Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

J E Z S Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(1): 1541-1546

Received: 26-11-2018
Accepted: 30-12-2018

SK Fashi Alam
Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India

Biswajit Patra
Department of Agricultural Entomology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, India

Arunava Samanta
Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India

Correspondence
Biswajit Patra
Department of Agricultural Entomology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, India

Evaluation of some new insecticide mixtures for management of litchi fruit borer

SK Fashi Alam, Biswajit Patra and Arunava Samanta

Abstract
Litchi fruit borer is a serious threat of litchi production causing significant economic losses. Insecticides are the first choice to the farmers to manage this serious pest of litchi. Therefore, field experiments were conducted to evaluate some new mixture formulation of insecticides against litchi fruit borer during 2013 and 2014. The experiments were conducted at the Horticultural Farm of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal, India in litchi orchard (cv. Bombai). Results of the experiments revealed that all the treatments were significantly superior over control. Chlorantraniliprole 9.3% +lambda cyhalothrin 4.6 % 150 ZC @ 35 g a.i./ha provided the best result both in terms of minimum fruit infestation (12.12 %) and maximum yield (95.92 kg/plant in weight basis and 4316.5 fruit/plant in number basis) followed by the treatment chlorantraniliprole10% +thiamethoxam 20% 300 SC @150 g a.i./ha (13.10% mean fruit infestation). Amongst the various treatments, thiamethoxam 25WG was the least effective as this treatment recorded the highest fruit infestation (22.88 % mean fruit infestation) and thereby lowest yield (78.16 kg/plant in weight basis and 3517 fruit/ plant in number basis).

Keywords: litchi fruit borer, chlorantraniliprole, lambda cyhalothrin, thiamethoxam

Introduction
Litchi (*Litchi chinensis* Sonn) is a scrumptious and mouth-watering subtropical fruit crop which is popular for its flavoured juicy aril. This fruit is famous for its unique taste, pleasant flavour and attractive appearance. In addition to these, litchi is a highly nutritious fruit which is rich in sugar and Vitamin C. The flavoured juicy aril part of the fruit is consumed. Apart from this direct consumption, litchi is also used to prepare various value added products. Because of these various uses, this fruit rules the domestic market as "Queen of fruits" during the season. Moreover, this fruit has also a good demand in different foreign countries. Hence, it has high export potential too.

It is said that the centre of origin of this fruit is in China and from there it was introduced to Burma and India by the end of the 17th century [1, 2]. China is the largest producer of litchi in the world and India ranks second in the world after China in litchi production, both in terms of quality and yield. Over the years, the area under this crop has increased in India. Horticultural Statistics of the Government of India reveals the area under this crop was only 49.3 thousand hectare in 1991-92 whereas in 2015-16 the area under this crop has increased to 90.1 thousand hectare [3]. So it is evident that cultivation of this crop is gaining momentum in several states of India. It may be due to its high demand and high economic return. But the fact is that although the area under this crop has increased but the trend of productivity over the years is not consistent.

Several factors are responsible for this inconsistent trend of productivity. Among various factors, infestation of insect pests is a major constraint in successful and profitable cultivation of this fruit crop. Litchi is infested by various pests round the year. About eleven major and minor pests have been reported in litchi [4]. Among the various insect pests, *Conopomorpha cramerella* Snellen (Gracillariidae: Lepidoptera) is a serious threat of litchi production causing significant economic losses [5-8]. Bhatia *et al.* (2000) [7] reported this pest is the most important factor for the lower yield of litchi.

Larvae usually damage the newly emerged shoots and after fruit formation it infests the fruit also. It has been found that the infestation of this pest varied from 13.6 to 64.9% in Himachal Pradesh and 24-32% infestation in Bihar condition showing the needs for systematic management of this pest. In West Bengal, *Conopomorpha cramerella* Snellen has been found

to cause severe damage to both immature and ripen litchi fruits. It punctures the peduncle of fruits resulting early fruit drop. Not only the fruits but also tender leaves and newly emerged young shoots are also severely damaged by this pest [9]. Chakraborty and Samanta (2005) [10] reported that in West Bengal the incidence of litchi fruit borer, *Conopomorpha cramerella* Snellen was up to 55 per cent. In Uttar Pradesh and Bihar, this is one of the major pests of litchi causing severe economic losses to the farmers [11].

