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## INTEGRATED MANAGEMENT OF LEPIDOPTERAN DEFOLIATORS IN LITCHI UNDER SUBTROPICS OF BIHAR

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### KEYWORDS

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## ABSTRACT

A field trial was conducted for two years at ICAR-National Research Centre on Litchi to develop the eco-sustainable bio-rational approaches for managing the litchi leaf folder, *Platyepplus aprobola* and litchi looper, *Perixera illepidaria*. Maximum (14.33) leaf folder incidence was observed in the month of October and minimum (0.33) population in January. In case of litchi looper maximum population (12.67) was observed in 42<sup>nd</sup> standard week (SW) with no population (0.00) in 1<sup>st</sup> and 2<sup>nd</sup> standard week. Pruning of twigs in June followed by application of 4 kg castor and 1 kg neem cake along with spraying of novaluron 10EC (0.015%) had minimum (10.00) leaf folder population treatment after 15 days of first spray followed by spinosad and fipronil as registered 14.67 and 15.00 leaf folder population, respectively. Similar insecticide was found effective in control of litchi looper during field investigation. For the management of lepidopteran defoliators in litchi pruning of twigs in June followed by application of 4 kg castor and 1 kg neem cake along with two spray of novaluron 10EC (0.015%) or fipronil 5SC (0.01%) is recommended.

## INTRODUCTION

Litchi (*Litchi chinensis* Sonn) is an important fruit crop belongs to family Sapindaceae. It is known as queen of the fruit due to its attractive deep pink/red colours and flavoured juicy aril (Singh *et al.*, 2012; Kumar *et al.*, 2014). India is the second largest producer of litchi in the world after China, with an area and production of 84,200 ha and 585,300 MT, respectively, during 2013–14 (NHB, 2014). The litchi growers are facing serious problem of many insects pests like litchi fruit and shoot borer, litchi mite, leaf folder, litchi looper, and as such the production is reduced drastically with marketability (Kumar *et al.*, 2011; Kumar *et al.*, 2014). The Leaf roller, *Platyepplus aprobola* (Lepidoptera: Tortricidae) is a cosmopolitan pest and has been reported in various fruit crops in Hawaii, South Africa, Australia, China and India. In India, it was first time reported from Bihar where it causing severe damage to litchi foliage. Lepidopteran defoliators of litchi causing severe damage to the new flush resulting poor growth of newly established orchard in particular and established orchard in general (Kumar *et al.*, 2011).

Leaf roller is a very serious litchi pest in Bihar and surrounding areas. Further, *Perixera illepidaria* (Lepidoptera: Geometridae) a looper species attacks tender leaves in mass and defoliate the new shoots. In severe attack, it completely defoliates the newly emerged flush. Besides litchi so many host plants *viz.*, longan, rambutan, mango, and castor have been reported for this pest (Kumar *et al.*, 2011; Kumar *et al.*, 2014). Therefore, keeping in view the importance of lepidopteran defoliators (litchi looper and leaf folder) field trials were conducted to assess the influence of climatic conditions on seasonal abundance and to evaluate the different IPM modules against these important pests.

## MATERIALS AND METHODS

Present studies were conducted at experimental farm of National Research Centre on Litchi, Muzaffarpur, Bihar during 2013 and 2014 situated between latitude and longitude of 26°5'87" N and 85°26'64" E, respectively at altitude of 210 msl. For recording defoliators population (litchi looper and leaf folder), ten trees of litchi cv. *Shahi* were selected randomly and trees were kept unsprayed during the period of investigation (2013-2014). Defoliator's population was recorded at standard week wise interval from 32<sup>nd</sup> SW of 2013 to 14<sup>th</sup> standard week of 2014. Four shoots (30 cm) from each tree were selected randomly to count the defoliator's population. Separate experiment comprising 12 treatments was laid out in RBD design with three replications to evaluate the efficacy of different IPM modules to manage lepidopteran defoliators in litchi (Table 2). Horticultural practices were performed as per recommended package of practices for litchi cv. *Shahi* under the trials (Rai *et al.*, 2000, Kumar *et al.*, 2014). Subsequently second spray was done at 30 days interval of each insecticide. Pre treatment imposition count was taken before spraying the plant with insecticides. Observations on leaf defoliator population in sprayed plant were recorded periodically at 3, 5 and 15 days after spray.

