Current Agriculture Research Journal Vol. **5**(1), 45-49 (2017)

Standardization of Pheromone Traps for the Mass Trapping of *Helicoverpa armigera* (Hubner) Hardwick in Tomato

K. D. SHAH[1]*, R. C. JHALA[2] and S. R. DHANDGE[1]

[1]Department of Entomology, College of Agriculture Junagadh Agricultural University, Junagadh 362 001, India.
[2]1-A, Rajvi Park, Vidya Dairy Road, Behind Veterinary College, Anand-388 00, India.
*Corresponding author E-mail: email: kalpit195@jau.in

http://dx.doi.org/10.12944/CARJ.5.1.05

(Received: March 02, 2017; Accepted: March 22, 2017)

ABSTRACT

An experiment was carried out during *rabi* 2011 and *summer* 2012 in Large Plot Completely Randomized Design with four treatments *viz.,* pheromone traps @ 30, 40, 50 /ha and control with ten replications to standardize the requirement of pheromone traps for mass trapping of *Helicoverpa armigera* (Hubner) Hardwick infesting tomato [*Solanumlycopersicum* Linnaeus] crop.The results revealed that the highest moth catches were recorded (9630 moths /ha) during first year, while 9405moths /ha were recorded during second year with an average of 9518 /ha during two consecutive years. The treatment of 50 traps /ha recorded significantly lowest population of eggs (0.78 /10 twigs), lowest larval population (1.32 /10 twigs) resulting in lowest fruit damage (3.71%).

Keywords: Pheromone trap, *Helicoverpaarmigera*, Mass trapping, Fruit damage and Tomato.

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is one of the highly demanded vegetable crop having worldwide demand and production of fresh fruits.In India, tomato crop is mainly grown in the states of Andhra Pradesh, Orissa, West Bengal, Karnataka, Bihar, Gujarat, Tamil Nadu, Uttar Pradesh and Rajasthan. Total area under the tomato crop in India is about 910 thousand hectare with production of 19193 thousand metric tons. The highest productivity of tomato is incurred by Spain having 66.81 t/ha while India has only 21.2 t/ha. In India, Andhra Pradesh contributed maximum production (3354.47 metric tons) but highest productivity was occupied by Karnataka (33.9 t/ha)[3]. The important insect pest of tomato is fruit borer, *Helicoverpa armigera* (Hubner) which limits production and market value of crop produce. *H. armigera* commonly known as gram pod borer, American bollworm and fruit borer[11] causes 40-50 percent damage to the tomato crop[12].*H. armigera* is the big threat in tomato production which causes yield losses about 20 to 60 percent by feeding on developing vegetables[15,10]. Apart from this, resistance to pesticide becomes a serious threat due to the injudicious use of chemical pesticide against the borer, presence of chemical traces on fruits over a long period of time and hazardous effect to the environment[4,5].As an alternate, IPM components *viz.,* behavioral manipulation (semio-chemicals) of insect pests isa feasible approach for monitoring & minimizingthe population of *H. armigera*. Number of maleinsects caught in pheromone baited trap is used asan indicator of pest presence or as an estimate of population density. Installation of large number of pheromone traps reduces the male moth population and thereby least chances of matin gwith females moth. As such, the eggs laid by the female moths are generally unfertilized. This technology i.e. mass trapping of moths can fit well and in a compatible manner as one of the IPM tools[13].For the mass trapping of *Leucinodesorbonalis* Gue. Inbrinjal[1]

and *H. armigera*in chick pea 40 pheromone traps per hectare have been standardized[2]. In order to reduce the excessive use of insecticides in tomato fields, environmentally sound control strategies have been developed, including pheromone trap, cultural control measures (*e.g.* crop rotation, selective removal and destruction of infested plant material)[9], the use of natural enemies (parasitoids, predators, entomopathogens and nematodes)[7,16] and resistant varieties of tomato[6]. Hence, in the present investigations, attempts were made to standardize the numbers of pheromone traps for mass trapping of male moths of *H. armigera* in tomato.