So, proper management of this pest is vital to the farmers for profitable cultivation of this crop. Although concepts like Integrated Pest Management, transgenic plants etc. are getting popularized day by day to protect the environment from various hazards, but still insecticide is the first choice among the farmers especially when the infestation is severe. But the problem is that injudicious use and heavy reliance on insecticides has posed several adverse effects such as development of insecticide resistance, outbreak of secondary pests, harmful effects on beneficial organisms and problem of pesticide residue. Hence, appropriate use of insecticides and the use of insecticides having a selective mode of action are recommended for insect pest management.

Therefore, considering all these important issues, an effort was made to evaluate the bio-efficacy of new insecticides mixtures along with conventional insecticides against litchi fruit borer to develop a suitable management strategy under West Bengal condition.

Materials and Methods

The experimental works were conducted at the Horticultural Farm of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal, India in litchi orchard (cv. Bombay) on selected uniform plants (10-15 years old, spaced 10 m apart). The field experimental site is situated under Gangetic Alluvial plains of West Bengal.

The experiment was laid out in a Randomized Block Design (RBD) with 11 treatments including control. Each treatment was replicated thrice. Following insecticides were used for the present study: chlorantraniliprole 9.3% +lamda cyhalothrin 4.6 % 150 ZC @ 21, 28 and 35 g a.i/ha (®Ampligo, Syngenta India Ltd.), chlorantraniliprole10% +thiamethoxam 20% 300 SC @ 105,128 and 150 g a.i/ha (®Durivo, Syngenta India Ltd.), chlorantraniliprole 18.5% SC @30 g a.i/ha, (®Coragen, E.I. DuPont India Pvt. Ltd), lamda cyhalothrin 4.9 CS @15 g a.i/ha, (®Matador, Syngenta India Ltd.), thiamethoxam 25WG @100 g a.i/ha (®Actara, Syngenta India Ltd.), quinalphos 25 EC @500 g a.i/ha (®Ekalux, Sandoz India Ltd.). All the recommended agronomical and cultural practices were followed in the experimental orchard.

The total quantity of each sole formulation or mixed formulation of insecticide required for spraying the replicated plots in the experiment was calculated on the basis of the active ingredient of their commercial product. The calculated amount of pesticides for each replicated plots was diluted with water and these were sprayed separately with the help of foot sprayer. Spraying was done on the outer as well as inner canopy in all the direction of the tree.

In each season the first spray was given at colour formation stage of the fruit and second spray was given 15 days after 1st spraying. Hundred fruits were taken randomly from different branches of each tree and the number of healthy and infested fruits was recorded at 7 days and 14 days after each spraying. The data were subjected to a necessary transformation wherever needed.

Results and Discussion

It was observed from the experiment that all the treatments were superior as compared to control and significantly reduced the infestation of litchi shoot and fruit borer. During 2013, the least infestation of the pest (16.18%) and the highest yield (93.62 kg/plant) were observed (Table-1) in chlorantraniliprole 9.3% +lambda cyhalothrin 4.6 % 150 ZC @ 35 g a.i./ha treated plants followed by the treatment chlorantraniliprole10% +thiamethoxam 20% 300 SC @ 150 g a.i./ha (17.01% infestation). Thiamethoxam 25WG was least effective during 2013 resulting maximum fruit infestation (25.8%).

A similar trend of efficacy was also observed (Table-2) during 2014. Chlorantraniliprole 9.3% +lambda cyhalothrin 4.6 % 150 ZC @ 35 g a.i./ha was the best treatment resulting minimum fruit infestation (8.06 %) followed by chlorantraniliprole10% +thiamethoxam 20% 300 SC @ 150 g a.i./ha (9.20%). Again, thiamethoxam 25WG was the least effective among all the treatments resulting maximum fruit infestation (19.96 %).