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## RESULTS AND DISCUSSION

Seasonal incidence

**Table 1: Incidence of Leaf folder and Litchi looper with weather parameters during 2013 and 2014**

Fortnight	Std. Week (SW)	Mean no. of insects/ shoot		Temperature (°C)		Relative Humidity (%)		Rainfall (mm)
		Leaf folder ( <i>Platyepplus aprobola</i> )	Litchi looper ( <i>Perixera illepidaria</i> )	Min.	Max.	07:00 hr	14: 00 hr	
August I	32	6.00	3.00	25.70	31.90	91.00	71.00	66.60
	33	7.67	2.67	25.90	33.00	91.00	72.00	15.00
August II	34	9.33	4.67	26.40	33.40	85.00	65.00	3.10
	35	9.67	4.67	25.90	32.50	91.00	72.00	15.60
September I	36	8.67	5.33	25.50	33.10	88.00	65.00	105.70
	37	9.33	6.00	26.30	34.80	89.00	59.00	0.00
September II	38	10.33	7.33	25.90	34.30	87.00	60.00	1.80
	39	10.67	8.67	25.20	34.30	87.00	65.00	3.60
October I	40	11.33	9.33	24.20	30.17	90.00	72.00	16.30
	41	14.00	9.67	23.60	31.30	89.00	65.00	18.90
	42	14.33	12.67	22.10	28.40	92.00	72.00	5.60
October II	43	11.67	13.33	21.20	31.10	93.00	63.00	0.00
	44	5.33	9.33	19.80	28.20	94.00	68.00	0.00
November I	45	5.00	8.67	14.80	28.90	90.00	44.00	0.00
	46	1.67	7.00	13.00	28.20	88.00	36.00	0.00
November II	47	2.00	1.33	11.10	27.40	89.00	37.00	0.00
	48	0.67	0.33	13.00	27.20	91.00	46.00	0.00
December I	49	0.67	0.33	11.10	27.20	90.00	41.00	0.00
	50	0.67	0.00	10.30	24.40	91.00	49.00	0.00
December II	51	0.33	0.67	11.20	22.90	89.00	59.00	0.00
	52	0.33	0.67	9.70	18.80	93.00	77.00	0.00
January I	1	0.00	0.00	9.00	21.30	87.10	57.80	0.00
	2	0.00	0.33	9.00	18.50	91.10	67.00	5.30
	3	0.33	0.33	9.50	18.80	91.00	74.20	4.20
January II	4	0.33	0.00	10.50	19.70	92.00	66.10	0.00
	5	1.67	0.33	8.90	17.60	90.90	74.70	0.00
February I	6	1.33	1.00	10.40	24.20	88.40	50.60	0.00
	7	2.67	1.67	10.80	20.40	89.40	61.60	29.60
February II	8	2.00	2.00	10.80	24.00	90.00	54.70	1.40
	9	5.33	2.67	14.30	24.70	90.00	64.30	1.70
March I	10	1.33	3.33	11.70	26.70	87.60	41.60	0.00
	11	2.00	3.67	15.00	30.30	88.10	41.10	0.00
March II	12	3.33	4.33	16.60	31.70	80.70	39.30	0.00
	13	2.67	4.00	18.30	34.60	70.30	28.10	0.00
	14	15	0.33	19.10	35.00	78.40	35.90	0.00

**Table 2: Treatment details of different IPM module against lepidopteran defoliators**

Treatments	Treatment details
T <sub>1</sub>	Pruning of twigs in June
T <sub>2</sub>	T <sub>1</sub> + manuring the litchi trees with 4 kg of castor and 1 kg of neem cake
T <sub>3</sub>	T <sub>1</sub> + fipronil 5SC (0.01%)
T <sub>4</sub>	T <sub>1</sub> + spinosad 45SC (0.014%)
T <sub>5</sub>	T <sub>1</sub> + novaluron 10EC (0.015%)
T <sub>6</sub>	T <sub>2</sub> + fipronil 5SC (0.01%)
T <sub>7</sub>	T <sub>2</sub> + spinosad 45SC (0.014%)
T <sub>8</sub>	T <sub>2</sub> + novaluron 10EC (0.015%)
T <sub>9</sub>	Spraying of fipronil 5SC (0.01%)
T <sub>10</sub>	Spraying of spinosad 45SC (0.014%)
T <sub>11</sub>	Spraying of novaluron 10EC (0.015%)
T <sub>12</sub>	Control (no pruning, no spray)

#### Litchi leaf folder (*Platyepplus aprobola*); Lepidoptera: Tortricidae

Seasonal incidence of leaf folder in litchi was recorded from 32<sup>nd</sup> standard week (2013) to 14<sup>th</sup> standard week (2014) at weekly interval. Results revealed that leaf folder incidence

was observed throughout the year with a population maximum (14.33) in October month and minimum (0.33) in January month (Table 1). However, no population was observed in 1<sup>st</sup> and 2<sup>nd</sup> standard week. Again in fluctuating trend leaf folder population reached up to 15.00 in 14<sup>th</sup> standard week during 2014. The increase in severity of folder during September month is associated with development of new flush as extension shoot during post rainy season. Similar finding were also reported by Singh (1971) from litchi plants.

