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INDUCTION OF RESISTANCE IN TOMATO AGAINST *HELICOVERPA ARMIGERA* (HUBNER) USING BIOFERTILIZERS

N. Muthukumaran, V. Selvanarayanan
Department of Entomology, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India

Abstract

Based on preliminary and confirmatory field screening of 321 tomato accessions for resistance against fruit borer, *Helicoverpa armigera* (Hubner), a promising accession Varushanadu Local was selected for studying induction of resistance using biofertilizers viz., *Azospirillum*, Phosphobacteria, *Pseudomonas* and K-solubilizer. In comparison, a susceptible check, I979 was also evaluated. The feeding preference of *H. armigera* larva was the least towards Varushanadu Local than I979 irrespective of the biofertilizer. Among the biofertilizers K-solubilizer treated plants were the least preferred than others. A trend was observed in both the free choice and confinement tests.

Key Words: Tomato; Induced resistance; Biofertilizers; *H. armigera*.

Introduction

Tomato (*Lycopessicon esculentum* Mill.) is an important and most popular vegetable crop. Tomato occupies an area of 520 thousand hectares with a production of 7420 thousand metric tonnes [1]. Tomato is attacked by a large number of insect pests from seedling stage until harvest, of them; the tomato fruit borer *Helicoverpa armigera* (Hub.) is predominant. Use of resistant cultivars is one of the important techniques under integrated pest management [2]. To overcome the environmental problems and health hazards due to residues of insecticides, host plat resistance is a viable alternate against insect pests on tomato. In the absence of natural heritable resistance, creating induced resistance in plants to pests by the manipulation of plant nutrients through biofertilizers application offers ample scope. Keeping this point in view, the present investigation was carried out to evaluate the role of certain biofertilizers in inducing resistance in tomato against the fruit borer *H. armigera*.

Materials and methods

Based on preliminary and confirmatory field screening of 321 tomato accessions for resistance against fruit borer, *H. armigera* a promising accession Varushanadu Local was selected [3] for further induction of resistance with biofertilizers. In comparison a susceptible check I979 was also evaluated.

In situ evaluation

The glasshouse screening was conducted at the Department of Entomology, Faculty of Agriculture, Annamalai University, Annamalainagar. Tamilnadu, India from February 2009 to May 2009. For raising the seedlings, earthen pots of 30 cm diameter were filled with soil and 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. Four microbial inoculants viz., *Azospirillum*, Phosphobacteria, *Pseudomonas* and K-solubilizer were used for inducing resistance as detailed below.

Sl. No.	Treatments	Dosage/pot	Method of application
1.	*Azospirillum*	200 mg	Soil
2.	Phosphobacteria	200 mg	Soil
3.	*Pseudomonas*	200 mg	Soil
4.	K-solubilizer	3 ml/kg of seed	Seed treatment

In vivo evaluation

Mechanisms of resistance, namely preference/non-preference of larvae for feeding was studied under glasshouse and laboratory conditions.

Preference/Non-preference

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 h was allowed into a specially designed screening cage, which consisted of a cylinder (10.5 cm diameter and 25 cm 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 (70 cm high). Leaf area infested by the larvae was measured by using a graph sheet before and 12, 24 and 48 hours after feeding. Three such replications were maintained per treatment.

Relative preference of *H. armigera* larvae to leaves of the accessions in free choice feeding was ascertained by leaf disc method under laboratory conditions. Leaf discs of 25 mm2 size were excised from the second leaf beneath the terminal bud of 30 day old plants from each accessions and were placed at equidistance circularly on moist filter paper in a 150 mm petridish. The leaf area consumed by the larva after 12, 24 and 48 hour was measured using a graph sheet. This experiment was replicated three times [4].

Estimation of microbial population

For estimating the population of various bio-inoculants, one g of soil was serially diluted upto 10-6 concentration. From a concentration of 10-5, 1 ml of sample was drawn and placed in different selective media adopting the procedures given below. *Azospirillum* population was determined in NFB semisolid media according to MPN technique [5], Phosphobacteria in Pikovaskaya medium [6]. *Pseudomonas* in Kings (B)medium according to [7] K-solubilizer according to [8]. For estimating the microbial population, soil samples were taken from the pot culture at 35 days after inoculation.

Statistical analysis

All the experiments were conducted in a randomized design and analysis of variance was used to work out the critical difference by adopting the procedure stated by [9].

