Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; SP2: 459-461

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Foliage feeding preference of fruit worm larvae towards tomato accessions as influenced by phyto and growth hormones

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Abstract
A study was undertaken to analyse the foliage feeding preference of *Helicoverpa armigera* (Hubner) larvae towards tomato accessions as influenced by phyto and growth hormones. The influence of phyto and growth hormones on the feeding preference of fruit worm *H. armigera* in an already identified insect tolerant, tomato accession Varushanadu Local in comparison with a susceptible check, 1979 was studied under glasshouse conditions at Department of Entomology, Annamalai University, Tamil Nadu, India. The foliage feeding was the minimum in the plants that received foliar application of SA, irrespective of the accessions followed by NAA applied plants.

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

Introduction
Tomato (*Lycopersicon esculentum.* Mill.) botanically referred to the family Solanaceae is one of the most important and popular vegetable crop. Food value of tomato is very rich because of higher contents of vitamins A, B and C including calcium and carotene (Bose and Som, 1990) [3]. The bollworm, *Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae), a highly polyphagous species and a pest of major economic importance on a wide range of crops, particularly cotton, soybeans, tobacco, chickpea and pigeonpea. The polyphagous pest of worldwide occurrence inflicting annual crop damage in India worth US $1 billion. (Sharma, 2001) [9]. To avoid the ecological problems caused due to indiscriminate use of insecticides, utilization of Host Plant Resistance (HPR) is an ecological viable, alternate management strategy against insect pests. In the absence of natural resistance in the gene pool of crop plants or lack of desirable yield attributes in the identified insect tolerant/resistant crop varieties, creating induced resistance in plants by the manipulation of plant nutrients is attempted, of late. Keeping this point in view, the present investigation was carried out to evaluate the influence of growth hormones on feeding preference of fruitworm in tomato.

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) [8] 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.

Larval feeding preference under no-choice condition

Relative leaf damage by *H.armigera* larvae under no choice feeding was assessed under glasshouse conditions. A single third instar larva of *H. armigera*, pre-starved for 6 hrs was allowed into a specially designed screening cage, which consisted of a cylinder (10.5cm diameter and 25cm long) made from a mylar film sheet with muslin and nylon mesh cloth affixed at either open end enclosing the foliage of individual accessions induced with different treatments. The cage was fixed to the top of a wooden stick (70cm high). Leaf area infested by the larvae was measured by using a graph sheet before and 24, 48 and 72 hours after feeding. Three such replications were maintained per treatment.

Larval feeding preference under free choice condition

Relative preference of *H. armigera* larvae to leaves of the test accessions in free choice feeding was ascertained by leaf disc method under laboratory condition. Leaf discs of 25mm^2 size were excised from the second leaf beneath the terminal bud of 30 days old plants from each accession and were placed at equidistance circularly on moist filter paper in a 150 mm Petri dish. The leaf area consumed by the larva after 24, 48, and 72 hrs was measured using a graph sheet (Kauffman and Kennedy, 1989). This experiment was replicated three times.

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) [5].

Results and Discussion

The foliage feeding was the minimum in the plants that received foliar application of SA, irrespective of the accessions followed by NAA applied plants. The damage was the maximum in 1979 than Varushanadu Local, irrespective of the treatments. This trend was found in both confinement (Table 1) and free choice tests (Table 2). The maximum damage was found in control (without treatment) plants. In the all experiments, the accession 1979 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) [4] and Selvanarayanan and Narayanasamy (2006) [7]. 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) [6].

Among the phyto hormones and growth regulator, applied plants foliage 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) [2]. On the other hand, Abro *et al*. (2004) [1] reported that, there was no significant effect of plant growth regulator Planofix (NAA) on the population development of jassids and whitefly and bollworm infestation in cotton.

It is concluded from the present investigation that the accession Varushanadu Local was less preferred by *H. armigera*. Also, among the treatments, salicylic acid treated plants induced higher anti feeding effect on *H. armigera.*

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

S. No.	Treatments	Leaf damage (%)					
		24 hrs		48 hrs		72 hrs	
		VL	I 979	VL	I 979	VL	I 979
1.	GA	19.40 (26.13)	20.12 (26.63)	31.40 (34.08)	48.50 (44.14)	48.84 (44.33)	64.18 (53.24)
2.	NAA	18.32 (25.34)	15.56 (23.23)	28.42 (32.21)	40.34 (39.43)	36.32 (37.06)	51.30 (45.74)
3.	SA	5.64 (13.73)	5.92 (14.08)	7.20 (15.56)	9.80 (18.23)	11.10 (19.46)	15.24 (22.97)
4.	Control	28.82 (32.46)	22.22 (28.12)	52.15 (46.23)	56.62 (48.80)	60.18 (50.87)	75.50 (60.33)
CD (p = 0.05)							
Among treatments		0.64	0.57	0.78			
Between accessions		0.45	0.40	0.55			
Treatments X Accessions		0.91	0.80	1.10			

Each value is a mean of three replications

Values in parentheses are arc sine transformed

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

S. No.	Treatments	Leaf damage (%)					
		24 hrs		48 hrs		72 hrs	
		VL	I 979	VL	I 979	VL	I 979
1.	GA	20.16 (26.69)	25.54 (30.35)	29.36 (32.80)	41.40 (40.04)	35.60 (36.63)	50.14 (45.08)
2.	NAA	7.42 (15.80)	10.46 (18.87)	10.08 (18.49)	18.16 (25.22)	15.50 (23.18)	25.55 (32.05)
3.	SA	0.80 (5.06)	1.32 (6.59)	5.40 (13.43)	5.54 (13.61)	9.72 (18.16)	10.88 (19.25)
4.	Control	26.36 (30.89)	30.10 (33.26)	35.50 (36.57)	50.52 (45.29)	52.20 (46.26)	60.18 (50.87)
CD (p = 0.05)							
Among treatments		0.69	0.66	3.17			
Between accessions		0.48	0.47	2.24			
Treatments X Accessions		0.97	0.94	4.49			

Each value is a mean of three replications

Values in parentheses are arc sine transformed

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