#### Litchi looper (*Perixera illepidaria*); Lepidoptera: Geometridae

Seasonal incidence of litchi looper in litchi was recorded from August 2013 (32<sup>nd</sup> standard week) to March 2014 (14<sup>th</sup> standard week) at weekly interval. Results revealed that litchi looper population was observed throughout the study period with maximum (13.33; 43<sup>rd</sup> standard week) and minimum (0.33; 1<sup>st</sup> standard week) population in the month of October and January, respectively (Table 1). However, no population was observed in 2<sup>nd</sup> and 3<sup>rd</sup> SW (first fortnight of January). Further fluctuating trend in population build up clearly indicates influence of weather parameters on looper population (Fig. 1). Kumar *et al.* (2014) also recorded severe outbreak of

**Table 3: Effect of different IPM module against leaf folder, *Platyepplus aprobola***

Treatments	Mean no. of leaf folder (larvae)/ shoot							
	First Spray				Second Spray			
	Before 1 <sup>st</sup> day	After 3 <sup>rd</sup> day	After 5 <sup>th</sup> day	After 15 <sup>th</sup> day	Before 1 <sup>st</sup> day	After 3 <sup>rd</sup> day	After 5 <sup>th</sup> day	After 15 <sup>th</sup> day
T <sub>1</sub>	38.67	40.67	42.33	45.00	47.33	50.00	54.33	59.67
T <sub>2</sub>	36.33	39.00	40.67	48.00	42.67	45.33	48.33	52.00
T <sub>3</sub>	38.67	14.00	11.33	14.00	40.00	13.33	11.67	14.67
T <sub>4</sub>	40.00	16.33	13.00	16.67	38.00	12.00	8.00	13.33
T <sub>5</sub>	41.33	20.00	16.33	22.00	34.33	15.00	10.33	17.67
T <sub>6</sub>	36.00	12.00	10.67	15.00	34.67	10.33	9.00	16.67
T <sub>7</sub>	34.33	10.33	9.00	14.67	30.33	8.33	6.33	12.33
T <sub>8</sub>	34.33	7.67	7.67	10.00	29.00	9.00	6.00	14.00
T <sub>9</sub>	49.00	38.00	37.67	46.33	40.67	30.00	25.67	32.67
T <sub>10</sub>	54.33	47.33	40.00	48.67	49.67	40.33	29.67	38.67
T <sub>11</sub>	54.67	46.00	41.00	45.67	51.00	42.33	30.00	45.00
T <sub>12</sub>	60.33	66.33	73.33	78.67	61.33	70.33	76.33	84.67
CD (5%)	10.62	8.62	7.33	7.60	6.41	5.52	5.94	5.67
SE(m)	3.60	2.92	2.48	2.58	2.17	1.87	2.01	1.92

**Table 4: Effect of different IPM module against litchi looper, *Perixera illepidaria***

Treatments	Mean no. of litchi loopers (larvae)/ shoot							
	First Spray				Second Spray			
	Before 1 <sup>st</sup> day	After 3 <sup>rd</sup> day	After 5 <sup>th</sup> day	After 15 <sup>th</sup> day	Before 1 <sup>st</sup> day	After 3 <sup>rd</sup> day	After 5 <sup>th</sup> day	After 15 <sup>th</sup> day
T <sub>1</sub>	26.67	27.67	28.00	35.00	46.67	56.33	62.33	69.33
T <sub>2</sub>	20.33	19.33	17.67	19.33	39.00	41.00	36.67	50.33
T <sub>3</sub>	21.67	0.00	0.33	6.33	41.33	0.00	1.00	2.67
T <sub>4</sub>	20.33	0.00	0.00	3.33	34.00	0.00	0.00	1.67
T <sub>5</sub>	22.00	0.00	0.00	1.33	35.00	0.00	0.00	0.33
T <sub>6</sub>	17.67	0.00	0.00	4.67	27.67	0.00	0.00	3.67
T <sub>7</sub>	18.00	0.00	0.00	3.00	30.33	0.00	0.00	1.67
T <sub>8</sub>	20.00	0.00	0.00	0.67	38.00	0.00	0.00	0.33
T <sub>9</sub>	29.00	0.00	0.33	7.33	44.00	0.00	0.67	3.00
T <sub>10</sub>	32.33	0.00	0.00	2.67	47.67	0.00	0.00	1.33
T <sub>11</sub>	33.33	0.00	0.00	1.67	47.33	0.00	0.00	0.67
T <sub>12</sub>	38.00	40.33	45.33	56.00	62.00	72.33	77.67	80.33
CD (5%)	5.04	2.99	2.59	2.60	6.38	3.33	2.42	3.31
SE(m)	1.71	1.01	0.88	0.88	2.16	1.13	0.82	1.12

looper from Bihar during August to November in litchi orchard.

