni, prabhav, Nirmal 2530, N.S. 962, NS 592, Siddharth, Amrita, Bhagya, Kapila and Pusa-Ruby were tested for resistance against *Helicoverpa armigera* infestation under field conditions. The varieties JK 25 and Prabhav had minimum fruit weight loss (1.57% and 3.26%) as well as minimum number of infested fruits (1.85% and 3.79%) respectively by the *Helicoverpa armigera*. These variety also had minimum *Halicoverpa armigera* larval population, i.e. 0.14, and 0.22 larvae/plant, respectively. The variety Pusa-Ruby and Amrita had maximum loss in fruit weight (30.41% and 21.67%) as well as maximum number of infested fruit (30.85% and 23.28%) with larval population of 1.05 and 0.68 larvae/plant. Pusa-Ruby was categorized as susceptible genotypes with fruit infestation (30.85%) and larval population per plant (1.05%). Variety Bhagya, JK Ratan, Siddharth, NS 592, and Amrita (20.21%, 20.51%, 21.10%, 21.44% and23.28%) was categorized as moderately susceptible. Variety JK Nandini, Kapila, NS 962 Nirmal 2530 (14.70%, 15.62%, 15.81%, and 19.51%,) was categorized as moderately resistant. Variety JK 25 and Prabhav (1.85% and 3.79%) and declared as resistant variety to tomato fruit borer.

Keywords: Screening, Tomato varieties, Fruit borer, Vegitable

INTRODUCTION

Tomato (*Solanum Lycopersicum*) is one of the most popular and commercially important vegetable crop in India which belongs to the family Solanaceae. It ranks next to potato and sweet potato in the world vegetable production (Anonymous,1997) and tops the list of conned pests are major ones that have been reported to attack tomato at all stages of crop growth.

In India recent statistics show that tomato was grown in 8.79 lakh hectare of land and the total production was approximately 182.26 lakh tones and productivity level of 20.7 tones/ha (Anonymous 2014).

Tomato, like other vegetables, is more prone to insect pests and diseases mainly due to their tenderness and softness as compared to other crops. The damage caused by insect-pests is one of the main constraints which limit the vegetables (Choudhary, 1979). Among many factors responsible for low yields of tomato, insect production of tomato. Among the insect pests, the key insect-pests of tomato include jassids (*Amrasca bigutulla* Ishida), aphid (*Aphis gossypi* Glover and *Myzus persicae* Sulzer), white fly (*Bemisia tabaci* Gennadius), cutworm (*Agrotis* sp.), tobacco caterpillar (*Spodoptera litura* Fabr.) and tomato fruit borer (*Helicoverpa armigera* Hubner), which infest and hamper the growth of plants. Out of these insect-pests, tomato fruit borer (*Helicoverpa armigera*) is the major constraints in the higher production of tomato fruits. Tomato fruit borer is highly destructive pest causing serious damage and responsible for significant yield loss up to 55 per cent (Talekar *et al.* 2006). However, tomato fruit borer causes 40-50 per cent damage to the tomato crop (Pareek and Bhargava 2003). Cultivation of *Helicoverpa* resistant tomato cultivars is limited due to a lack of data on potential genetic sources and plant mechanisms (antixenosis) of resistance (Dhillon *et al.* 2005). In USA alone, *Helicoverpa* spp. causes a loss of more than one billion dollars to various crops, despite insecticide applications, worth another $250 million per year (Anonymous 1976; Johnson *et al*. 1986). Control of the insect pests through the application of insecticides cause ill effects like development of insecticide resistance in the pests, pest resurgence, environmental pollution and health hazards. Now trend has been shifted towards an integrated pest management (IPM). Host plant or varietal resistance constitutes an important tool for the integrated management of the pest insect. There are many reported studies, where the populations of *Heliothis spp*. were managed, using host plant resistance, alone or in conjunction with other methods (Lukefahr *et al.*, 1971; Lukefahr, 1982).

MATERIAL AND METHOD

Varietal Screening: Seeds of twelve varieties, viz., J.K. Ratan, JK 25, J.K. Nandni, Prabhav, Nirmal 2530, NS 962, NS 592, Siddharth, Amrita, Bhagya, Kapila and Pusa-ruby (susceptible check) were sown in the field. The experiment was replicated three times with plot size of 3X2 M^2. 3-4 leaf stage

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seedling were transplanted in the field. No plant protection measures applied in the experimental field. Number of larvae plant^{-1} from five randomly selected plants and fruit infestation per plant from ten randomly selected plants, in itch variety, was recorded at weekly intervals for preliminary screening experiment.

Data on the fruit infestation, by the pest and larval population of *Helicoverpa armigera*, were recorded by following procedure.

The average larval-population plant^{-1} for each variety was calculated by the simple arithmetic means (Wakil *et al*., 2009).

