



# Comparative efficacy of chemical and botanical pesticides against citrus leaf minor (*Phyllocnistis citrella* Stainton)

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## ABSTRACT

The investigation was conducted with 8 Treatments:- Dimethoate 30 EC @ 0.03 per cent, Abamectin 1.8 EC @ 0.003 per cent, Spinosad 45 SC @ 0.03 per cent, Acetamiprid 20 SP @ 0.04 per cent, Imidacloprid 17.8 SL @ 0.005 per cent, *Neem* oil 2 per cent, NSKE 5 per cent and control (water spray) on citrus leaf minor. Such treatments were arranged in statistical design RBD with three replications. In overall, cumulative effect of 3 applications of all the treatments T<sub>5</sub> Abamectin 1.8 EC (0.003%) recorded lowest (7.66%) leaves infestation of leaf minor and found at par with T<sub>2</sub> Spinosad 45 SC (0.03%) *i.e.* 8.42 per cent leaf infested. The next best effective treatments, T<sub>4</sub> Acetamiprid 20 SP (0.04%), T<sub>3</sub> Imidacloprid 17.8 SL (0.005%), T<sub>1</sub> Dimethoate 30 per cent (0.03%), T<sub>6</sub> *Neem* oil (2%) and T<sub>7</sub> NSKE (5%) with infestation of 9.37 per cent, 10.46 per cent, 13.08 per cent, 14.63 per cent and 15.21 per cent, respectively and these treatments groups were at par with each other. Maximum infestation of leaf minor was noticed in control (water spray) is 24.75 per cent.

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## INTRODUCTION

The citrus leaf minor (CLM), *Phyllocnistis citrella* Stainton (Lepidoptera : Gracillariidae), is an important pest of citrus and related rutaceae and ornamental plants almost worldwide (Achor *et al.*, 1997). The CLM mines leaves, surface tissue of young shoots and stems and less frequently the fruit (Sponagel and Diaz, 1994). Although citrus leaf minor causes indirect damage to young leaves which predisposes them to infection by

canker so, controlling citrus leaf minor is a vital component of canker management (Pena *et al.*, 1996 and Belaue *et al.*, 2005).

The citrus leaf minor (CLM), *Phyllocnistis citrella*, is a small lepidopteron pest of citrus. Damage is caused by the larvae as they mine immature foliage. Twisted and curled leaves are generally the first symptoms in Severe infestations (average of two or more mines per leaf) can retard the growth and yield of nursery and

Sr. No.	Chemical name	Conc. (%)	Trade name	Group	Poison	Waiting period
1.	Dimethoate 30% EC	0.03	Roger	Organophosphate	Contact	5-6 days
2.	Spinosad 45 SC	0.03	Oneup	Spinosyn	Contact and stomach	2 days
3.	Imidacloprid 17.8 SL	0.005	Knight	Neonicotinoids	Systemic	1-3 days
4.	Acetamiprid 20 SP	0.04	Wapkil	Neonicotinoids	Contact and stomach	3 days
5.	Abamectin 1.8 EC	0.003	Dynamec	Botanical	Systemic	1 day
6.	<i>Neem</i> oil	2	Yashneem+	Botanical	Stomach	3-4 days
7.	NSKE	5	Yashneem+	Botanical	Stomach	3-4 days
8.	Control (water spray)	-				

newly planted trees, but their effect on mature trees is less serious. Such infestations usually occur in late summer and autumn and are often related to low natural enemy activity they rarely occur in spring because the production of new growth is prolific and synchronized, and quickly becomes immune to attack. It has about 5-9 generation in a year, with peak period in early summer and early autumn. It has high migration ability from outside of orchards and high fertility. It present in epidermis of citrus leaf and get substantial protection, therefore, it get difficult to direct contract of chemical to the larval body. Commonly used pesticides are not able to manage the infestation of leaf minor in nursery and field. Therefore, it is very important to botanical as well as chemical pesticides against citrus leaf minor. Chemical control of citrus leaf minor have been found effective by many researchers across the globe Boulahia *et al.*, 1996.