MATERIALS and METHODS

An experiment to standardized number of pheromone traps required for the management of *Helicoverpa armigera* tomato was carried out during two consecutive years in farmer's field located at Village: Vadala, Taluka & District: Kheda (*rabi* 2011) and at Village: Vadia, Taluka: Savli & District: Vadodara(Summer 2012) in Large Plot Completely Randomized design with 4 different treatments *viz.,* pheromone traps @ 30, 40 & 50 /haand 10 repetitions. Each treatment was allotted to a plot of 0.5 hectare with tomato plants spaced at 90 X 60 cm. The pheromone traps were installed equidistantly one month after transplanting plants. The lures were changed twice at 25 days interval after initial installation of traps. The observations on population of eggs and larva; damage to fruits; and moth catches were recorded at weekly interval after installation of traps. Each plot was divided into 10 quadrates (each of 500 m^2) considering one quadrate as one repetition. Five plants were selected randomly in each quadrate and observations on population of eggs and larva as well as damage to fruits were recorded on 2 randomly selected twigs (each of 10 cm length) per plant. The data on egg and larval population on 10 twigs as well as per cent damaged fruits were analysed period-wise as well as pooled over periods and years.

RESULTS

The data on moth catches presented in Table 1 revealed that the total moth catches were highest during first (9630 moths /ha) as well as second (9405 moths /ha) year with an average of 9518 moths /ha in the treatment of 50 traps/ha followed by 40 traps /ha (8020 in the first year, 8060 in the second year with an average 8040 /ha) and 30 traps/ha (7170 in the first year, 6843 in the second year and average 7005/ha). Thus, as number of traps /ha increased, the moth catches /ha also increased.

The data presented in Table 2 revealed that all the three treatments (30, 40 & 50 traps /ha) recorded significantly lower population of eggs and larvae as well as per cent pod damage than control (No-trap). The treatment of 50 traps /ha recorded significantly lowest population of eggs (0.78 eggs /10 twigs) followed by 40 (0.89 eggs /10 twigs) and 30 (1.90 eggs /10 twigs) traps /ha, which were at par with each other. So far the data on larval population and per cent damaged fruits are concerned; the treatment of 50 traps /ha recorded lowest larval population (1.32 /10 twigs) and per cent fruit damage (3.71) and it was at par with the treatment of 40 traps /ha which recorded 1.38 larvae /10 twigs and 4.37 per cent fruit damage.

Table 1: Moth catches under different treatments in tomato

Treatments	Moth catches/ trap (Total of 10 observations)		
	First year	Second year	Mean of two years
30 Traps /ha	238.98	228.09	233.54
	{7170}	{6843}	{7005}
40 Traps /ha	200.5	201.50	201.00
	{8020}	{8060}	{8040}
50 Traps /ha	192.6	188.10	190.35
	{9630}	{9405}	{9518}

Table: 2 Impact of mass trapping of H. armigera moths on the damage in tomato (pooled over periods and year)