Damaged and undamaged fruits, from randomly selected ten plants, in each variety, were counted, at weekly intervals. Percent fruit-infestation was calculated by the following formula (Wakil *et al*., 2009).

Fruit Infestation Percentage = B/A ×100

Where

A= Total fruits (damaged + undamaged), and

B= Damaged fruits

RESULT

Fruit infestation and larval population per plant on tested variety of tomato varied significantly (Table 1). The percentage fruit damage varied from 1.85 to 30.85 in different varieties. The least fruit damage (1.85%) was recorded in variety J.K. 25, followed by Prabhav (3.79%) with larval population (0.14% and 0.22%) and no significant difference among them and scored as resistant categories. Whereas, the percentage damaged fruit on weight basis in different varieties ranged from 1.57 to 30.41. The tomato variety J.K. 25 had significantly least weight loss (1.57%) followed by Prabhav (1.94%).

The moderate fruit damage was recorded in J.K. Nandini (14.70%) followed by Kapila (15.62%), N.S. 962 (15.81%) and Nirmal 2530 (19.51%) based on the number of damage fruit percentage, with larval population (0.41%, 0.48%, 0.48%, and 0.65%) respectively whereas variety J.K. Nandini (13.67) as well as N.S. 962 (14.76), had moderate loss on weight basis. Significantly maximum fruit damage on number basis was recorded on variety Pusa-Ruby (30.85%), with larval population (1.05%) where as the losses on weight basis was also maximum in variety Pusa-Ruby (30.41 %).

The minimum per cent fruit damage by *Helicoverpa armigera* was recorded in J.K. 25 and Prabhav on the number basis and on the weight basis the minimum fruit damage was recorded in J.K. 25 and Prabhav, however it was moderate in case of J.K. Nandni, Nirmal 2530, NS 962 and Kapila based on number whereas, J.K. Nandni, NS 962, Bhagya and Kapila had moderate level of infestation on weight basis. Significantly maximum fruit damage on number basis was recorded on variety Pusa Ruby, where as the losses on weight basis was also maximum in variety Pusa-Ruby.

Table 1. A Comparison of means for the data regarding the larval population of the fruit borer/plant and fruit infestation/plant on different variety of tomato during 2016-17

Variety	Fruit Infestation (%)	Wt. of damaged fruit %	Larval population (%)	Remark
JK Ratan	20.51	18.88	0.64	MS
JK 25	1.85	1.57	0.14	R
JK Nandini	14.70	13.67	0.41	MR
Prabhav	3.79	3.26	0.22	R
Nirmal 2530	19.51	18.81	0.65	MR
NS 962	15.81	14.76	0.48	MR
NS 592	21.44	17.22	0.68	MS
Siddharth	21.10	21.43	0.66	MS
Amrita	23.28	21.67	0.68	MS
Bhagya	20.21	15.37	0.55	MS
Kapila	15.62	16.36	0.48	MR
Pusa-Ruby	30.85	30.41	1.05	S

DISCUSSION

A number of plant characteristics are known to render the cultivars less suitable or unsuitable for the feeding, oviposition and development of insect pests (Rafiq *et al*., 2008). It may be due to plant trichomes (Johnson, 1956), phenol contents (Banerjee and Kalloo, 1989) and quality of host plant (Bazzaz *et al*., 1987). In contrast, some characteristics like nutrients (GoncalvesAlvin *et al*., 2004) improve the quality of host plant which resultantly favors the insects. Screening of tomato genotypes for resistance/susceptibility against tomato fruit borer was conducted to manage the fruit borer with environmentally safe tactics. Similar kind of study has been documented by Khanam *et al.* (2003) who evaluated genotypic susceptibility of tomato genotypes different from those in present study.

In present study we found JK 25, Prabhav as resistant tomato variety against tomato fruit borer. It may be due to less fleshy and smooth surface of fruits of these genotypes. These genotypes may be resistant due to tight mesocarp and hard pulp of fruits (Mishra *et al.*, 1988), high orthodihydroxy phenols and trichome density in the foliage (Selvanarayanan and Narayanasamy, 2006). The variety Pusa Ruby were found susceptible, may be due to the reason of high nitrogen content (Minkenberg and Ottenheim, 1990) and high non reducing sugar in the foliage (Selvanarayanan and Narayanasamy,2006). Kashyap and Verma (1987) reported that Pusa Ruby was found to susceptibility against *H. armigera* among the various genotypes screened. Gc *et al.* (1997) have also reported the susceptibility of Pusa Ruby against *H. armigera.*

CONCLUSION

The present study revealed that none of the tested genotypes were free from *Helicoverpa armigera* infestation. However, based on the mean fruit weight loss (%) by *Helicoverpa armigera* larvae (2016-2017), the variety JK 25 and Prabhav were found to be comparatively resistant, while variety Pusa-Ruby were found to be most susceptible to *Helicoverpa armigera* infestation. The larval population per plant was positive correlated with fruit damage on weight as well as on number basis. The fruit damage on weight basis and on number basis showed positive correlation with each other. The above genotypes performed better in the field and need to be further explored. In this context, investigating the physical and biochemical plant characters of the studied genotypes from a view point of host plant resistance to *Helicoverpa armigera*, would be useful contribution towards development of a resistant variety that can be incorporated into an IPM strategy.

