Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(2): 1403-1406

Received: 12-01-2020
Accepted: 14-02-2020

Arun Kumar
Department of Entomology, Sardar Vallabhbhai Patel University of Agricultural and Technology, Meerut, Uttar Pradesh, India

Rajendra Singh
Department of Entomology, Sardar Vallabhbhai Patel University of Agricultural and Technology, Meerut, Uttar Pradesh, India

Sucharu Singh
Department of Entomology, Sardar Vallabhbhai Patel University of Agricultural and Technology, Meerut, Uttar Pradesh, India

Sushant kumar
Department of Entomology, Sardar Vallabhbhai Patel University of Agricultural and Technology, Meerut, Uttar Pradesh, India

Deepak Singh Pal
Department of Entomology. Chandra Shekhar Azad University of Agricultural and Technology, Kanpur, Uttar Pradesh, India

Corresponding Author:
Arun Kumar
Department of Entomology, Sardar Vallabhbhai Patel University of Agricultural and Technology, Meerut, Uttar Pradesh, India

Evaluation of different newer insecticides against mango hopper (*Amritodus atkinsoni* L.)

Arun Kumar, Rajendra Singh, Sucharu Singh, Sushant kumar and Deepak Singh Pal

Abstract
A field trials were conducted carried out at the HRC, Siwaya farm of Sardar Vallabhbhai Patel University of Agricultural and Technology, Meerut U.P., India during 2018-19 to manage the mango hopper, *Amaritodus atkinsoni* L, using chemical and bio insecticides. These was used of different treatments Dinutefuran 50% WP@ 0.005 > imidacloprid 17.8 SL @ 0.005% > dimethoate 30 EC @ 0.005% > thiamethoxam 50 WG @ 0.01% > neemal oil @ 1500 PPM > NSKE @ 5% > *Metarhizium anisopliae* $1x10^8$ cfu/ml > *B. bassiana* $1.0X10^8$ cfu/ml. Dinutefuran proved most effective as 4.59 per cent mortality was recorded in it and it was statically superior over all the other treatments as well as untreated control and second Imidacloprid was also effective in suppressing *Amritotus atkinsoni*.

Keywords: Temperature, treatments, panicle, effectiveness, mortality, suppressing

Introduction
Mango is a "National fruit of India" because of delicious taste, besides delicious taste, excellent flavour and attractive fragrance. A 100 g serving of raw mango has 65 calories and about half the vitamin C found in oranges. Mangoes are thought to help stop bleeding, to strengthen the heart and to benefit the brain. Fresh mangoes and mango pulp are the important items of argil-exports. The mango kernel contains 8-10 per cent good quality fat, which can be used for soap and also as a substitute for cola in confectionery. The mango is also used to make the processed products like candy, relishes, pickles, beverages and many more. Insect pest problems are increasing fast because of rapid change in the agro-ecosystems, advancement of modern agricultural practices. More than 400 insect pests have been listed attacking this king fruit (Srivastava, 2000) [10]. Out of these, about two dozen insect pests severely damage different parts of mango tree. The major pests of mango are leaf hoppers, *Idioscopus clypealis*, *I. nitidulus*, *Amritodus atkinsoni*; mango mealybug, *Drosicha mangiferae*; gall midge, *Erosomia indica*, *Dasyneura amaramanjarae*, *Procistiphora indica*; stone weevil, *Sternochetus mangiferae*; leaf webber, *Orthaga euadrusalis*; fruit fly, *Bactrocera* spp., mango stem borer, *Batocera* spp., termites, *Odontotermes* spp.; shoot borer, *Chlumetia transversa*; bark eating caterpillar, *Indarbela quadrinotata* and scale insect, *Pulvinaria poligonata.*, (Srivastava, 1997) [9]. Among the mango pests, mango hoppers are most serious and widespread pests throughout the country (Verghese, 2000) [11]. *Amritodus atkinsoni* (Lethierry), *Idioscopus clypealis* (Lethierry) *I. niveosparsus* (Lethierry) and *I. nitidulus* (Walker), are serious pests of mango at flowering and fruiting stages and could cause yield loss up to 100% (Rahman *et al*., 2007) [5].