Results and Discussion

On evaluating the induction of resistance in the accessions Varushanadu Local and I979 against H. armigera based on their feeding preference, it was observed that the damage was the maximum in the confinement than free choice test (Table 2) because of the forced confinement of the larvae as earlier noted by [10]. The feeding damage by the larvae was the maximum in the accession I979 than Varushanadu Local irrespective of the biofertilizer. In line with this, larval population of the *H. armigera* was found to be the least in the Varushanadu Local as earlier reported by [11].

Table 1. Feeding preference of *H. armigera* larvae under free choice

Sl. No.	Treatments	Per cent feeding					
		24 h		48 h		72 h	
		V.L	I979	V.L	I979	V.L	I979
1.	*Azospirillum*	25.15 (30.13)	31.78 (34.33)	60.38 (51.00)	72.02 (58.05)	84.60 (66.89)	89.45 (71.09)
2.	*Phosphobacteria*	11.98 (19.37)	19.96 (26.56)	19.11 (25.92)	30.05 (33.27)	23.30 (28.86)	41.61 (40.16)
3.	*Pseudomonas*	22.25 (28.18)	24.10 (29.40)	36.80 (37.35)	43.16 (40.51)	56.70 (48.85)	70.24 (56.91)
4.	K-solubilizer	7.40 (15.79)	13.18 (21.30)	10.36 (18.81)	18.31 (25.33)	14.30 (22.22)	24.83 (29.87)
5.	Control	29.76 (33.09)	32.11 (34.57)	33.07 (34.76)	70.89 (57.35)	58.17 (49.72)	90.72 (72.34)
	CD (p = 0.05)	1.59	2.32	1.62	1.95	1.77	2.29

Each value is a mean of three replications
Values in parentheses are sine transformed values

In free choice test, among the treatments, K-solubilizer treated accessions were less preferred by *H. armigera* (Table 1). This may due to maximum the microbial population in the soil. Population of K-solubilizing microbe and phosphobacteria was 26.86 and 26.88 per cent respectively over initial population of soil (Table 3).

Table 2. Feeding preference by *H. armigera* under confinement

Sl. No.	Treatments	Per cent feeding					
		24 h		48 h		72 h	
		V.L	I979	V.L	I979	V.L	I979
1.	*Azospirillum*	21.28 (27.49)	21.79 (27.83)	62.93 (52.53)	73.81 (59.21)	94.83 (76.45)	96.64 (79.53)
2.	*Phosphobacteria*	24.04 (29.33)	21.89 (27.90)	60.70 (51.35)	30.38 (33.46)	78.68 (62.51)	70.27 (56.98)
3.	*Pseudomonas*	24.70 (29.80)	26.97 (31.24)	61.43 (51.59)	55.80 (48.33)	92.37 (74.00)	91.24 (72.74)
4.	K-solubilizer	17.75 (25.03)	19.46 (26.21)	32.90 (35.00)	34.77 (36.15)	57.66 (49.43)	57.25 (49.20)
5.	Control	27.24 (31.44)	25.82 (30.53)	62.04 (51.94)	57.72 (49.93)	97.36 (80.54)	97.49 (80.90)
	CD (p = 0.05)	1.15	1.54	1.29	1.32	1.19	1.55

Each value is a mean of three replications
Values in parentheses are sine transformed values

Besides, *Azospirillum* treated plants of the accession Varushanadu Local recorded higher feeding by *H. armigera* larva than other biofertilizers. In contrast to this, *Azospirillum* treated plants were found to have increased level of total phenol [12] which conferred insect resistance.

It is concluded that the K-solubilizer was found to exert higher insect resistance than other biofertilizers. Further in depth biochemical analysis may unravel the actual factors of resistance.

Table 3. Microbial population in the biofertilizer samples and soil samples

Sl. No.	Microbial inoculants	Population in the product	Population in soil (log 10 cfu/g dw soil)		
			Initial population	Population 35 days after treatment	Percentage increase over initial population
1.	*Azospirillum*	8.64	4.62	5.24	15.04
2.	*Phosphobacteria*	8.34	4.24	5.38	26.88
3.	*Pseudomonas*	8.94	4.84	5.64	16.52
4.	K-solubilizer	8.14	4.02	5.10	26.86

Each value is mean of three replication.

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