The Pharma Innovation Journal 2021; SP-10(9): 414-418

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(9): 414-418

www.thepharmajournal.com
Received: 13-07-2021
Accepted: 15-08-2021

YK Pathan
Post Graduate Student, Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharashtra, India

NK Bhute
Assistant Entomologist, Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharashtra, India

CS Patil
Head, Department of Agricultural Entomology, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharashtra, India

ST Aghav
Assistant Professor of Agricultural Entomology, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

DP Pacharne
Associate Professor of Agronomy, Director of Extension Education, Mahatma Phule Krishi Vidyapeeth, Rahuri–Ahmednagar, Maharashtra, India

Corresponding Author
YK Pathan
Post Graduate Student, Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharashtra, India

Evaluation of different insecticides against pink bollworm, *Pectinophora gossypiella* (Saunders) in *Bt* cotton

YK Pathan, NK Bhute, CS Patil, ST Aghav and DP Pacharne

Abstract
The present study entitled, Evaluation of different insecticides against pink bollworm, *Pectinophora gossypiella* (Saunders) in *Bt* cotton under field condition during *Kharif* 2020. Observation were made on rosette flowe%, green boll damage%, larval population per 20 bolls, open boll damage%, locule damage% and yield (q/ha). The results of experiment revealed that, among the tested insecticide chlorantraniliprole 18.5 SC found effective in management of pink bollworm, recording lowest rosette flower (7.44%), green boll damage (8.78%), pink bollworm larvae (3.09/20 bolls). At harvest chlorantraniliprole 18.5 SC recording less open boll damage (7.26%) and locule damage (4.09%). For all the recorded observation spinetoram 11.7 SC and lambda cyhalothrin 5 EC were found at par with chlorantraniliprole 18.5 SC. Among tested insecticides chlorantraniliprole 18.5 SC produced highest yield of seed cotton (20.45 q/ha). Among different tested insecticides the highest ICBR i.e. 1:19.25 was observed in spinetoram 11.7 SC.

Keywords: pink bollworm, *Pectinophora gossypiella*, *Bt*, cotton

Introduction
Cotton is a key fiber crop grown in more than seventy nations throughout the world. Cotton is a significant crop in the world's economic, political, and social concerns. Cotton is a member of the Malvaceae family and the genus *Gossypium*. It is popularly known as "White Gold" and "Friendly Fiber." Global 2019-2020 cotton area, production and productivity were 34.50 million hectares (85.50 million acres), 121 million bales and 791 Kg/ha (Anonymous, 2020a) [4]. India occupies 37.56% of world cotton area and produces 24.26% of world cotton production and stands tall. In India during 2019-2020 the area, production and productivity of cotton were 125.84 lakh hectares, 360 lakh bales of 170 Kg and 486 Kg lint/ha respectively (Anonymous, 2020b) [5]. Exports of cotton yarn, thread, textiles, and apparels bring in between $12 and $14 billion in foreign exchange each year for India. India's domestic and international trade is projected to be worth (Rs. 15,000 crores) 30 US $ billion dollars every year (Anonymous, 2015) [2]. Cotton exports generate around Rs 76,000 crores in foreign exchange earnings, accounting for one-third of our country's overall foreign exchange earnings (Anonymous, 2007) [1].
The larvae of *P. gossypiella* damage the floral outgrowths *i.e.*, improper flower opening, small round holes are seen on the septa between the locules, stained lint around the feeding area and bad quality seed cotton. It causes 2.80 to 61.90 per cent loss in seed cotton yield, 2.10 to 47.10 per cent loss in oil content and 10.00 to 55.00 per cent damage to green bolls (Anonymous, 2018)[3]. It interferes with the growth of cotton plant by incomplete boll opening, reducing the staple size, strength and enhance the contents of trash in the lint (Hassan 2014) [8].
Keeping these views, it is important to compare the efficacy of insecticides against pests for effective pest management and to reduce the indiscriminate use of insecticides. Thus, the present study was conducted to evaluate different insecticides against pink bollworm at AICCIP Rahuri, Dist. Ahmednagar (M.S.).

Materials and Methods
Experimental details
A field study was conducted to evaluate the different insecticides against pink bollworm, *P. gossypiella* during *kharif* 2020 under randomized block design (RBD) at AICCIP, Rahuri, and Dist. Ahmednagar (M.S.) with nine treatments including an untreated control and were replicated thrice.