Methods and materials
To evaluate the bio-efficacy of newer insecticides and bio pesticides against mango hoppers, field trials was be conduct during May 2018 to April 2019 at the Horticultural Research Centre Sardar Vallabhabhai Patel University of Agriculture & Tech., Meerut (U.P.) with Nine treatments, replicated thrice in Randomized Block Design. Nine tree of mango (Var. Dashehari) were be randomly selected and tagged, the insecticidal treatments would be applied with the help of rocker sprayer before bud burst stage on the these tree when the pest population reaches between 5-10 hoppers/twig/panicle. The pre and post treatment observations would be recorded before twentyfour hour and after 1DBS, 7DAS, 14DAS and 21DAS days of insecticide spray,

respectively. The hopper population was recorded on randomly selected and tagged twelve/panicle *i.e.* three panicle in each direction (North, South, East, and West) per branch in each tree. The sample size of each panicle/were of about ten to twelve cm. The pretreatment hopper counts along with the post treatment population reduction were transformed and subjected to statistical analysis for result interpretation. The fruit yield was also recorded from each treatment.

Table 1: Details of the treatments used in the insecticide trial

Treat.	Chemical Name	Conc.	Trade name	Doses/Lit of water	No. of application & method
T1	Imidacloprid 17.8 SL	0.005	Coro-imida	0.4 ml/Lit	2 &Foliar spray
T_2	Dinutefuran 50% WP	0.005	xtrim	0.2 ml/Lit	2 &Foliar spray
T_3	Thiamethoxam 50 WG	0.01	Savor	0.1 ml/Lit	2 &Foliar spray
T_4	Dimethoate 30 EC	0.005	Herogor	1.6 ml/Lit	2 &Foliar spray
T_5	*Metarhizium anisopliae* $1x10^8$ cfu/ml	0.004	Ballabhbhai	2 gm/Lit	2 &Foliar spray
T_6	*Baeuberia bassiana* $1x10^8$ cfu/ml	0.004	Ballabhbhai	2 gm/Lit	2 &Foliar spray
T_7	Neemal 1500	1500 ppm	Neemal	10 ml/Lit	2 &Foliar spray
T_8	NSKE 5%	----		50 g/Lit	2 &Foliar spray
T_9	Untreated				----------

The data obtained from the field experiments were subjected to ANOVA analysis, Standard Error of mean, and Critical difference (CD). The fruit yield per tree was recorded and converted into hectare basis at each harvest and data were subjected to statistical analysis.

Results and discussion

The efficacy of different insecticides against mango leaf hopper *Amritodus atkinsini* was observed separately on the tree panicles. The data regarding the effectiveness of various treatments at different intervals are described below in detail:

A. First applications

The effect of different insecticides/biopesticides treatment on the mortality of mango leaf hopper *Amritodus atkinsini* in mango crop is presented in (Table 2), the results revealed that all the treatments were significantly effective in controlling mango leaf hopper as compared to control. The mortality ranged from 2.81 to 12.30 during in the year 2018-19 before the spray of treatments, it did not differ significantly to each other.

Data recorded on 3rdday after the application of various treatments (Table 2). Dinutefuran 50% WP@ 0.2 ml/L was the best treatment by bringing down the mortality of mango mango leaf hopper up to 2.81 during 2018-19 years. The other treatments in order of per cent mortality was Imidacloprid 17.8 SL @ 0.4ml/L (3.48) followed by dimethoate 30 EC @ 1.6 ml/L (4.92) thiamethoxam 50 WG @ 0.1 ml/L (5.46) neemal oil 1500 ppm 3 ler pf water (7.37), NSKE @ 5% (8.54), *Metarhizium anisopliae* $1x10^8$ cfu/ml (11.18) and *Beauveria bassiana* @ 1 X 10^9 cfu/ml (12.30) during in the year 2018-19 respectively.

Similar trend was recorded on 7th day of application. Dinutefuran 50% WP again was the most effective treatment (3.03 mortality). The second most effective treatment was Imidacloprid

Table 2: Efficacy of newer insecticides against Mango hopper *A. atkinsoni* after first spray during 2018-19