#### Evaluation of different IPM modules

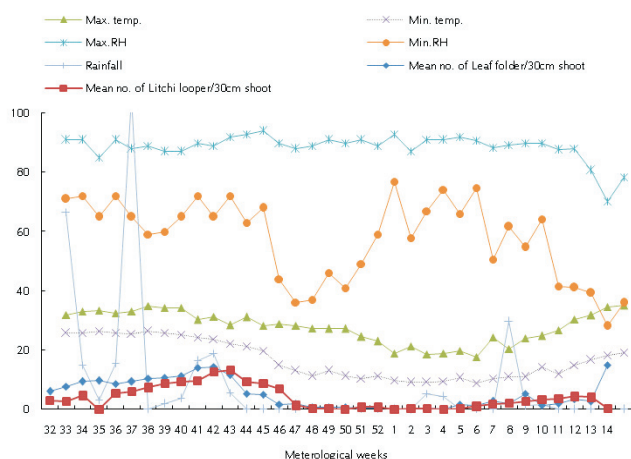
##### Litchi leaf folder (*Platyepplus aprobola*); Lepidoptera: Tortricidae

The data presented in Table 3 clearly showed that all the treatments significantly reduced the litchi leaf folder population. Initial population of leaf folder was ranged from 34.33 to 60.33 clearly indicates that pruning of twigs in June followed by application of manures in the litchi trees with 4 kg of castor and 1 kg of neem cake initially decrease leaf folder population as observed in T<sub>2</sub> (36.66), T<sub>6</sub> (36.00), T<sub>7</sub> (34.33), T<sub>8</sub> (34.33). Pruning of twigs in June followed by manure application in the litchi trees with 4 kg of castor and 1 kg of neem cake with spraying of novaluron 10EC (0.015%) registered minimum leaf folder population (10.00) after 15 days of first spraying against 78.67 in control followed by spinosad 45SC (0.014%) and fipronil 5SC (0.01%) as registered 14.67 and 15.00 leaf folder population, respectively. Similar trend of infestation was noticed after 2<sup>nd</sup> spray. Downward (2004) found that spinosad was highly effective against diamondback moth and several other important lepidopteran pests; whereas, Paliwal and

Oommen (2005) reported spinosad was most effective against tobacco caterpillar (*S. litura*) in cauliflower. Meena and Raju (2015) reported that spinosad and fipronil was most effective insecticides against tomato fruit borer (*Helicoverpa armigera*). Nataraja *et al.* (2015) also reported that novaluron 10 EC registered minimum fruit infestation (1.7%) against 18.6% in control in okra.

##### Litchi looper (*Perixera illepidaria*); Lepidoptera: Geometridae

Before one day spray average minimum looper population (20.00) was noticed with T<sub>2</sub> against 38.00 in control (Table 4) indicates pruning of twigs in June followed by manuring the litchi trees with 4 kg of castor and 1 kg of neem cake initially reduce looper population. After three day spray no population was noticed in all insecticidal treatments against 40.33 in control clearly showed that all tested insecticides are highly effective against litchi looper. During 5<sup>th</sup> day observation mostly treatments registered 0.00 looper population except T<sub>3</sub> and T<sub>6</sub> sprayed with fipronil 5SC (0.01%). After 15 day of spray minimum looper population was observed with T<sub>11</sub> i.e. spraying of novaluron 10EC (0.015%). Similar trend was observed during second spraying. Nataraja *et al.* (2015) also



**Figure 1: Seasonal abundance of litchi looper and leaf folder at Muzaffarpur during 2013-14**

reported novaluron 10 EC was highly effective against okra fruit borer. According to Jat *et al.* (2014) spinosad 45SC @ 200ml/ha caused maximum reduction in population of tobacco caterpillar (85.33%) and were significantly superior over other treatments. Further, Topagi *et al.* (2010) reported that spinosad 45 SC (0.015%) was very effective against *S. litura* with 51% mean reduction in larval population over untreated check. The finding of present investigation holds a good promise in lepidopteran defoliators (litchi leaf folder, *Platyepplus aprobola* and litchi looper, *Perixera illepidaria*) management and it showed that pruning of twigs in June followed by application of 4 kg of castor and 1 kg of neem cake followed by two spray of novaluron 10EC (0.015%) or spinosad 45SC (0.014%) or fipronil 5SC (0.01%) was effective in controlling lepidopteran defoliators in litchi ecosystem.

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