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Seasonal Incidence and Management of *Spodoptera litura* F. on Coriander

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ABSTRACT

Coriander sown at early date (24th November) and at later date (12th December) both recorded peak incidence of *Spodoptera litura* F.during the month of January. The incidence on early sown crop had no significant relationship with temperature and relative humidity but the incidence on late sown crop had significant and negative correlation with minimum temperature. The late sown crop was attacked earlier and more heavily infested than the early sown crop. The results of the chemical control trial indicated that thiodicarb @ 0.075% and acephate @ 0.075% were the most effective in reducing the larval population of *S. litura*.

Key words : Coriander, Seasonal Incidence, *Spodoptera litura.*

Coriander (*Coriandrum sativum* Linn.) is one of the spice crops grown in India with an area of 282.50 thousand hectares and a production of 172.30 thousands tonnes during 2005.While, Andhra Pradesh alone had an area of 23.98 thousand hectares with a production of 9.31 thousands and a productivity of 388 kg ha^{-1}(Indian Harvest: Database of Centre for Monitoring Indian Economy, CMIE Pvt. Ltd.). Coriander is gaining importance in the Krishna-Godavari (K.G.) zone of Andhra Pradesh in *rabi* season. Its yield is influenced by many pests and diseases, one of which is tobacco caterpillar, *Spodoptera litura* F., which is threatening its cultivation. As this crop is gaining importance in K.G. zone, the present study was carried out to find out the seasonal dynamics of the pest besides, evaluation of certain newer chemicals.

MATERIAL AND METHODS

The field experiment was conducted at Agricultural College Farm, Bapatla during *rabi,* 2006-07. All recommended practices were followed to raise the crop. Coriander variety Kalmi was sown at two different dates of sowing *i.e.* November 24th (early sown) and December 12th (late sown) in 2006 in two bulk plots each of 100m^2 by adopting 30 x10 cm spacing. The incidence of the tobacco caterpillar was recorded from 50 randomly selected plants at five different locations in each bulk plot, soon after noticing the infestation, and the observation was continued upto maturity of the crop in each plot at five days interval. The pest incidence was correlated with meteorological data for establishing the effect of weather parameters on the incidence of *S.litura.* The incidence was established through simple correlation and multiple linear regression studies.

For management of *S. litura* on coriander, the experiment was laid in a RBD with ten treatments including the untreated check and replicated thrice. Plots of net size 5x4 m were prepared and enclosed by bunds all round and with irrigation channels in between the replications. Nine different insecticides, *viz.* acephate 75WP (0.075%), imidacloprid 17.8 SL (0.00445%), azadirachtin 1500ppm (5ml/l), fipronil 5SC (0.01%), thiodicarb 75SP (0.075%), cartap hydrochloride 50SP (0.01%), abamectin 1.8EC (0.0018%), novaluron 10EC (0.01%) and dimethoate 30EC (0.06%) were used in the chemical control trial. The crop received two rounds of foliar spray, the first one during vegetative phase at 54 days after sowing and a second spray at 65 days after sowing. The larval population was recorded one day before spaying as pretreatment count and on 1, 5 and 10 days as post treatment counts. The observations were recorded from 10 randomly selected plants which were tagged in each plot, leaving the border rows. Per cent population reduction of *S. litura* over untreated check in different treatments was calculated using modified Abbot's formula and these values were further transformed to the corresponding angular values and the data was subjected to statistical analysis.

RESULTS AND DISCUSSION

The initial infestation of the pest on early sown crop was noticed during the 51st standard week on 23rd December, 2006 (Table 1). The population

Table 1. Influence of abiotic factors on the seasonal incidence of *S. litura* on coriander during *rabi,* 2006 – 07 (Early sown)

Date of observation	Temperature (°C)		Relative Humidity (%)		*S. litura*
	Max	Min	Morning	Evening	Mean population 10 plants^{-1}
Dec' 18th	30.76	17.60	94.40	73.60	0.00
Dec' 23rd	29.88	17.72	90.80	69.40	9.00
Dec' 28th	30.04	16.58	94.80	73.40	9.33
Jan' 2nd	30.34	17.18	82.80	71.20	10.67
Jan' 7th	30.66	16.30	91.60	61.80	11.33
Jan' 12th	29.81	15.99	91.09	58.09	12.67
Jan' 17th	29.60	14.94	91.80	62.60	14.00
Jan' 22nd	29.95	15.73	95.51	68.69	15.00
Jan' 27th	30.34	17.09	96.97	70.57	14.33
Feb' 2nd	30.62	17.42	95.00	69.40	11.00
Feb' 6th	30.50	16.56	96.51	73.11	7.67

Table 2. Influence of abiotic factors on the seasonal incidence of *S. litura* on coriander during *rabi,* 2006 – 07 (Late sown)