## MATERIAL AND METHODS

An experiment of management of citrus leaf minor with chemical and botanical pesticides was carried out in citrus orchards of Horticulture field, SHIATS, Allahabad. Observations on leaf infestation of citrus leaf minor at pre-count before one day, 3 days after spraying (DAS) and 7 DAS of each application in field were worked out for testing the efficacy of all the treatments (Table A).

The data on per cent infestation of citrus leaf minor was calculated by adopting the following formula:

$$\text{Per cent leaves infestation} = \frac{\text{Infected leaves}}{\text{Total leaves}} \times 100$$

The results obtained from field observations was analysed statistically as per Gomez and Gomez (1984)

for RBD and parenthesis of square root transformation. The significance was referred to 'F' tables of Fisher and Yates (1963).

## RESULTS AND DISCUSSION

The result obtained from present investigation are summarized below:

### Per cent infestation of citrus leaf miner after first application :

At 3 DAS Spinosad 45 SC was most significant and recorded lowest (9.77 %) leaf infestation and found at par with Abamectin 1.8 EC, Imidacloprid 17.8 SL, Acetamiprid 20 SP and Diamethoate 30 per cent EC which exhibited 10.65, 11.38, 11.54 and 12.71 per cent leaves infestation of CLM. *Neem* oil was next in order of merit with 13.54 per cent leaves infestation and was at par with NSKE, leaf miner infestation was 14.22 per cent. The highest per cent leaf damage was noticed in control (water spray) *i.e.* 24.46 per cent. While at 7 DAS Spinosad 45 SC and Acetamiprid 20 SP recorded 7.57 and 8.71 per cent leaves infestations seventh days after first spraying, respectively and found at par with each other and these were followed by Imidacloprid 17.8SL (9.77), Abamectin 1.8EC(9.95), Dimethoate 30 per cent EC (11.33), *Neem* oil (14.64) and NSKE (15.86). per cent leaves damage due to leaf miner. Highest per cent leaves infestation 23.6 per cent was observed in control (water spray) (Table 1).

### Per cent infestation of citrus leaf miner after second application :

At 3 DAS amongst all the treatments Abamectin 1.8 EC was most significant and recorded lowest 7.65 per cent leaf infestation and found at par with

Acetamiprid 20 SP(8.49) and Spinosad 45 SC(9.64). Imidacloprid 17.8 SL was next in order of merit with 10.87 per cent leaves infestation and was significantly superior to Dimethoate 30 per cent EC(14.85), *Neem* oil (15.10) and NSKE (14.93) per cent leaves infestation observed. The highest per cent leaf damage was noticed in control (water spray) *i.e.* 25.36 per cent. While at 7 DAS all the treatments were significantly superior over control (water spray) in reducing of per cent leaves infestation of citrus leaf miner at 7<sup>th</sup> days after treatment. Abamectin 1.8 EC (5.74%) found statistically significant

and at par with Spinosad 45 SC (7.27) and Acetamiprid 20 SP(7.62) per cent leaves infestation (Table 2).

### Per cent infestation of citrus leaf miner after third application :

From the data of 3 DAS of third application revealed that Abamectin 1.8 EC was significantly superior over all the treatments which recorded lowest 4.68 per cent of leaf miner infestation. Spinosad 45 SC recorded 7.45 per cent leaves infestation was second in order of merit and found significantly superior to Acetamiprid 20

Table 1: Per cent infestation of citrus leaf miner after first application				
Sr. No.	Treatments	Conc.(%)	(% ) Leaves infestation at	
			3 DAS	7 DAS
1.	Dimethoate 30% EC	0.03	12.71(3.57)	11.33(3.37)
2.	Spinosad 45 SC	0.03	9.77(3.13)	7.57(2.75)
3.	Imidacloprid 17.8 SL	0.005	11.38(3.37)	9.77(3.13)
4.	Acetamiprid 20 SP	0.04	11.54(3.40)	8.71(2.95)
5.	Abamectin 1.8 EC	0.003	10.65(3.26)	9.95(3.15)
6.	<i>Neem</i> oil	2	13.54(3.68)	14.64(3.83)
7.	NSKE	5	14.22(3.77)	15.86(3.98)
8.	Control (water spray)	-	24.46(4.95)	23.67(4.86)
	'F' Test		Sig.	Sig.
	S.E.±		0.07	0.09
	C.D. (P=0.05)		0.22	0.26
	CV (%)		3.5	4.3