Cumulative effect of various treatments against litchi fruit borer and fruit yield based on two applications during each season showed (Table-3) that all the treatments were significantly more effective than the untreated control. Based on the overall effect of different treatments it was observed that chlorantraniliprole 9.3% +lambda cyhalothrin 4.6 % 150 ZC @ 35 g a.i./ha provided the best result both in terms of minimum fruit infestation (12.12 %) and maximum yield (95.92 kg/plant in weight basis and 4316.5 fruit/plant in number basis) followed by the treatment chlorantraniliprole10% +thiamethoxam 20% 300 SC @150 g a.i./ha. Amongst the various treatments, thiamethoxam 25WG was the least effective as this treatment recorded the lowest yield (78.16 kg/plant in weight basis and 3517 fruit/ plant in number basis) and the highest fruit infestation (22.88 % mean fruit infestation). It was also observed during the experimentation that with the increasing dosage of the mixture formulation of insecticides, the per cent fruit infestation decreased and as a result the fruit yield increased. None of the individual formulation of the treatments recorded above 81kg/plant fruit yield whereas each of the mixture formulation treatment brought more than 81kg/plant fruit yield. So it could be said that the efficacy of the mixture formulation insecticides was better instead of applying the individual formulation. This may be due to the different mode of action of the mixture formulation of insecticidal treatments as compared to a single mode of action in individual treatment and thereby better efficacy.

In the present investigation chlorantraniliprole 9.3% +lambda cyhalothrin 4.6% 150 ZC @ 35 g a.i./ha was found to be very much effective treatment followed by chlorantraniliprole10% +thiamethoxam 20% 300 SC @150 g a.i./ha against litchi fruit borers during both the seasons. The information regarding bio-efficacy of these mixed formulations against litchi fruit borers is very scanty. Hence, the present results may be compared with related works based on the efficacies of individual insecticide against other lepidopteran pests. Baskaran *et al*. (2012) [12] reported that chlorantraniliprole 9.6 + lamdacyhalothrin 4.6% at different doses were effective in reducing the population of bollworm complex of cotton. Lamda-cyhalothrin both in combination with

chlorantraniliprole and sole application proved its effectiveness against litchi fruit borer in the present investigation. Present results are in line of Ngim *et al.* (1992) [13] who reported that lambda-cyhalothrin was effective for the control of the gracillariid, *Conopomorpha cramerella* on cocoa in Malaysia. In the present experiment, quinalphos 25 EC @ 500 g a.i/ha treated plant showed 22.53% fruit infestation. This performance of quinalphos 25 EC is not satisfactory as compared to the other treatments in the experiment. But Singh and Sharma (2010) [14] reported different result. They showed that quinalphos was the most effective in controlling fruit borer, *Acrocercops cramerella* Snell on litchi in Sirmour district of Himachal Pradesh whereas Singh (1975) [15] reported that 100% mortality of litchi fruit borer was observed 24 hours after the application of quinalphos. This may be due to the different agro-climatic situations where experiments were conducted or other factors may be attributed to this good result of quinalphos at their experiment. Moreover, susceptibility status of two different population of this pest may differ against quinalphos. Thiamethoxam was less effective insecticide as compared to other treatments against litchi fruit borer in our present experiment. On the contrary, Sahoo *et al*. (2010) [16] reported moderate efficacy of thiamethoxam against litchi fruit borer.

So, it can be concluded from the present experiment that chlorantraniliprole 9.3% +lambda cyhalothrin 4.6 % 150 ZC @ 35 g a.i./ha was the best treatment both in terms of minimum fruit infestation and maximum yield. So, this mixture formulation of insecticide may be used to manage litchi fruit borer but before that the impact of this mixture formulation on natural enemies and residue on fruits need to be considered. Moreover, it will also be prudent to conduct efficacy trials at different agro-climatic zones and generate the data before using it for management of this serious pest of litchi.

Acknowledgement

The authors are grateful to the Head of the Department, Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur for providing necessary facilities to conduct these experiments during Ph D research work.

Table 1: Efficacy of insecticides against litchi fruit borer (*Conopomorpha cramerella* Snellen) during April- June, 2013 at Gayespur, Nadia, West Bengal.