A popular *Bt* cotton hybrid Ajeet-199 was sown during *kharif* 2020 with a spacing of 90 cm x 90 cm in the plot size of 7.2 m x 5.4 m. Insecticides were sprayed thrice during the investigation period.

The pre-treatment count was taken before spraying for taking decision to initiate imposition of treatments and subsequently post treatment count were recorded after ten days of each spray application. The observations on rosette flowers, per cent green boll damage, larval population per 20 green bolls, per cent open boll damage and per cent locule damage in open boll in each treatment were recorded. During the crop season, picking of seed cotton was done manually using human labour at the appropriate time without contamination of plant parts or trash. Individual plot seed cotton yields were recorded in separate pickings and expressed as quintal per ha.

$$\text{Per cent Rosette flowers (\%)} = \frac{\text{No. of Rosette flowers}}{\text{Total No. of flowers}} \text{ X } 100$$

$$\text{Per cent Green boll damage (\%)} = \frac{\text{No. of damage green boll}}{\text{Total No. of green bolls}} \text{ X } 100$$

$$\text{Per cent Locule damage (\%)} = \frac{\text{Number of damaged locule}}{\text{Total number of locule}} \text{ X } 100$$

$$\text{Per cent Open boll damage (\%)} = \frac{\text{Number of bad open boll}}{\text{Total number of open boll}} \text{ X } 100$$

Results and Discussion

Rosette flower

It is clear from the Table 1. thatall tested insecticides found significantly superior over control (31.48 per cent mean rosette flower) in reduction of the rosette flowers due to pink bollworm larvae *P. gossypiella* during the 1st, 2nd, and 3rd spray. Mean per cent rosette flower ranged between 7.44 to 13.54 per cent in different treatments. Amongst the tested insecticides, chlorantraniliprole 18.5 SC was found to be most effective treatment which induce highest effect, representing 76.37% reduction in rosette flower over control. However, it was followed by the treatments spinetoram 11.7 SC and lambda cyhalothrin 5EC which were at par with chlorantraniliprole 18.5 SC and recorded 73.32% and 69.50% reduction over control respectively. Next best treatment was indoxacarb 15.8 EC with 64.45% reduction in rosette flower over control. Profenophos 30 EC, emamectin benzoate 5 SG, fenpropathrin 30 EC and cypermethrin 25 EC were at par with indoxacarb 15.8 EC and recorded 61.34%, 60.48%, 58.35% and 56.99% reduction in rosette flower over control. The present findings on rosette flowers due to *P. gossypiella* corroborate with the results of Naik *et al*. (2015) [10], who reported that chlorantraniliprole 18.5 SC recor0ded the lowest incidence of bollworm at 60 and 80 DAS. Wayal *et al.* (2007) [11] reported that the lambda- cyhalothrin 5 EC formulation, a dose of 50 g. a. i./ha proved to be most effective in reducing pink bollworm incidence in flower.

Green Boll Damage

It is evident from table 2. that the mean per cent green boll damage due to pink bollworm ranged between 8.78 to 13.41 per cent in different treatments which were significantly superior over control (32.68 per cent) in reduction of the green boll damage during 1st, 2nd and 3rd sprays. Data showed that amongst tested insecticides, chlorantraniliprole 18.5 SC induce highest effect, representing 73.13% reduction in green boll damage over control.

However, it was followed by the treatments spinetoram 11.7 SC and lambda cyhalothrin 5 EC which were at par with chlorantraniliprole 18.5 SC and recorded 70.20% and 67.01% reduction over control respectively. Next best treatment was indoxacarb 15.8 EC with 63.31% reduction in green boll damage over control. Profenophos 30 EC, emamectin benzoate 5 SG, fenpropathrin 30 EC and cypermethrin 25 EC were at par with indoxacarb 15.8 EC and recorded 61.78%, 61.05%, 60.25% and 58.97% reduction in green boll damage over control. The present findings on green boll damage due to *P. gossypiella* are in line with the results of Naik *et al*. (2015) [10], who found that the chlorantraniliprole 18.5 SC recorded the lowest incidence of bollworm at 60 and 80 DAS. Similarly, the present findings are in confirmed with Manikrao (2017) [9] who who reported that minimum green boll damage by larvae was recorded in chlorantraniliprole 18.5 SC treated plots.