S. No.	Treatment	Conc. %	Doses/Lit of water	Mean population of mango hopper/ 5 panicle				
				First spray				
				Pre-Count	3 DAS	7 DAS	14 DAS	21 DAS
1	T_1 Imidacloprid 17.8 SL	0.005	0.4 ml/Lit	24.55 (29.69)	3.48 (10.74)	4.17 (11.78)	5.35 (13.36)	6.64 (14.92)
2	T_2 Dinutefuran 50% WP	0.005	0.2 ml/Lit	25.51 (30.32)	2.81 (9.61)	3.03 (9.99)	4.02 (11.52)	5.59 (13.63)
3	T_3 Thiamethoxam 50 WG	0.01	0.1 ml/Lit	25.62 (30.39)	5.46 (13.50)	6.98 (15.27)	7.78 (16.19)	8.11 (16.53)
4	T_4 Dimethoate 30 EC	0.005	1.6 ml/Lit	25.72 (30.46)	4.92 (12.80)	5.58 (13.66)	6.69 (14.98)	7.38 (15.75)
5	T_5 *Metarhizium anisopliae* $1x10^8$ cfu/ml	0.004	2 gm/Lit	24.61 (29.73)	11.18 (19.52)	13.56 (21.60)	14.46 (22.34)	15.86 (23.45)
6	T_6 *Baeuberia bassiana* $1x10^8$ cfu/ml	0.004	2 gm/Lit	25.86 (30.55)	12.30 (20.52)	14.32 (22.23)	15.40 (23.10)	16.94 (24.29)
7	T_7 Neemal 1500PPM	1500 ppm	10 ml/Lit	25.50 (30.32)	7.37 (15.74)	8.10 (16.52)	9.27 (17.72)	10.03 (18.45)
8	T_8 NSKE	5%	50 g/Lit	25.38 (30.23)	8.54 (16.99)	9.28 (17.73)	10.07 (18.48)	11.52 (19.83)
9	T_9 Untreated			26.53 (30.99)	30.50 (33.50)	34.41 (35.90)	38.34 (38.24)	42.23 (40.51)
	CD			N.S.	0.839	1.142	1.050	1.075
	SE(m)			0.318	0.278	0.378	0.347	0.355

(4.17 mortality) followed by dimethoate (5.58 mortality), thiamethoxam (6.98 mortality), neemal oil 1500 ppm (8.10 mortality), NSKE @ 5% (9.28 mortality), *Metarhizium anisopliae* (13.56) and *Beauveria bassiana* (14.32) respectively during the year 2018-19.

Data recorded after 14th days of first spray showed that the treatment of Dinutefuran 50% WP@ 0.2 ml/L proved most effective as 4.02 per cent mortality was recorded in it and it was statically superior over all the other treatments as well as untreated control. Imidacloprid 17.8 SL @ 0.4ml/L (5.35 per cent mortality) was also effective in suppressing *Amritotus atkinsoni*. During this observational period the other treatment to follow were dimethoate 30 EC @ 1.6 ml/L (6.69) thiamethoxam 50 WG @ 0.1 ml/L (7.78) neemal oil 1500 ppm 3 liter pf water (9.27), NSKE @ 5% (10.07), *Metarhizium anisopliae* $1x10^8$ cfu/ml (14.46) and *Beauveria bassiana* @ 1 X 10^9 cfu/ml (15.40) during respectively, and their efficacy was statically superior over the control. The maximum damage of 38.34 per cent damage was recorded in untreated control plot.

As far as the data recorded after 21 days of spraying is concerned Dinutefuran 50% WP@ 0.2 ml/L proved most effective as 5.59 per cent mortality was recorded in it and it was statically superior over all the other treatments as well as