Treatments	Dose g a.i. /ha	% fruit infested of litchi fruit borer on various days after application (DAA)							Over all Mean % fruit infested of litchi fruit borer	Yield (number basis /plant) at mature stage	Yield (kg/plant) at mature stage
		Pre-Treatment Count	7 Days after1st spraying	14 days after 1st spraying	Mean of 1st spray	7 Days after 2nd spraying	14 days after 2nd spraying	Mean of 2nd spray			
Chlorantraniliprole 9.3% + Lambda cyhalothrin 4.6 % 150 ZC	21	29.20	26.14 (30.75)	25.46 (30.30)	25.80 (30.53)	22.33 (28.20)	20.02 (26.58)	21.18 (27.39)	23.49 (28.96)	3840	85.33
Chlorantraniliprole 9.3% + Lambda cyhalothrin 4.6 % 150 ZC	28	30.67	23.67 (29.11)	23.05 (28.69)	23.36 (28.90)	20.13 (26.66)	18.00 (25.10)	19.07 (25.88)	21.21 (27.39)	3920	87.11
Chlorantraniliprole 9.3% + Lambda cyhalothrin 4.6 % 150 ZC	35	29.89	21.00 (27.27)	18.12 (25.19)	19.56 (26.23)	15.46 (23.15)	10.12 (18.55)	12.79 (20.85)	16.18 (23.54)	4213	93.62
Chlorantraniliprole10% +Thiamethoxam20% 300 SC	105	30.21	26.35 (30.89)	25.31 (30.20)	25.83 (30.55)	23.66 (29.11)	21.01 (27.28)	22.34 (28.19)	24.08 (29.37)	3774	83.87
Chlorantraniliprole10% +Thiamethoxam20% 300 SC	128	29.77	24.46 (29.64)	24.00 (29.33)	24.23 (29.49)	21.45 (27.59)	17.32 (24.59)	19.39 (26.09)	21.81 (27.79)	3901	86.69
Chlorantraniliprole10% +Thiamethoxam20% 300 SC	150	31.50	22.12 (28.06)	18.46 (25.45)	20.29 (26.75)	18.45 (25.44)	9.00 (17.46)	13.73 (21.45)	17.01 (24.10)	4012	89.16
Chlorantraniliprole 18.5% SC	30	30.32	26.96 (31.28)	26.00 (30.66)	26.48 (30.97)	23.61 (29.07)	21.41 (27.56)	22.51 (28.32)	24.50 (29.64)	3715	82.56
Lambda cyhalothrin 4.9 CS	15	30.18	26.66 (31.09)	25.67 (30.44)	26.17 (30.76)	23.00 (28.66)	20.54 (26.95)	21.77 (27.80)	23.97 (29.28)	3832	85.16
Thiamethoxam 25WG	100	31.11	27.96 (31.92)	27.00 (31.31)	27.48 (31.61)	25.13 (30.09)	23.12 (28.74)	24.13 (29.41)	25.80 (30.51)	3623	80.51
Quinalphos 25 EC	500	30.24	27.45 (31.60)	26.46 (30.96)	26.96 (31.28)	25.01 (30.01)	23.00 (28.66)	24.01 (29.33)	25.48 (30.30)	3696	82.13
Untreated Control (Water spray)		29.95	36.25 (37.02)	38.32 (38.25)	37.29 (37.63)	44.33 (41.74)	47.16 (43.37)	45.75 (42.56)	41.52 (40.10)	2760	61.33
SEm (±)		N.S	0.62	0.45	0.54	0.50	0.60	0.55	0.55	1.20	0.80
C.D. at 5%		N.S	1.82	1.33	1.58	1.48	1.76	1.62	1.60	3.55	2.37

N.B.:
NS- Non significant,
Figures in parentheses are angular transformed values.

Table 2: Efficacy of insecticides against litchi fruit borer (*Conopomorpha cramerella* Snellen) during April- June, 2014 at Gayespur.

Treatments	Dose g a.i. /ha	% fruit infested on various days after application (DAA)							Over all Mean % fruit infested of litchi fruit borer	Yield (number basis /plant) at mature stage	Yield (kg/plant) at mature stage
		Pre-Treatment Count	7 Days after1st spraying	14 days after 1st spraying	Mean of 1st spray	7 Days after 2nd spraying	14 days after 2nd spraying	Mean of 2nd spray			
Chlorantraniliprole 9.3% +Lambda cyhalothrin 4.6 % 150 ZC	21	26.32	22.12 (28.06)	20.04 (26.59)	21.08 (27.32)	16.32 (23.83)	15.45 (23.15)	15.89 (23.49)	15.89 (23.49)	3812	84.71
Chlorantraniliprole 9.3% +Lambda cyhalothrin 4.6 % 150 ZC	28	27.11	20.78 (27.12)	18.18 (25.24)	19.48 (26.18)	15.46 (23.15)	15.00 (22.79)	15.23 (22.97)	15.23 (22.97)	3922	87.16
Chlorantraniliprole 9.3% +Lambda cyhalothrin 4.6 % 150 ZC	35	26.86	18.42 (25.42)	12.45 (20.66)	15.44 (23.04)	10.12 (18.55)	6.00 (14.18)	8.06 (16.36)	8.06 (16.36)	4420	98.22
Chlorantraniliprole10% +Thiamethoxam20% 300 SC	105	26.56	21.71 (27.77)	20.51 (26.93)	21.11 (27.35)	17.45 (24.69)	16.17 (23.71)	16.81 (24.20)	16.81 (24.20)	3619	80.42