Pink Bollworm Larvae/ 20 Bolls

The results of the present study indicated that, all treatments proved superior over the control (Table 3). Mean larval population per twenty bolls ranged between 3.09 to 7.57 in different treatments. Obtained results showed that amongst tested insecticides, chlorantraniliprole 18.5 SC induce highest effect, representing 81.04% reduction in larval population over control. However, it was followed by the treatments spinetoram 11.7 SC and lambda cyhalothrin 5 EC which were at par with chlorantraniliprole 18.5 SC and recorded 74.97% and 65.83% reduction over control respectively. Next best treatment was indoxacarb 15.8 EC with 61.60% reduction in larval population over control. Profenophos 30 EC, emamectin benzoate 5 SG, fenpropathrin 30 EC and cypermethrin 25 EC were at par with indoxacarb 15.8 EC and recorded 57.61%, 54.91%, 53.62% and 53.56% reduction in larval population over control. The present findings on larval population of *P. gossypiella* per twenty bolls are in line with the results of Divya *et al.* (2020) [7], who found that the chlorantraniliprole 18.5 SC recorded the lowest larval population. The present findings regarding pink bollworm larval population per twenty green bolls corroborate with the results of Naik *et al.* (2015) [10] and Bajya *et al.* (2015) [6], who reported that the chlorantraniliprole 18.5 SC was found effective with 62.33% reduction in *P. gossypiella* larval population.

Open Boll Damage

Based on number of bad opened bolls and good opened bolls at each picking, the per cent open boll damage was calculated and presented in table 4.

It is evident from table 4. that the mean per cent open boll damage was significantly less in all treatments (7.26 to 10.46 per cent) which were superior over control (32.27 per cent). Obtained results showed that amongst tested insecticides, chlorantraniliprole 18.5 SC induce highest effect, representing 77.50% reduction in open boll damage over control. However, it was followed by the treatments spinetoram 11.7 SC and lambda cyhalothrin 5 EC which were at par with chlorantraniliprole 18.5 SC and recorded 75.33% and 72.92% reduction over control respectively. Next best treatment was indoxacarb 15.8 EC with 71.58% reduction in open boll

damage over control. Profenophos 30 EC, emamectin benzoate 5 SG, fenpropathrin 30 EC and cypermethrin 25 EC were at par with indoxacarb 15.8 EC and recorded 69.76%, 68.52%, 68.27% and 67.59% reduction in open boll damage over control. The present findings on open boll damage due to *P. gossypiella* are in line with the results of Divya *et al*. (2020) [7], who found that the chlorantraniliprole 18.5 SC recorded the maximum good open boll and minimum bad open boll with higher cotton yield.

Locule Damage

It is evident from table 4. that the mean per cent locule damage was significantly less in all treatments (4.09 to 6.64 per cent) which were superior over control (30.13 per cent). Obtained results showed that amongst tested insecticides, chlorantraniliprole 18.5 SC induce highest effect, representing 86.43% reduction in locule damage over control. However, it was followed by the treatments spinetoram 11.7 SC and lambda cyhalothrin 5 EC which were at par with chlorantraniliprole 18.5 SC and recorded 84.60% and 82.77% reduction over control respectively. Next best treatment was indoxacarb 15.8 1EC with 81.91% reduction in locule damage over control. Profenophos 30 EC, emamectin benzoate 5 SG, fenpropathrin 30 EC and cypermethrin 25 EC were at par with indoxacarb 15.8 EC and recorded 81.25%, 80.45%, 79.32% and 77.96% reduction in locule damage over control. The present findings onlocule damage due to *P. gossypiella* are in line with the results of Divya *et al*. (2020) [7], who found that the chlorantraniliprole 18.5 SC recorded the minimum locule damage. Similarly, the present finding0s are in confirmed with Manikrao (2017) [9] whoreported that minimum open locule damage by larvae was recorded in chlorantraniliprole 18.5 SC treated plots.

Yield

It is evident from table 4. that the yield obtained in different treatments were obtained and analysed. The results showed significant difference in yield over control in different treatment as indicated in Table 4. Among the tested insecticide highest seed cotton yield was obtained in chlorantraniliprole 18.5 SC (20.45 q/ha) which were found at par with spinetoram 11.7 SC (19.11 q/ha) and lambda cyhalothrin 5 EC (17.85 q/ha). Next best treatment was indoxacarb 15.8 EC (15.78 q/ha) which were at par with Profenophos 30 EC (15.25 q/ha), emamectin benzoate 5 SG (13.25 q/ha) and fenpropathrin 30 EC (13.09 q/ha). However, lowest yield was recorded in the cypermethrin 25 EC (11.73 q/ha).The present findings on seed cotton yield corroborate with the results of Divya *et al*. (2020) [7] who reported highest seed cotton yield in chlorantraniliprole 18.5 SC. The results on the yield in different plots of insecticidal treatments are in accordance with Manikrao (2017) [9] who recorded highest seed cotton yield in chlorantraniliprole 18.5 SC.