Date of observation	Temperature (°C)		Relative Humidity (%)		*S. litura*
	Max	Min	Morning	Evening	Mean population 10 plants^{-1}
Jan' 7th	30.66	16.30	91.60	61.80	15.33
Jan' 12th	29.81	15.99	91.09	58.09	15.00
Jan' 17th	29.60	14.94	91.80	62.60	14.00
Jan' 22nd	29.95	15.73	95.51	68.69	14.67
Jan' 27th	30.34	17.09	96.97	70.57	15.33
Feb' 1st	30.62	17.42	95.00	69.40	13.33
Feb' 6th	30.50	16.56	96.51	73.11	13.00
Feb' 11th	29.98	16.93	94.03	70.91	12.67
Feb' 16th	30.22	17.80	94.20	71.40	11.33
Feb' 21st	30.49	19.52	89.54	66.71	9.33

Table 3. Correlation between abiotic factors and larval population of *S. litura* on coriander during *rabi*, 2006 - 07

Weather parameters	Early sown Correlation coefficient (r)
X_1 – Maximum temperature (°C)	- 0.5494 NS
X_2 – Minimum temperature (°C)	- 0.5800 NS
X_3 – Morning relative humidity (%)	- 0.0550 NS
X_4 – Evening relative humidity (%)	- 0.5174 NS

NS: Non significant * Significant at 5% level

gradually increased and reached its peak of 15 larvae per ten plants by the 4th standard week on 22nd January, 2007 and thereafter declined to 7.67 per ten plants by the 6th standard week *i.e.* on 6th February. The initial infestation of *S. litura* on late sown crop was observed with a pest density of 15.33 larvae per ten plants during the 1st standard week *i.e.* on 7th January, 2007 (Table 2). The population gradually declined and rose to another peak (15.33 larvae per ten plants) on the 4th standard week *i.e.* on 27th January. Thereafter, the population gradually declined. Similarly, Bhavani (1995), Srinivas and Rao (1999) and Babu (2002) all reported peak population of *S. litura* during January on groundnut.

The correlation studies indicated no significant between the larval populations of *S. litura* on early sown crop and selected weather parameters (temperature and humidity) (Table 3). Multiple Linear Regression analysis also showed that none of the weather parameters had any significant effect on the larval population. It was observed that the coefficient (R^2) of all the weather parameters had any significant on the larval population. It was observed that the coefficient of determination (R^2) of all the weather parameters was 0.8903 which showed that the climatic factors together influenced variation in the larval incidence to the extent of 89.03 % (Table 4).

The correlation studies indicated that the maximum temperature was found to be highly significant and negatively correlated with the larval population on late sown crop but all the other abiotic factors were found to be non significant (Table 5). Nadaf and Kulkarni (2006) reported a highly significant larval population of *S. litura* on chilli with minimum temperature. The Multiple Linear Regression equation derived to predict the population fluctuation of *S. litura* based on weather parameters was

$$Y = - 60.37 + 1.37X_1 + 0.04X_2 + 0.70X_3 - 0.57X_4^*$$

It was observed that the coefficient of determination for larval incidence was 0.9691 which indicated that the climatic factors together were able to explain the variation in the larval population to the extent of 96.91 out of 100 and the partial regression coefficient for evening relative humidity was found to be negative and significant. Thus, every 1% rise in evening relative humidity is expected to bring down the larval population by 0. 57 (Table 6).

In chemical control trial, data obtained from two sprays were pooled together and analysed (Table 7). Cumulative efficacy of three observations recorded at 1, 5 and 10 days after two spays indicated that thiodicarb (0.075%) recorded the highest reduction (74.02%) of *S. litura* larval population over control. This might be possible because thiodicarb being an oxime carbamate had predominant stomach action. Varalakshmi (2004) and Rao *et al.* (2006) reported the efficacy of thiodicarb in reducing the *S. litura* larval population upto 75.48 per cent and 71.74 per cent, respectively. The second best treatment was acephate (0.075%) with 71.72 per cent reduction. acephate being an organophosphorous compound with systemic action was proved effective against lepidopteran pests (Gupta, 1999). Rao *et al.* (2006) also reported the higher efficacy of acephate against *S. litura* on fenugreek. This was followed by abamectin (0.0018%) and cartap hydrochloride (0.01%) showing a larval reduction of 66.93 per cent and 63.86 per cent, respectively. Abamectin belongs to avermectins, a novel insecticide with contact and stomach action. Murugan and Ramachandran (2000) and Hadapad *et al.* (2001) reported the efficacy of abamectin against *Plutella xylostella* on cabbage. Cartap hydrochloride is a contact and stomach poison with blocking action in the central nervous system that leads to paralysis (David and Kumar Swamy, 1982). Rao *et al.* (1996) and Malla Reddy *et al.* (2004) reported the efficacy of cartap hydrochloride against *Leucinodes orbonalis* and *Hellula undalis,* respectively. The treatments with moderate efficacy were novaluron (0.01%) and fipronil (0.01%) with 55.96 percent and 53.87 percent reduction in larval population, respectively. Novaluron was a novel benzophenyl urea compound and acted on the larvae by inhibiting chitin formation and thereby causing abortive moulting. Prithviraj and Chatterjee (2004) and Rao *et al.*(2006) reported moderate efficacy of novaluron against *S. litura* while the findings on fipronil were in agreement with those of Tiwari (2005) and Sekh (2007) .