Chlorantraniliprole10% +Thiamethoxam20% 300 SC	128	27.21	20.24 (26.74)	19.21 (25.99)	19.73 (26.37)	16.72 (24.14)	15.12 (22.88)	15.92 (23.51)	15.92 (23.51)	3775	83.89
Chlorantraniliprole10% +Thiamethoxam20% 300 SC	150	27.35	18.11 (25.19)	15.25 (22.99)	16.68 (24.09)	11.14 (19.50)	7.25 (15.62)	9.20 (17.56)	9.20 (17.56)	4321	96.02
Chlorantraniliprole 18.5% SC	30	26.83	22.01 (27.98)	19.96 (26.54)	20.99 (27.26)	17.95 (25.07)	16.46 (23.94)	17.21 (24.50)	17.21 (24.50)	3551	78.91
Lambda cyhalothrin 4.9 CS	15	27.10	21.74 (27.79)	19.05 (25.88)	20.40 (26.84)	17.46 (24.70)	17.00 (24.35)	17.23 (24.52)	17.23 (24.52)	3547	78.82
Thiamethoxam 25WG	100	27.13	23.21 (28.80)	22.14 (28.07)	22.68 (28.43)	20.17 (26.69)	19.75 (26.39)	19.96 (26.54)	19.96 (26.54)	3411	75.80
Quinalphos 25 EC	500	26.25	22.17 (28.09)	22.04 (28.00)	22.11 (28.04)	20.00 (26.57)	19.14 (25.94)	19.57 (26.25)	19.57 (26.25)	3517	78.16
Untreated Control (Water spray)		27.35	34.21 (35.80)	37.32 (37.65)	35.77 (36.73)	41.57 (40.15)	46.91 (43.23)	44.24 (41.69)	44.24 (41.69)	2835	63.00
SEm (±)		N.S	0.47	0.49	0.48	0.56	0.51	0.53	0.51	1.08	0.80
C.D. at 5%		N.S	1.37	1.45	1.41	1.64	1.51	1.58	1.50	3.19	2.35

N.B.:
NS- Non significant,
Figures in parentheses are angular transformed values.

Table 3: Efficacy of insecticides against litchi fruit borer (*Conopomorpha cramerella Snellen*) during April- June, 2013-2014 (Two seasons) at Gayespur, Kalyani BCKV, Nadia, West Bengal

Treatments	**Dose g a.i. /ha**	**Over all Mean % fruit infested of litchi fruit borer**	**Yield (number basis /plant) at mature stage**	**Yield (kg/plant) at mature stage**
Chlorantraniliprole 9.3% +Lambda cyhalothrin 4.6 % 150 ZC	21	19.69 (26.22)	3826	85.02
Chlorantraniliprole 9.3% +Lambda cyhalothrin 4.6 % 150 ZC	28	18.22 (25.18)	3921	87.14
Chlorantraniliprole 9.3% +Lambda cyhalothrin 4.6 % 150 ZC	35	12.12 (19.95)	4316.5	95.92
Chlorantraniliprole10% +Thiamethoxam20% 300 SC	105	20.45 (26.79)	3696.5	82.15
Chlorantraniliprole10% +Thiamethoxam20% 300 SC	128	18.86 (25.65)	3838	85.29
Chlorantraniliprole10% +Thiamethoxam20% 300 SC	150	13.10 (20.83)	4166.5	92.59
Chlorantraniliprole 18.5% SC	30	20.85 (27.07)	3633	80.74
Lambda cyhalothrin 4.9 CS	15	20.60 (26.90)	3689.5	81.99
Thiamethoxam 25WG	100	22.88 (28.52)	3517	78.16
Quinalphos 25 EC	500	22.53 (28.28)	3606.5	80.15
Untreated Control (Water spray)		42.88 (40.89)	2797.5	62.17
SEm (±)		0.53	1.14	0.80
C.D. at 5%		1.55	3.37	2.36

N.B.: Figures in parentheses are angular transformed values.