untreated control. Imidacloprid 17.8 SL @ 0.4ml/L (6.64 per cent mortality) was also effective in suppressing *Amritotus atkinsoni*. During this observational period the other treatment to follow were dimethoate 30 EC @ 1.6 ml/L (7.38) thiamethoxam 50 WG @ 0.1 ml/L (8.11) neemal oil 1500 ppm 3 ler pf water (10.03), NSKE @ 5% (11.52), *Metarhizium anisopliae* 1x10^8 cfu/ml (15.86) and *Beauveria bassiana* @ 1 X 10^9 cfu/ml (16.94), respectively, were statically superior over the control (42.23 per cent damage). The present investigation is in agreement with the findings of Samanta *et al.,* (2008) [6]. First spray of *Beauveria bassiana* @ 1 × 10 7 spores /ml) at panicle emergence stage followed by second spray (after 15 days of first spray) of *Verticillium lecanii* (@ 1 × 107 spores/ml). Third need-based spray of Neem Azal (10000 ppm @ 8 ml/l. of water). Field experiments carried out for two years during 2007 and 2008 on the efficacy of different insecticides *viz*., organochlorines (endosulfan 0.05%), organophosphates (monocrotophos 0.05%, profenophos 0.05%), carbamates (thiodicarb 0.05%, carbaryl 0.05%), neonicotinoids (imidacloprid 0.005%) and botanicals (azadirachtin 0.05%) against mango hoppers (*Amritodus atkinsoni* Lethierry and *Idioscopus clypealis* Lethierry) and their influence on fruit yield with avoidable losses, revealed that the imidacloprid was most effective Adnan *et al.,* (2014) [1]. During 2013 to manage the mango hopper, *Idioscopus clypealis* L, using three chemical insecticides, Imidacloprid (0.3%), Alam *et al.,* (2016). Experiments were conducted to study the bio-efficacy of mixture formulation of thiamethoxam 12.6% + lambda cyhalothrin 9.5% 247 ZC at three different doses (22, 27.5 and 33 g a.i./ha) Qureshi *et al.,* (2017). The use of the systemic insecticides thiamethoxam (Actara®) and imidacloprid (Confidor®) has been previously shown to be an effective method in reducing the numbers of sap-sucking insects in mangoes. thiamethoxam and imidacloprid against mango leafhoppers Chaudhari *et al.,* (2017) [3]. Studied Management of mango hopper with newer chemical pesticides, indicated that imidacloprid 17.8 SL @ 0.007% was superior with thiomethoxam 25 WG @ 0.0025% Shawan *et al.* (2018) [8]. Botanicals (Neem extract and Mahogoniextract) with 3 concentrations (0.5%, 1.0% and 1.5%) maintaining six replications of each to know their efficacy to control Mango hopper and botanical insecticides, *Azadirachtine* based Neem extract 1.5% was the best insecticide Neem extract (1.5%) showed higher efficacy than Mahogoniextract (1.5%) among the botanicals. Sharanabasappa *et al.* (2018) [7]. dinotefuron 20 SG found to be best the treatment which recorded a significantly lowest number of nymphs and adults, followed by imidacloprid 70 WG Economics of different treatments showed that Incremental CB ratio were obtained in case of dinotefuron 20 SG (1:4.15), imidacloprid 70 WG (1: 3.93), Acetamiprid 20 SP (1:3.84).

B. Second applications

The effect of different insecticides/biopesticides treatment on the mortality of mango leaf hopper *Amritodus atkinsini* in mango crop is presented in Table 3. The results revealed that all the treatments were significantly effective in controlling mango leaf hopper as compared to control. The mortality ranged from 1.67 to 45.89 during in the year 2018-19 before the spray of treatments, it did not differ significantly to each other.

Data recorded on 3 day after the application of various treatments (Table 3). Dinutefuran 50% WP@ 0.2 ml/L was the best treatment by bringing down the mortality of mango mango leaf hopper up to 1.67 during 2018-19 years. The other treatments in order of per cent mortality was Imidacloprid 17.8 SL @ 0.4ml/L (2.48) followed by dimethoate 30 EC @ 1.6 ml/L (3.92) thiamethoxam 50 WG @ 0.1 ml/L (4.79) neemal oil 1500 PPM 10 ml/ler of water (6.37), NSKE 5% @ 50gm/L (7.54),

Metarhizium anisopliae 1x108cfu/ml (10.18) and *Beauveria b assiana* @ 1 X 109 cfu/ml (11.30) during in the year 2018-19. Similar trend was recorded on 7 day of application. Dinutefuran 50% WP again was the most effective treatment (2.36 mortality). The second most effective treatment was Imidacloprid (3.17 mortality) followed by dimethoate (4.58 mortality), thiamethoxam (5.64 mortality), neemal oil 1500 PPM (7.77 mortality), NSKE @ 5% (8.28 mortality), *Metarhizium anisopliae* (12.23) and *Beauveria bassiana* (13.66) respectively during the year 2018-19.

Data recorded after 14th days of first spray showed that the treatment of Dinutefuran 50% WP@ 0.2 ml/L proved most effective as 3.35 per cent mortality was recorded in it and it was statically superior over all the other treatments as well as untreated control. Imidacloprid 17.8 SL @ 0.4ml/L (4.68 per cent mortality) was also effective in suppressing *Amritotus atkinsoni.* During this observational period the other treatment to follow were dimethoate 30 EC @ 1.6 ml/L (5.50) thiamethoxam 50 WG @ 0.1 ml/L (6.45) neemal oil 1500 ppm 3 ler pf water (8.49), NSKE @ 5% (9.40), *Metarhizium anisopliae* 1x10^8 cfu/ml (13.46) and *Beauveria bassiana* @ 1 X 10^9 cfu/ml (14.40) during respectively, and their efficacy was statically superior over the control. The maximum damage of 43.74 per cent damage was recorded in untreated control plot.