Treatments	Egg population (Pooled of 12 observations) per 10 twigs			Larval population (Pooled of 12 observations) per 10 twigs			Per cent damaged fruits Pooled of 10 observations		
	First year	Second year	Pooled over year	First year	Second year	Pooled over year	First year	Second year	Pooled over year
1	2	3	4	5	6	7	8	9	10
30 Traps /ha	1.58b	1.53b	1.55b	1.90b	1.84b	1.87b	18.37b	16.00b	17.19b
	(1.75) [43.72]	(1.84) [42.31]	(1.90) [41.71]	(3.11) [38.50]	(2.89) [39.66]	(3.00) [38.52]	(9.93) [28.20]	(7.60) [35.81]	(8.73) [31.90]
40 Traps /ha	1.21a	1.14a	1.18b	1.40a	1.33a	1.37a	13.67a	10.46a	12.06a
	(0.94) [69.77]	(0.80) [74.92]	(0.89) [72.69]	(1.46) [70.92]	(1.27) [73.48]	(1.38) [71.72]	(5.59) [59.58]	(3.30) [72.12]	(4.37) [65.91]
50 Traps /ha	1.15a	1.10a	1.13a	1.39a	1.31a	1.35a	12.90a	9.32a	11.11a
	(0.71) [77.17]	(0.71) [77.74]	(0.78) [76.07]	(1.43) [71.71]	(1.22) [74.53]	(1.32) [72.95]	(4.98) [63.99]	(2.62) [77.87]	(3.71) [71.06]
Control	1.96c	1.92c	1.94c	2.35c	2.30c	2.32c	21.83c	20.13c	20.98c
	(3.11)	(3.19)	(3.26)	(5.02)	(4.79)	(4.88)	(13.83)	(11.84)	(12.82)
Mean	1.47	1.42	1.45	1.76	1.69	1.73	16.69	13.97	15.33
	(1.46)	(1.52)	(1.6)	(2.6)	(2.35)	(2.49)	(8.25)	(5.83)	(6.99)
				ANOVA					
S. Em. +Treatment (T)	0.04	0.04	0.01	0.06	0.06	0.02	0.32	0.45	0.21
Period (P)	0.03	0.03	0.02	0.04	0.03	0.02	0.39	0.48	0.3
Year (Y)	-	-	0	-	-	0	-	-	0.06
T x P	-	-	0.02	-	-	0.02	-	-	0.3
T x Y	0.06	0.05	0.03	0.07	0.07	0.03	0.79	0.96	0.42
P x Y	-	-	0.04	-	-	0.05	-	-	0.59
T x P x Y	-	-	0.05	-	-	0.08	-	-	0.84
C.D. @ 5 % T	0.12	0.11	0.04	0.11	0.18	0.06	0.89	1.32	0.66
P	0.09	0.08	0.05	0.16	0.1	0.07	1.05	1.43	0.82
Y	-	-	0.01	-	-	0.01	-	-	0.18
T x P	0.16	0.14	0.05	0.19	0.19	0.07	NS	2.66	0.82
T x Y	-	-	NS	-	-	NS	-	-	1.17
P x Y	-	-	NS	-	-	NS	-	-	1.65
T x P x Y	-	-	NS	-	-	NS	-	-	NS
C. V. %	12.34	11.47	11.65	12.59	12.83	12.27	14.94	21.73	17.5

Notes: 1. Figures outside the parenthesis are $\sqrt{X + 0.5}$ transformed values in column 2-7 and arcsine transformed values in column 8-10; while those inside are

per cent reduction in the population of eggs (76.07) and larvae (72.95) as well as per cent fruit damage (71.06) than the treatments of 40 (72.69, 71.72 and 65.91, respectively) & 30 (47.71, 38.52 and 31.90, respectively) traps /ha.

DISCUSSION

The highest moth catches were recorded (9630 moths /ha) during first year, while 9405moths /ha were recorded during second year with an average of 9518 /ha during two consecutive years. The treatment of 50 traps /ha recorded significantly lowest population of eggs (0.78 /10 twigs), lowest larval population (1.32 /10 twigs) and per cent fruit damage (3.71). Since the treatment of 50 traps /ha and 40 traps /ha were at par with each other, so far larval population and per cent fruit damage are concerned, 40 traps /ha can be considered as optimum number for annihilation of males of *H. armigera*in tomato crop.The findings of research are in good agreements with[14]who reported the highest moth catches (9630 during 2011-12, 11272 during 2012-13 with an average of 10451 moths/ha) in pigeon pea crop installed with of 50 traps /ha. There was a successive reduction of the cutworm population during the years 2003 and 2004 infesting potato crop after the installation of 50 traps per and also lower down the damage caused[8]. Comparing the results with other crop i.e. pigeon pea, 50 traps /ha is required to manage this pest which may be due to dense vegetation of the crop but in case of tomato 40 as well as 50 traps /ha found best but looking to the economics of the treatment, 40 traps / ha can be recommended to the farmers for mass trapping of the male moths of *H. armigera* and thereby in reducing population of eggs and larvae as well as per cent fruit damage in tomato crop. As the finding is somewhat new in tomato crop but the results are also in good agreements with the findings of other authors in different crops.

ACKNOWLEDGMENT

The authors would like to thank Indian Council of Agriculture Research, New Delhi for sponsoring the Emeritus Scientist Project as well as Anand Agricultural University for the continuous support during the experiment.

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