References

1. Goto YB. Lychee (litchi) and its processing, Pacific Rim Food conf. 1960; 1:15-23.
2. Liang J. Thi litchi: A historical review of origin, utilization and development of its culture. J d Agriculture traditionnelle et de Botanique Applique. 1981; 28(3, 4):259-270.
3. Anonymous. Horticultural Statistics at a Glance 2017. Horticulture Statistics Division Department of Agriculture, Cooperation and Farmers Welfare, Ministry of griculture and Farmers Welfare Government of India. 2009, 147. http://nhb.gov.in/PDFViwer.aspx?enc=3ZOO8K5CzcdC/Yq6HcdIxC0U1kZZenFuNVXacDLxz28=
4. Hameed SF, Singh PP, Singh SP. Pest in litchi: Botany, Production and Utilisation (Ed. Chauhan K S), Kalyani Publishers, Ludhiana, India, 2001, 194-208.
5. Zhang JY, LI X, Jiang C, Meng F, MA L, WU SR. Influences of temperature and nutrition on the development and longevity of *Sympiesis soriceicornis* and *Apanteles theivorae*. J. Northwest A&F Univ., (Nat. Sci. Ed.). 2011; 39(6):154-160.
6. Sharma DD, Agrawal ML. Studies on the biology and immature stages of litchi fruit borer *Conopomorpha cramerella* (Snellen) (Lepidoptera: Gracillariidae). J. Res. Rajendra Agril. Univ.1988; 6(1, 2):84-87.
7. Bhatia R, Sharma R, Agnihotri RP. Field evaluation of insecticides for the control of litchi fruit borer *Conopomorpha cramerella* (Lepidoptera: Gracillariidae) on litchi (*Litchi chinensis*) in Himachal Pradesh. Indian J. agric. Set. 2000; 70(5):301-304.
8. Sharma DD. Major pests of litchi in Bihar. Indian Farming. 1985; 35(2):25-26.
9. Nair N, Sahoo AK. Incidence of *Conopomorpha cramerella* Snellen (Gracillariidae: Lepidoptera): A serious pest of litchi fruits control in West Bengal. Environment and Ecology. 2006; 24S(3A):772-775.
10. Chakraborty Kalyan, Samanta Arunava. Evaluation of litchi germplasms based on biochemical parameters along with incidence of leaf roller (*Platypepla aprobola* Meyer.) and fruit borer (*Conopomorpha cramerella* Snellen). Annals of Plant Protection Sciences. 2005; 13(2):338-342.
11. Lall BS, Sharma DD. Studies on the Bionomics and control of the Cacao moth *(Acrocercops cramerella* Sn. Gracillariidae: Lepidoptera) Academy of Sciences. 1976, 22.
12. Baskaran RKM, Rajavel DS, Suresh K, Jayaraj J, Palanisamy N. Evaluation of bioefficacy of alike 22.1 ZC (thiamethoxam 12.6%+ Lamdacyhalothrin 9.5%) against pest complex in groundnut, Pestology. 2012; XXXVI(6).
13. Ngim CK, Ho SH, Ooi PAC. (ed.), Lim GS (ed.), Teng, PS. Control of the cocoa pod borer (*Conopomorpha cramerella*) with lamda cyhalothrin. Proceedings of the 3rd international conference on plant protection in the tropics, Genting Highlands Malaysia. 1990; 2:82-89.
14. Singh R, Sharma M. Varietal reaction and chemical control of litchi fruit borer, *Acrocercops cramerella* Snell in Himachal Pradesh, Journal-of-Insect-Science-Ludhiana. 2010; 23(2):180-183.
15. Singh H. *Acrocereops cramerella* Sncll. (Gracillariidae: Lepidoptera) as a pest of litchi in Uttar Pradesh and its control. Indian J. Hort. 1975; 32(3, 4):152-153.
16. Sahoo AK, Anusmriti Roy, Ray SK. Comparative efficacy of insecticides and neem formulations against Litchi fruit borer, *Conopomorpha cramerella* Snellen (Gracillariidae: Lepidoptera), The-Journal-of-Plant-Protection-Sciences. 2010; 2(2):92-94.