REFRENCECES

Anonymous (1997). FAO production year books, basis Data Unit. Statistics Division, FAO, ROME Italy, 51; 125-127.

Anonymous (1976). Agricultural Research Service. ARS. Nalt. Heliothis Planning Conf. New Orleans. La, US. Department of Agriculture. Washington D.C. p. 36

Banerjee, M.K. and Kalloo (1989). Role of phenols in resistant to tomato leaf curl virus, *Fusarium wilt* and fruit borer in *Lycopersicon*. *Current Sci*. 58: 575-576.

Bazzaz, F.A., Chiarello, N.R., Coley, P.D. and Pitelka, L.F. (1987). Allocating resources to reproduction and defense. *Biosci.* 37:58-67.

Choudhury, B. (1979). Vegetable (6^{th} Revised Edn.) the Directors National BookTrust New Delhi, India, pp;45.

Gc, Y.D., Pandey, R.R. and Bhoosal, D.L. (1997). Management of tomato fruit worm *Helicoverpa armigera* during 1996/97. *Lumle* Agric. Research centre. No.97-46 10 pp.

Goncalves Alvin, S.J., Collevatti, R.G. and Fernandes, G.W. (2004). Effects of genetic variability and habitat of *Qualea parviflora* (Vochysiacea) on herbivory by free feeding and gall farming insects. *Ann. Bot.* 94:259-268.

Johnson, B. (1956). The influence on aphids of the glandular hairs on tomato plants. *Plant Pathol.* 5:131-132.

Johnson, S.J., King, E.G. and Jr. Bradlay, J.R. (1986). Theory and tactics of *Heliothis* population management. I. Cultural and biological control. South.Coop. Ser. Bull. 316:161.

Kashyap, R.K. and Verma, A.N. (1987). Factors imparting resistance to fruit damage by *Helicoverpa armigera* (Hubner) in some tomato phenotypes. *Insect Sci. Applic.,* 8: 111-114.

Khanam, U.K.S., Hossain, M., Ahmad, N., Uddin, M.M. and Hussain, M.S. (2003). Varietal screening of tomato to tomato fruit borer, *Helicoverpa armigera* (Hub.) and associated tomato plant characters. *Pak. J. Biol. Sci.* 6: 412-413.

Lukefahr, M.J. (1982). A review of the problems, progress and prospects for host plant resistance to *Heliothis* spp. p.223-231. In: W. Reed and V. Kumble (eds.). International Workshop on *Heliothis* Management. ICRISAT, India.

Lukefahr, M.J., Houghtaling, J.E. and Graham, H.M. (1971). Supression of *Heliothis* population with glabrous cotton stains. *J. Econ. Entomol*. 64:486-488.

Minkenberg, O.P.J.M. and Ottenheim, J.G.W. (1990). Effects of leaf nitrogen content of tomato plants on preference and performance of a leaf mining fly. *Oceologia* 83: 291-298.

Mishra, P.N., Singh, Y.V. and Nautiyal, M.C. (1988). Screening of brinjal varieties for resistance to shoot and fruit borer, *Leucinodes orbonalis* Guen. (Lepidoptera: Pyralidae). *South Ind. Hort.* 36:182-88.

Pareek, P.L. and Bhargava, M.C. (2003). Estimation of avoidable losses in vegetables caused by borers under semi arid condition of Rajasthan. *Insect Environ.*, **9**: 59-60.

Rafiq, M., Ghaffar, A. and Arshad, M. (2008). Population dynamics of whitefly (*Bemisia tabaci*) on cultivated crop hosts and their role in regulating its carryover to cotton. *Int. J. Agric. Biol*. 9:68-70.

Selvanarayanan, V. and Narayanasamy, P. (2006). Factors of resistance in tomato accessions against the fruit worm, *Helicoverpa armigera* (Hubner). *Crop Protec*. 25:1075-1079.

Talekar, N.S., Open, R.T. and Hanson, P. (2006). *Helicoverpa armigera* management: a review of AVRDC's research on host plant resistence in tomato. *Crop Protec.*, 5: 461-467.

Wakil, W., Ashfaq, M., Ghazanfar, M.U., Afzal, M. and Riasat, T. (2009). Integrated management of *Helicoverpa armigera* in chickpea in rainfed areas of Punjab, Pakistan. *Phytoparasitica* 37:415-420.