Economics of the different Insecticides

The ICBRs of different treatments was worked out (Table 5). Among different tested insecticides the highest ICBR i.e. 1:19.25 was observed in spinetoram 1132.7 SC followed by lambda cyhalothrin 5 EC (1:17.98), chlor1antraniliprole 18.5 SC (1:12.28) and indoxacarb 15.8 EC (1:11.63). Lowest ICBR was observed in cypermethrin 25 EC (1:3.75).

Table 1: Efficacy of different insecticides on rosette flower due to pink bollworm, *P. gossypiella* (Saunders) under field conditions

Tr. No.	Treatments	Dose g.or ml. a.i./ha	Rosette flower%					%ROC
			Precount	1st Spray	2nd Spray	3rd Spray	Mean	
1	Profenophos 50 EC	750	14.00(21.96)	14.11(22.05)	12.07(20.32)	10.33(18.74)	12.17(20.41)	61.34
2	Indoxacarb 15.8 EC	75	14.11(22.05)	13.67(21.69)	11.35(19.68)	8.55(17.00)	11.19(19.54)	64.45
3	Emamectin benzoate 5 SG	11	13.67(21.69)	14.33(22.23)	12.33(20.55)	10.67(19.06)	12.44(20.65)	60.48
4	Lambda cyhalothrin 5 EC	20	13.00(21.13)	12.44(20.64)	9.33(17.78)	7.03(15.37)	9.60(18.04)	69.50
5	Cypermethrin 25 EC	55	14.67(22.51)	15.33(23.04)	14.00(21.96)	11.28(19.62)	13.54(21.58)	56.99
6	Chlorantraniliprole 18.5 SC	30	14.67(22.51)	10.67(19.06)	7.33(15.70)	4.33(12.01)	7.44(15.83)	76.37
7	Spinetoram 11.7 SC	50	13.67(21.69)	11.15(19.50)	8.67(17.12)	5.38(13.41)	8.40(16.84)	73.32
8	Fenpropathrin 30 EC	87.5	14.33(22.23)	15.01(22.79)	13.33(21.41)	11.00(19.36)	13.11(21.22)	58.35
9	Untreated (control)	-	14.33(22.23)	22.11(28.04)	32.67(34.85)	39.67(39.02)	31.48(34.12)	
SE(m)			0.73	0.80	0.90	1.13	0.78	
CD at 5%			NS	2.38	2.69	3.38	2.33	
CV%			9.00	9.62	11.57	5.44	8.94	

(Figures in parenthesis are arcsine transformed values). (ROC- Reduction over Control) (NS- Non significant)

Table 2: Efficacy of different insecticides on green boll damage due to pink bollworm, *P. gossypiella* under field conditions

Tr. No.	Treatments	Dose g.or ml. a.i./ha	Green boll damage%					%ROC
			Precount	1st Spray	2nd Spray	3rd Spray	Mean	
1	Profenophos 50 EC	750	12.67(20.84)	16.01(23.58)	13.27(21.35)	8.18(16.61)	12.49(20.68)	61.78
2	Indoxacarb 15.8 EC	75	13.03(21.15)	15.42(23.11)	12.67(20.84)	7.88(16.30)	11.99(20.25)	63.31
3	Emamectin benzoate 5 SG	11	13.33(21.41)	16.33(23.83)	13.49(21.54)	8.38(16.82)	12.73(20.90)	61.05
4	Lambda cyhalothrin 5 EC	20	12.67(20.84)	15.19(22.93)	11.07(19.43)	6.07(14.26)	10.78(19.16)	67.01
5	Cypermethrin 25 EC	55	13.48(21.53)	17.01(24.35)	14.13(22.07)	9.10(17.55)	13.41(21.48)	58.97
6	Chlorantraniliprole 18.5 SC	30	12.33(20.55)	13.55(21.59)	9.33(17.78)	3.45(10.70)	8.78(17.23)	73.13
7	Spinetoram 11.7 SC	50	12.67(20.84)	14.08(22.03)	10.12(18.54)	5.03(12.96)	9.74(18.18)	70.20
8	Fenpropathrin 30 EC	87.5	12.67(20.84)	16.65(24.07)	13.65(21.67)	8.67(17.12)	12.99(21.12)	60.25
9	Untreated (control)	-	12.45(20.65)	24.52(29.67)	33.25(35.26)	40.00(39.22)	32.68(34.82)	-
SE(m)			0.57	0.45	0.93	1.19	1.00	
CD at 5%			NS	1.35	2.77	3.58	2.99	
CV%			7.68	9.54	11.00	6.50	12.37	

