Impact of growth hormones on the fruit feeding preference of fruit worm in tomato

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Abstract A study was undertaken to analyse the fruit feeding preference of *Helicoverpa armigera* (Hubner) larvae towards tomato accessions as influenced by growth hormones. The influence of growth hormones on the fruit feeding preference of fruit worm *H. armigera* in an already identified insect tolerant, tomato accession Varushanadu Local in comparison with a susceptible check, I 979 was studied under glasshouse conditions at Department of Entomology, Annamalai University, Tamil Nadu. The fruit feeding was the minimum in the plants that received foliar application of Salicylic Acid (SA), irrespective of the accessions followed by NAA applied plants.

Keywords: Tomato. Fruit feeding, Growth hormones, *H.armigera*

I.INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is an important and the most popular vegetable crop, extensively cultivated all throughout the world. Among the various insect pests responsible for lowering the yield of tomato crop, the fruit worm, *Helicoverpa armigera* (Hubner) is highly destructive causing serious damage (Sharma *et al*., 2009) [1]. Dependence on chemical insecticides for managing this insect is restricted in vegetable crops like tomato because of the toxic residues in the fruits which are to be consumed afresh. To avoid such problems caused due to indiscriminate use of insecticides, utilization of Host Plant Resistance (HPR) is an ecologically viable, alternate insect pest management strategy. The elicitors of induced responses can be sprayed on crop plants to build up the natural defense system against damage caused by herbivores. Induced resistance could be exploited as an important tool for the pest management to minimize the use insecticides in pest control (War *et al*., 2012) [2].

II. MATERIALS AND METHODS

Based on preliminary and confirmatory field screening of 321 tomato accessions for resistance against fruitworm *H. armigera*, a promising accession Varushanadu Local was selected (Selvanarayanan and Narayanasamy, 2004) [3] for further studies on the influence of organic nutrients and micronutrients on enhancing resistance traits. For comparison, a susceptible check I 979 was also evaluated. The evaluation was conducted under glasshouse condition at the Department of Entomology, Faculty of Agriculture, Annamalai University. The mean average temperature and relative humidity during these seasons were 28°C to 33°C and 70% to 85% respectively. For raising the seedlings, earthen pots of 30cm diameter were filled with potting mixture comprising two parts of soil, one part of sand and one part of farm yard manure. Then the seeds were sown and covered with a thin layer of sand. The seedlings were irrigated regularly. Twenty five days old seedlings were transplanted @ one seedling per pot.

For evaluating the induction of resistance by growth hormones, Gibberellic Acid (GA), Naphthalene Acetic Acid (NAA) and Salicylic Acid (SA) procured from Ganesh Scientific Limited, Mayiladuthurai, Tamil nadu, India were used as described below.

S. No.	Treatments	Dosage	Date of application	Method of application
1.	GA	10mg / lit	3 DAT	Foliar

2.	NAA	10 mg / lit	3 DAT	Foliar
3.	SA	100 mg / lit (digested with ethanol 5 ml)	3 DAT	Foliar

*DAT - Days After Transplanting.

2.1.Relative fruit damage by confined feeding

On the seventh day from the first fruit appearance, young fruits of the accessions treated with different external inputs were excised with calyx. They were placed individually inside a plastic container with moist filter paper spread at the bottom. Fruit calyx was wrapped with moist cotton to keep the fruit afresh. Three replications per treatment were maintained. Third instar larva @ one per replication, pre - starved for six hours were allowed to feed on the fruits. After 24, 48 and 72 hours, the reduction in initial fruit weight was recorded. A control set for each treatment was also maintained without larval release to study the reduction in fruit weight due to drying. This reduction was taken into consideration while computing quantum of fruit consumed in the treatments with larval release.

2.2. Relative fruit damage by free choice

Young fruits of the accessions treated with different external inputs were excised with calyx, weighed individually and placed at equidistant circularly in a plastic container (30 cm x 15 cm x 8 cm) having moist filter paper spread at the bottom @ one fruit per accession. Three replications were maintained and 6 hr pre - starved third instar larva @ one per replication was released at the centre of the container. Reduction in the fruit weight after 24, 48 and 72 hours was recorded. A control set for each treatment was also maintained without larval release to study the reduction in fruit weight due to drying. This reduction was taken into consideration while computing quantum of fruit consumed in the treatments with larval release.