Figures in parentheses are corresponding values of square root transformation

Table 2 : Per cent infestation of citrus leaf miner after second application				
Tr. No	Treatments	Conc. (%)	(% ) Leaves infestation at	
			3 DAS	7 DAS
1	Dimethoate 30% EC	0.03	14.85 (3.85)	13.23 (3.64)
2	Spinosad 45 SC	0.03	9.64 (3.10)	7.27 (2.70)
3	Imidacloprid 17.8 SL	0.005	10.87 (3.30)	9.88 (3.14)
4	Acetamiprid 20 SP	0.04	8.49 (2.91)	7.62 (2.76)
5	Abamectin 1.8 EC	0.003	7.65 (2.77)	5.74 (2.40)
6	<i>Neem</i> oil	2	15.10 (3.89)	16.88 (4.11)
7	NSKE	5	14.93 (3.86)	16.42 (4.05)
8	Control (water spray)	-	25.36 (5.18)	26.78 (5.04)
	'F' Test		Sig.	Sig.
	S.E.±		0.08	0.06
	C.D. (P=0.05)		0.24	0.17
	CV (%)		3.9	2.8

Figures in parentheses are corresponding values of square root transformation

**Table 3 : Per cent infestation of citrus leaf miner after third application**

Tr. No	Treatments	Conc. (%)	(% Leaves infestation at	
			3 DAS	7 DAS
1	Dimethoate 30% EC	0.03	13.54(3.68)	13.07(3.62)
2	Spinosad 45 SC	0.03	7.45 (2.73)	6.35(2.52)
3	Imidacloprid 17.8 SL	0.005	11.46 (3.39)	9.44 (3.07)
4	Acetamiprid 20 SP	0.04	10.43 (3.23)	9.11 (3.02)
5	Abamectin 1.8 EC	0.003	4.68 (2.16)	3.84 (1.96)
6	<i>Neem</i> oil	2	14.55 (3.81)	15.86 (3.98)
7	NSKE	5	15.56 (3.94)	15.57 (3.95)
8	Control (water spray)	-	25.01 (5.00)	25.10 (5.01)
	'F' Test		Sig.	Sig.
	S.E.±		0.1020	0.0786
	C.D. (P=0.05)		0.30	0.23
	CV (%)		5.1	4.0

Figures in parentheses are corresponding values of square root transformation

**Table 4 : Cumulative effect of three applications on per cent infestation of citrus leaf miner**

Tr. No	Treatments	Conc. (%)	(% Leaves infestation at	
			3 DAS	7 DAS
1	Dimethoate 30% EC	0.03	13.70 (3.71)	12.46 (3.54)
2	Spinosad 45 SC	0.03	8.95 (2.99)	7.89 (2.66)
3	Imidacloprid 17.8 SL	0.005	11.23 (3.25)	9.7 (3.11)
4	Acetamiprid 20 SP	0.04	10.15 (3.17)	8.60 (2.91)
5	Abamectin 1.8 EC	0.003	7.66 (2.73)	7.67 (2.55)
6	<i>Neem</i> oil	2	14.39(3.76)	14.88 (3.97)
7	NSKE	5	14.90 (3.79)	15.52 (3.99)
8	Control (water spray)	-	24.94 (4.97)	24.56 (5.02)
	'F' Test		Sig.	Sig.
	S.E.±		0.0497	0.0635
	C.D. (P=0.05)		0.30	0.23
	CV (%)		5.1	4.0