The remaining treatments in the descending order of efficacy were imidacloprid 0.00445 percent (44.50%), dimethoate 0.06 percent (38.33%) and azadirachtin (5ml/l) which recorded the least (35.30) per cent reduction in larval population over untreated control. Thus, thiodicarb (0.075%) and acephate (0.075%) were found most effective in reducing the larval population of *S. litura* and therefore could be used to manage this pest in coriander.

Table 4. Multiple linear regression analysis of larval population of *S. litura* on certain weather parameters on coriander during *rabi*, 2006 – 07

Variable	Partial regression coefficient	Standard error	t- value
X_1 – Maximum temperature (°C)	- 0.004	3.30	0.001 NS
X_2 – Minimum temperature (°C)	0.778	1.39	0.559 NS
X_3 – Morning relative humidity (%)	-0.810	0.88	0.917 NS
X_4 – Evening relative humidity (%)	0.028	0.39	0.071 NS

Intercept : 68.024 R^2 value : 0.8903 NS : Non significant

Table 5. Correlation between abiotic factors and larval population of *S. litura* on coriander during *rabi*, 2006 - 07

	Late sown
Weather parameters	Correlation coefficient (r)
X_1 – Maximum temperature (°C)	- 0.2132 NS
X_2 – Minimum temperature (°C)	- 0.7888 **
X_3 – Morning relative humidity (%)	- 0.3157 NS
X_4 – Evening relative humidity (%)	- 0.3658NS

NS: Non significant ** Significant at 1% level

Table 6. Multiple linear regression analysis of larval population of *S. litura* on certain weather parameters on coriander during *rabi*, 2006 – 07

Variable	Partial regression coefficient	Standard error	t- value
X_1 – Maximum temperature (°C)	1.3672	0.9061	1.5088 NS
X_2 – Minimum temperature (°C)	0.0406	0.4309	0.0943 NS
X_3 – Morning relative humidity (%)	0.6950	0.2348	2.9589 NS
X_4 – Evening relative humidity (%)	-0.5660	0.1276	4.4374 *

Intercept : -60.367 R^2 value : 0.9691 NS : Non significant * Significant at 5% level

Table 7: Mean efficacy of treatments (after two sprays) against *S. litura* on coriander during *rabi*, 2006-07.

Treatments	Pre-treatment larval population per 10 plants	Mean per cent reduction of *S. litura* over control at			Mean efficacy
		1 DAS	5 DAS	10 DAS	
T_1 : Acephate 0.1%	23.67	71.64 (57.83)[b]	72.06 (58.09)[b]	71.46 (57.71)[b]	71.72 (57.87)[b]
T_2 : Imidacloprid 0.00445%	23.67	44.50 (41.84)[g]	45.38 (42.35)[g]	43.89 (41.49)[g]	44.59 (41.89)[g]
T_3 : Azadirachtin (5 ml/l)	23.33	35.72 (36.70)[j]	35.38 (36.50)[j]	34.79 (36.14)[j]	35.30 (36.45)[j]
T_4 : Fipronil 0.01%	23.00	55.03 (47.89)[ef]	53.60 (47.06)[h]	52.97 (46.70)[f]	53.87 (47.22)[f]
T_5 : Thiodicarb 0.075%	23.33	73.39 (58.95)[a]	74.39 (59.60)[a]	74.27 (59.52)[a]	74.02 (59.35)[a]
T_6 : Cartap Hydrochloride 0.01%	23.00	62.96 (52.51)[d]	64.11 (53.20)[d]	64.51 (53.43)[d]	63.86 (53.04)[d]
T_7 : Abamectin 0.0018%	23.33	67.17 (55.05)[c]	66.32 (54.33)[c]	67.30 (55.12)[c]	66.93 (54.90)[c]
T_8 : Novaluron 0.01%	23.00	55.85 (48.36)[e]	56.64 (48.81)[e]	55.40 (48.10)[e]	55.96 (48.42)[e]
T_9 : Dimethoate 0.06%	23.00	39.42 (38.89)[h]	38.66 (38.45)[h]	38.40 (38.29)[h]	38.83 (38.54)[h]
T_{10} : Control	24.00	-	-	-	-
F- test		Sig	Sig	Sig	Sig
SEm±		0.345	0.282	0.314	0.103
C.D. at 5% Level		1.10	0.904	1.00	0.328

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