(Figures in parenthesis are arcsine transformed value)
(ROC- Reduction over Control)
(NS- Non significant)

Table 3: Efficacy of different insecticides on larval population of pink bollworm, *P. gossypiella* under field conditions.

Tr. No.	Treatments	Dose g.or ml. a.i./ha	Pink bollworm larvae /20 bolls					%ROC
			Precount	1st Spray	2nd Spray	3rd Spray	Mean	
1	Profenophos 50 EC	750	6.36(2.62)	9.33(3.14)	6.82(2.70)	4.59(2.26)	6.91(2.72)	57.61
2	Indoxacarb 15.8 EC	75	7.40(2.81)	8.18(2.95)	6.26(2.60)	4.33(2.20)	6.26(2.60)	61.60
3	Emamectin benzoate 5 SG	11	6.15(2.58)	9.13(3.10)	7.49(2.83)	5.45(2.44)	7.35(2.80)	54.91
4	Lambda cyhalothrin 5 EC	20	7.67(2.86)	7.92(2.90)	5.33(2.42)	3.47(1.99)	5.57(2.46)	65.83
5	Cypermethrin 25 EC	55	7.11(2.76)	9.44(3.15)	7.67(2.86)	5.60(2.47)	7.57(2.84)	53.56
6	Chlorantraniliprole 18.5 SC	30	6.45(2.64)	3.98(2.12)	3.02(1.88)	2.26(1.66)	3.09(1.89)	81.04
7	Spinetoram 11.7 SC	50	7.33(2.80)	5.04(2.35)	4.17(2.16)	3.03(1.88)	4.08(2.14)	74.97
8	Fenpropathrin 30 EC	87.5	6.52(2.65)	9.00(3.08)	7.78(2.88)	5.90(2.53)	7.56(2.84)	53.62
9	Untreated (control)	-	6.93(2.73)	14.04(3.81)	16.33(4.10)	18.52(4.36)	16.30(4.10)	-
SE(m)			0.54	0.27	0.19	0.12	0.21	
CD at 5%			NS	0.80	0.56	0.35	0.61	
CV%			13.70	11.07	10.79	11.96	6.43	

(Figures in parenthesis are squreroot transformed value)
(ROC- Reduction over Control)
(NS- Non significant)

Table 4: Efficacy of different insecticides on open boll damage and locule damage due to pink bollworm, *P. gossypiella* and yieldunder field conditions (mean of three picking)

Sr. No	Treatments	Dose g. or ml. a.i. /ha	Open boll damage	% ROC	Locule damage	% ROC	Yield
1	Profenophos 50 EC	750	9.76(18.20)	69.76	5.65(13.75)	81.25	15.25
2	Indoxacarb 15.8 EC	75	9.17(17.62)	71.58	5.45(13.49)	81.91	15.78
3	Emamectin benzoate 5 SG	11	10.16(18.58)	68.52	5.89(14.04)	80.45	13.25
4	Lambda cyhalothrin 5 EC	20	8.74(17.19)	72.92	5.19(13.16)	82.77	17.85
5	Cypermethrin 25 EC	55	10.46(18.86)	67.59	6.64(14.93)	77.96	11.73
6	Chlorantraniliprole 18.5 SC	30	7.26(15.62)	77.50	4.09(11.66)	86.43	20.45
7	Spinetoram 11.7 SC	50	7.96(16.38)	75.33	4.64(12.43)	84.60	19.11
8	Fenpropathrin 30 EC	87.5	10.24(18.66)	68.27	6.23(14.45)	79.32	13.09
9	Untreated (control)	-	32.27(34.60)	-	30.13(33.28)	-	9.85
SE(m)			0.66		0.52		0.92
CD at 5%			1.98		1.56		2.75
CV%			9.96		7.82		10.46