Figures in parentheses are corresponding values of square root transformation

**Table 5 : Overall cumulative effect of three spraying on per cent infestation of citrus leaf miner**

Tr. No.	Treatments	Conc. (%)	(%) Mean leaves infestation
1	Dimethoate 30% EC	0.03	13.08 (3.63)
2	Spinosad 45 SC	0.03	8.42 (2.83)
3	Imidacloprid 17.8 SL	0.005	10.46 (3.18)
4	Acetamiprid 20 SP	0.04	9.37 (3.05)
5	Abamectin 1.8 EC	0.003	7.66 (2.64)
6	<i>Neem</i> oil	2	14.63 (3.87)
7	NSKE	5	15.21 (3.89)
8	Control (water spray)	-	24.75(4.99)
	'F' Test		Sig.
	S.E.±		0.03
	C.D. (P=0.05)		0.09
	CV(%)		1.6

Figures in parentheses are corresponding values of square root transformation

SP (10.43%), Imidacloprid 17.8 SL (11.46%), Dimethoate 30 per cent EC (13.54%) *Neem* oil (14.55%) and NSKE (15.56%) leaves infestation of citrus leaf miner. Highest per cent leaves infestation *i.e.* 25.01 per cent was noticed in control (water spray). At 7 DAS amongst all the different treatments Abamectin 1.8 EC (3.84%) was highly significant which recorded lowest per cent leaves infestation. From the remaining treatments, Spinosad 45 SC (6.35%) was best in minimum leaves infestation of citrus leaf miner and found significantly superior to Acetamiprid 20 SP (9.11%) and Imidacloprid 17.8 SL (9.44%). Dimethoate 30% EC (13.07%) NSKE (15.57%) and *Neem* oil (15.86%) (Table 3).

### Cumulative effect of three applications on per cent infestation of citrus leaf miner in field :

From the cumulative data of third day after spraying of all three applications revealed that Abamectin 1.8 EC (7.66%) was significantly superior over all the treatments and found at par with Spinosad 45 SC which recorded (8.95%) per cent of leaf miner infestation (Table 4). At 7 DAS Treatment Abamectin 1.8 EC observed (7.67%) leaves infestation and was most significant over all the treatments, like to 3 DAS. Same kind of result was obtained in treatment Spinosad 45 SC as it was second in order of merit recording 7.89 per cent leaves infestation and found significantly superior to Acetamiprid 20 SP (8.60%), Imidacloprid 17.8 SL (9.70%), Dimethoate 30 per cent EC (12.46%), *Neem* oil (14.88) and NSKE (15.52%) leaves infestation recorded. Significantly highest per cent leaves infestation *i.e.* 24.56 per cent was noticed in control (water spray).

### Overall cumulative effect of three applications on per cent infestation of citrus leaf miner :

The data presented in Table 5 indicated that all the treatments were significantly superior over control. The minimum per cent leaves infestation was observed in the treatment Abamectin 1.8 EC *i.e.* 7.66 per cent and found significantly superior over others. The next best treatment was Spinosad 45 SC (8.42%) infestation of leaf miner and was significantly superior to Acetamiprid 20 SP (9.37%) and Imidacloprid 17.8 SL (10.46%), Dimethoate 30 per cent EC (13.08%) of leaf miner infestation and these were at par with each other. Third effective group of treatments *viz.*, *Neem* oil (14.63%) and NSKE (15.21%) leaves infestation recorded. The highest infestation was noticed in treatment control

(water spray) *i.e.* 24.75 per cent. In present study Abamectin, Spinosad and Acetamiprid showed the minimum per cent leaves infestation. Similar findings were also reported by Perovic *et al.* (2006) and Rao *et al.* (2008).

The present study confirmed the efficacy of certain chemical and botanical pesticides against major pest of citrus in India. As the time passes more and more new products are being introduced to the market which need close monitoring and evaluation. Based on present finding it could be suggested that Abamectin 1.8 EC @ 0.0003 per cent and spinosad 45 SC @ 0.03 per cent should be listed in the spray schedule for the control of citrus leaf miner.

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