As far as the data recorded after 21st days of spraying is concerned Dinutefuran 50% WP@ 0.2 ml/L proved most effective as 4.59 per cent mortality was recorded in it and it was statically superior over all the other treatments as well as untreated control. Imidacloprid 17.8 SL @ 0.4ml/L (5.97 per cent mortality) was also effective in suppressing *Amritotus atkinsoni.*

During this observational period the other treatment to follow were dimethoate 30 EC @ 1.6 ml/L (6.38) thiamethoxam 50 WG @ 0.1 ml/L (7.77) neemal oil 1500 ppm 3 ler pf water (9.52), NSKE @ 5% (10.52), *Metarhizium anisopliae* 1x10^8 cfu/ml (15.08) and *Beauveria bassiana* @ 1 X 10^9 cfu/ml (15.94), respectively, were statically superior over the control (45.89 per cent damage). The present investigation is in agreement with the findings of Samanta *et al.,* (2008) [6]. Experimented first spray of *Beauveria bassiana* @ 1 × 10 7 spores /ml) at panicle emergence stage followed by second spray (after 15 days of first spray) of *Verticillium lecanii* (@ 1 × 107 spores/ml). Third need-based spray of Neem Azal (10000 ppm @ 8 ml/l. of water).

Table 3: Efficacy of newer insecticides against Mango hopper *A. atkinsoni* after Second spray during 2018-19.

S. No.	Treatment	Conc. %	Doses/Lit of water	Mean population of mango hopper/ 5 panicle			
				second spray			
				3 DAS	7 DAS	14 DAS	21 DAS
1	T_1 Imidacloprid 17.8 SL	0.005	0.4 ml/Lit	2.48 (9.04)	3.17 (10.26)	4.68(12.49)	5.97 (14.14)
2	T_2 Dinutefuran 50% WP	0.005	0.2 ml/Lit	1.67 (7.40)	2.36 (8.83)	3.35 (10.54)	4.59 (12.37)
3	T_3 Thiamethoxam 50 WG	0.01	0.1 ml/Lit	4.79 (12.64)	5.64 (13.74)	6.45 (14.71)	7.77 (16.17)
4	T_4 Dimethoate 30 EC	0.005	1.6 ml/Lit	3.92 (11.37)	4.58 (12.35)	5.50 (13.55)	6.38 (14.61)
5	T_5 *Metarhizium anisopliae* $1x10^8$ cfu/ml	0.004	2 gm/Lit	10.18 (18.59)	12.23 (20.46)	13.46 (21.52)	15.08 (22.83)
6	T_6 *Baeuberia bassiana* $1x10^8$ cfu/ml	0.004	2 gm/Lit	11.30 (19.63)	13.66 (21.68)	14.40 (22.29)	15.94 (23.52)
7	T_7 Neemal 1500PPM	1500 ppm	10 ml/Lit	6.37 (14.61)	7.77 (16.17)	8.49 (16.93)	9.52 (17.96)
8	T_8 NSKE 5%	------	50 g/Lit	7.54 (15.93)	8.28 (16.72)	9.40 (17.84)	10.52 (18.91)
9	T_9 Untreated			34.83 (36.16)	38.74 (38.48)	43.74 (41.39)	45.89 (42.63)
	CD			0.964	0.347	0.524	0.881
	SE(m)			0.319	0.115	0.173	0.291