2.3.Statistical analysis

All the experiments were conducted in a completely randomized design and analysis of variance was used to work out the critical difference by adopting the procedure stated by Gomez and Gomez (1984) [4].

III. RESULTS AND DISCUSSION

In confinement test, the minimum fruit damage was recorded in the plants of Varushanadu Local, irrespective of the treatments. Among the treatments, fruits of SA treated plants were less preferred by *H. armigera* larva followed by NAA applied plants (Table 1). In free choice test, the minimum fruit damage was found in the plants of Varushanadu Local treated with SA followed by plants applied with NAA (Table 2). The accession I 979 was highly preferred by *H. armigera*. In glasshouse evaluation, accession Varushanadu Local was less preferred by *H. armigera*. In line with this, larval populations of the fruit worm *H. armigera* was found to be the least in Varushanadu Local as earlier reported by Dhakshinamoorthy (2002) [5]and Selvanarayanan and Narayanasamy (2006) [6]. The accession Varushanadu Local collected from a hilly terrain in Southern India is a suspected natural cross between *L. esculentum* and *L. pimpinellifolium* and hence the resistance traits derived from the wild accession *L. pimpinellifolium* would have offered such resistance. Such wild relatives or their derivatives have been reported to possess resistance against the fruit borer, *H. armigera* (Sankhyan and Verma, 1997) [7].

Among the growth regulator, applied plants fruit feeding preference was the minimum towards the plants that received foliar application of salicylic acid. This may due to defence related compounds that are produced more in plants induced with salicylic acid (Agarwal, 1998) [8]. In addition, the salicylic acid is a known elicitor of Pathogenesis Related (PR) proteins in different crops and has been associated with insect resistance in rice plants (Ishii *et al*., 1962) [9]. Inbar *et al*. (1998) [10]found that application of salicylic acid to tomato plants induced the several known pathogenesis related proteins and its application effectively reduced the incidence of diseases and population of herbivores. On the other hand, Ettipibool *et al*. (2001)[11] who observed that, the growth regulators did not show significant effect on treated plants reaction against insect pests.

Table 1. Fruit feeding preference of *H. armigera* larvae towards tomato accessions as influenced by growth hormones – Confinement test

S. No.	Treatments	Quantum of fruits (g) consumed at					
		24 hrs		48 hrs		72 hrs	
		VL	I 979	VL	I 979	VL	I 979
1.	GA	0.79 (0.88)	1..06 (1.02)	1.24 (1.11)	1.93 (1.38)	1.98 (1..40)	2.27 (1.50)
2.	NAA	0.85 (0.92)	0.80 (0.89)	1.12 (1.05)	1.36 (1.16)	1.38 (1.17)	1.85 (1.35)
3.	SA	0.21 (0.45)	0.24 (0.48)	0.32 (0.56)	0.66 (0.80)	0.75 (0.86)	1.03 (1.01)
4.	Control	1.26 (1.12)	1.34 (1.15)	1.48 (1.21)	2.22 (1.48)	2.36 (1.53)	2.92 (1.70)

CD (p = 0.05)

Among treatments	0.053	0.058	0.034
Between accessions	0.038	0.041	0.024
Treatments X Accessions	0.075	0.082	0.048

Each value is a mean of three replications
Values in parentheses are square root transformed

Table 2. Fruit feeding preference of *H. armigera* larvae towards tomato accessions as influenced by growth hormones - Free choice test

S. No.	Treatments	Quantum of fruits (g) consumed at					
		24 hrs		48 hrs		72 hrs	
		VL	I 979	VL	I 979	VL	I 979
1.	GA	0.76 (0.87)	0.83 (0.91)	1.02 (1.00)	1.11 (1.05)	1.28 (1.13)	1.46 (1.20)
2.	NAA	0.45	0.97	0.72	1.20	1.02	1.38

		(0.67)	(0.98)	(0.84)	(1.09)	(1.00)	(1.17)
3.	SA	0.18 (0.42)	0.24 (0.48)	0.46 (0.67)	0.81 (0.89)	0.86 (0.92)	1.04 (1.01)
4.	Control	1.10 (1.04)	1.26 (1.12)	1.22 (1.10)	1.46 (1.20)	1.46 (1.20)	1.84 (1.35)

CD (p = 0.05)

Among treatments	0.045	0.043	0.029
Between accessions	0.032	0.030	0.020
Treatments X Accessions	0.064	0.061	0.041

Each value is a mean of three replications
Values in parentheses are square root transformed

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