(Figures in parenthesis are arcsine transformed value)
(ROC- Reduction over Control)
(NS- Non significant)

Table 5: Economics of different insecticides for control of pink bollworm in *Bt* cotton

Sr. No	Treatments	Forml g. or ml./ ha	Cost of insecticides/ ha	Cost of labour	Treatments cost	Cost of cultivation	Total cost	Yield/ ha	Gross income	Net income	Income difference	BCR	ICBR
1	Profenophos 50 EC	1500	1410	2175	3585	42000	45585	15.25	88831.25	43246.25	27870	1.95	7.77
2	Indoxacarb 15.8 Ec	500	560	2175	2735	42000	44735	15.78	91918.5	47183.5	31807.25	2.05	11.63
3	Emamectin benzoate 5SG	220	440	2175	2615	42000	44615	13.25	77181.25	32566.25	17190	1.73	6.57
4	Lambda cyhalothrin 5 EC	400	280	2175	2455	42000	44455	17.85	103976.25	59521.25	44145	2.34	17.98
5	Cypermethrin 25 EC	220	132	2175	2307	42000	44307	11.73	68327.25	24020.25	8644	1.54	3.75
6	Chlorantraniliprole 18.5 SC	150	2475	2175	4650	42000	46650	20.45	119121.25	72471.25	57095	2.55	12.28
7	Spinetoram 11.7 SC	445	489	2175	2664	42000	44664	19.11	111315.75	66651.75	51275.5	2.49	19.25
8	Fenpropathrin 30 EC	295	460	2175	2635	42000	44635	13.09	76249.25	31614.25	16238	1.71	6.16
9	Untreated (control)	-	-	-	-	42000	42000	9.85	57376.25	15376.25	-	1.37	

Conclusions

Evaluation of different insecticides against pink bollworm in *Bt* cotton indicated that all the insecticides were found significantly superior over untreated control. The results indicated that among all insecticides the chlorantraniliprole 18.5 SC found most effective for control of rosette flower, green boll damage, larval population, open boll damage and locule damage. Similarly it was at par with the insecticides spinetoram 11.7 SC and lambda cyhalothrin 5 EC.

Acknowledgement

Authors are thankful to Cotton Breeder, All India Coordinated Cotton Improvement Project, MPKV, Rahuri and Head of Department, Agricultural Entomology, Post Graduate Institute, MPKV, Rahuri for providing the necessary facilities for research work.

References

1. Anonymous. The Hindu Survey of Indian Agriculture,

2007, 76-77.
2. Anonymous. Ministry of Textile, Annual Report, 2015-2016.
3. Anonymous. All India Coordinated Research Project on Cotton, Annual Report 2018.
4. Anonymous. Agricultural Market Intelligence Centre, PJTSAU 2020a. www.agricoop.nic.in.
5. Anonymous. All India Coordinated Research Project on Cotton, Annual Report 2020b. www.cicr.org.in.
6. Bajya DR, Baheti HS, Raza SK. Field efficacy of newer insecticide formulation Ampligo 150 ZC against bollworm complex in cotton. J Cotton Res. Dev 2015;29(1):94-98.
7. Divya B, Shivaray N, Sugeetha G, Vijaykumar L, Shashi Kumar C, Somu G, *et al.* Evaluation of newer molecules for the management of pink bollworm, *Pectinophora gossypiella* (Saunders) (Lepidoptera: Gelechidae) in cotton (*Gossypium spp*). J Ento. Zool. Stud 2020;8(1):383-386.
8. Hassan MB, Shafique FA. Current situation of edible vegetable oils and some propositions to curb the oil gap in Egypt, National Science 2014;8:1-7.
9. Manikrao MD. Evaluation of newer insecticides against bollworm complex in cotton. M. Sc. (Agri.) Thesis, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani 2017.
10. Naik VC, Ashwini A, Magar JG, Kumbhare S, Kranthi S,Venugopalan MV. Impact of new molecules on bollworm management in cotton under high density planting system. Symposium papers "Future technologies: Indian Cotton in the Next Decade 2015;3.22:79.
11. Wayal CB, Kharbade SB, Dethe MD, Chandele MG, Mehetre SS. Bio-efficacy of lambda-cyhalothrin5 CS formulation against pink bollworm, *Pectinophora gossypiella* (Saunders) on cotton. Pestology 2007;31(9):15-19.