Module II: First spray of Neem Azal (10000 ppm @ 3 ml/l. of water) at panicle emergence Kaushik *et al.*, (2014). Field experiments carried out for two years during 2007 and 2008 on the efficacy of different insecticides *viz*., organochlorines (endosulfan 0.05%), organophosphates (monocrotophos 0.05%, profenophos 0.05%), carbamates (thiodicarb 0.05%, carbaryl 0.05%), neonicotinoids (imidacloprid 0.005%) and botanicals (*azadirachtin* 0.05%) against mango hoppers (*Amritodus atkinsoni* Lethierry and *Idioscopus clypealis* Lethierry) and their influence on fruit yield with avoidable losses, revealed that the imidacloprid was most effective Adnan *et al.*, (2014) [1]. During 2013 to manage the mango hopper, *Idioscopus clypealis* L, using three chemical insecticides, Imidacloprid (0.3%), Alam *et al.*, (2016). Experiments were conducted to study the bio-efficacy of mixture formulation of thiamethoxam 12.6% + lambda cyhalothrin 9.5% 247 ZC at three different doses (22, 27.5 and 33 g a.i./ha) Qureshi *et al.*, (2017). The use of the systemic insecticides thiamethoxam (Actara®) and imidacloprid (Confidor®) has been previously shown to be an effective method in reducing the numbers of sap-sucking insects in mangoes. thiamethoxam and imidacloprid against mango leafhoppers Chaudhari *et al.*, (2017) [3]. Studed Management of mango hopper with newer chemical pesticides, indicated that imidacloprid 17.8 SL @ 0.007% was superior with thiomethoxam 25 WG @ 0.0025% Shawan *et al.*, (2018) [8]. Botanicals (Neem extract and Mahogoniextract) with 3 concentrations (0.5%, 1.0% and 1.5%) maintaining six replications of each to know their efficacy to control Mango hopper and botanical insecticides, *Azadirachtine* based Neem extract1.5% was the best insecticide Neem extract (1.5%) showed higher efficacy than Mahogoniextract (1.5%) among the botanicals.

Conclusion

Dinutefuran 50% WP@ 0.2 ml/L proved most effective as 4.59 per cent mortality was recorded in it and it was statically superior over all the other treatments as well as untreated control. Imidacloprid 17.8 SL @ 0.4ml/L (5.97 per cent mortality) was also effective in suppressing *Amritotus atkinsoni*. During this observational period the other treatment to follow were dimethoate 30 EC @ 1.6 ml/L (6.38) thiamethoxam 50 WG @ 0.1 ml/L (7.77) neemal oil 1500 ppm 3 ler pf water (9.52), NSKE @ 5% (10.52), *Metarhizium anisopliae* $1x10^8$ cfu/ml (15.08) and *Beauveria bassiana* @ 1 X 10^9 cfu/ml (15.94), respectively, were statically superior over the control (45.89 per cent damage).

References

1. Adnan SK. MD, Uddin MM, Alam MJ, Islam MS, Kashem MA, Rafii MY *et al*. Management of Mango Hopper, *Idioscopus clypealis*, Using Chemical Insecticides and Neem Oil. The Scientific World Journal. 2014; 709614:5p.
2. Alam, Sk Fashi, Patra Biswajit, Samanta Arunava. Evaluation of some new mixture formulations of insecticides for management of Mango hoppers. Ecosystem of Environmental & Conservation. 2016; 22(4):2067-2075.
3. Chaudhari AU, Sridharan S, Sundar Singh SD. Management of mango hopper with newer molecules and biopesticides under ultra high density planting system. Journal of Entomology and Zoology Studies. 2017; 5(6):454-458.
4. Qureshi M, Sohail, Thistleton Brian, Syeda Shamsa S, Hearnden Mark, Qureshi M Hanif. Managing mango leafhoppers and other associated species affected through systemic insecticides in mango orchards at Darwin, Australia, Pakistan Journal Entomology Karachi. 2011; 26(2):81-87.
5. Rahman SK. MD, Kuldeep. Mango hopper: bio ecology and management-A review Agric. Rev. 2007; 28(1):49-55.
6. Samanta A, Jana SK, Adhikary S, Somchowdhury AK. Efficacy of Various Insecticidal Modules against Mango Hopper. J. Ent. Res. 2008; 32(3):207-209.
7. Sharanabasappa, Pavithra HB, Maruthi MS, Nagarajappa Adiveppar. Efficacy of different newer insecticides against mango leaf hoppers. Journal of Entomology and Zoology Studies. 2018; 6(1):834-837.
8. Shawan SI, Rashed RU, Mitu AS, Jahan M. Efficacy of different chemical and `botanical insecticides in controlling mango hopper (*Amritodusatkinsoni* L.). Advances in Plants & Agriculture Research. 2018; 8(2):
9. Srivastava RP. Laboratory screening of screening of buprofezin and alcoholic extract of Alpinia galangal against mealy bug nymphs, *Drosicha mangiferae* Green. Indian Journal of. Entomology. 1997; 59:78-90.
10. Srivastava RP. Mango insect pests and their management. In: Mango cultivation. Int. Book Distribution Co., Lucknow, 2000, 187-299.
11. Verghese A. Effect of imidacloprid, lambda-cyhalothrin and azadirachtin on the mango hopper, *ldioscopus niveosparsus* (Leth.) (Homoptera: Cicaqellidae). Acta-Horticulturae. 2000; (509):733-736.