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Surveillance of mirid bug, *Poppiocapsidea biseratense* (Distant) in *Bt* cotton

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Abstract
Population fluctuation studies on mirid bug were conducted at Main Agricultural Research Station (MARS), Dharwad, Karnataka, India, during *kharif* 2016-17 and 2017-18. MRC 7351 (Kanaka) *Bt* cotton crop was raised under unprotected conditions during the the month of June-July. The pooled data of two years indicated that the activity of mirid bug started with the population of 0.89 bugs/ 5 squares during 36th MSW and steadily increased with a population of 3.03 to 10.50 bugs from 37th to 45th MSW, respectively and reached maximum peak at 46th MSW (12.00). Thereafter the population of bugs started to decreasing trend from 47th to 7th MSW. The damaged squares noticed from 37th MSW with 7.74 per cent and slowly increased from 38th to 43rd standard week with 8.49 to 17.62 per cent damage and reached peak at 48th MSW (23.76%). Thereafter the per cent damage decreased from 49th MSW (19.37) to 8th MSW (0.31). The coccinellids were noticed throughout the season starting from 33rd MSW (0.20/ plant) reaching two peaks at 49th MSW (1.16) and 51st MSW (1.14). The chrysoperla activity commenced from 36th MSW (0.20/ plant) with two peaks at 42nd MSW (1.27) and 45th MSW (1.02). Similarly, two peak populations of spiders were noticed at 42nd MSW and 44th MSW (1.34 and 1.60). Weather parameters and natural enemies correlated with the population of mirid bug showed negative association with maximum temperature, minimum temperature and rainfall and showed no significant relationship with mirid bug. Whereas maximum and minimum relative humidity were positively correlated and showed no significant relationship. Chrysoperla (0.823**) and spiders (0.912**) showed highly significant and positive correlation on mean number of mirid bugs while coccinellid (0.380*) showed positive with significant relationship. Weather parameters and natural enemies had an influence to an extent of 85.40 per cent.

Keywords: Surveillance, mirid bug, *Bt* cotton

Introduction
Cotton (*Gossypium* spp.) is considered as king of fiber and white gold because of most superior fiber and garment qualities with highest economic returns. Cotton is infested by a large number of insect pests right from the sowing till harvest. The insect pests are one of the major constraints in achieving optimum yield potential. Cotton crop harboured 1326 species of insects in different cotton growing areas of the world and 162 species have been reported on the crop in India (Hargreaves, 1948) [2]. Growing cotton that has been genetically modified to poison its main pest can lead to a boom in the numbers of other insects. Udikeri *et al*. (2011) [12] noticed some emerging and seriously occurring pests like mealy bugs, *Phenacoccus solenopsis* (Tinsley), mirid bugs, *Poppiocapsidea biseratense* (Distant) (Miridae: Hemiptera) and flower bud maggot, *Dasineura gossypii* Fletcher (Cecidomyiidae: Diptera) in southern part of India particularly in Karnataka.
After introduction of *Bt* cotton, mirid bugs were increasing day by day in Karnataka. In present days mirid bugs has replaced the position created by major bollworms and other sucking pests of *Bt* cotton. In South India, the mirid bugs are now creating havoc. *P. biseratense* since its first appearance in 2005 is rampant these days (Patil *et al*., 2006) [5]. Both nymphs and adults were feed on squares and small developing bolls. The affected area becomes rapidly dull in colour, then blackens and ultimately resulting in death of the cells in the region. Feeding by this insect leads to heavy shedding of medium sized squares and tiny bolls too. Larger squares suffer from damage that may cause development of deformed bolls which is often referred to as "parrot beaking". Udikeri (2008) [13] opines that if the infestation is severe in older bolls, the damaged bolls may not develop properly. As the squares and bolls drop off, then there is a significant reduction in yield.

In population dynamics of mirid bug, the impact of abiotic factors on population play a major role and acts as one of the tool to study the pest abundance. Keeping in view these points, the present studies were conducted on surveillance of mirid bug in *Bt* cotton

Material and Methods

The population fluctuation studies on mirid bugs were conducted at Main Agricultural Research Station (MARS), Dharwad, Karnataka, India, during kharif 2016-17 and 2017-18. MRC 7351 (Kanaka) *Bt* cotton crop was raised under unprotected condition in 10 X 10 m plot size sown in the month of June-July.

Observations on mirid bug populations were recorded at weekly intervals. Number of mirid bugs (both nymphs and adults)/ 5 flower squares/ plant and number of damaged and healthy squares/plant on 20 randomly selected plants were recorded. Number of natural enemies namely coccinellid, chrysoperla and spiders per plant were also recorded on randomly selected 20 plants.

The cumulative weekly mean number of mirid bugs, percentage of damage squares and number of natural enemies namely coccinellid, chrysoperla and spiders per plant were worked out. Weather parameters were recorded for correlation and regression studies.

The correlation and regression analysis was worked out between cumulative weekly mean population of mirid bug and various weather parameters with natural enemies to assess the impact on fluctuation of mirid bug using SPSS software.

Results and Discussion

Population of mirid bug

The incidence of mirid bug during 2016-17 revealed that the incidence of mirid bug started with population of 0.97 bugs per five squares during 36th MSW and steadily increased with a population of 3.45 to 10.80 bugs on 37th to 45th MSW, respectively (Table 1) and reached peak population of 12.00 bugs at 46th MSW. Thereafter the population of bugs swings to downward trend from 47th to 7th standard week recording 11.50 to 0.15 bug per five squares. During 2017-18, the incidence of mirid bug was started from 36th MSW with population of 0.80 bugs per five squares (Table 1) and reached peak population at 46th MSW (10.95). Thereafter the population of bugs decreased from 47th to 6th standard week.

Pooled analysis of two years (2016-17 and 2017-18) data on population dynamics of mirid bug showed similar trend as prevailed in individual years. The mean incidence of mirid bug started at 36th MSW with a population of 0.89 bugs/ 5 five squares and constantly increased and reached peak at 46th MSW (11.48 bugs). Thereafter the population of bugs decreased to 0.03 bug/5 squares at 9th standard week (Table 1).

It can be observed from the present findings that the incidence of mirid bug was less during early period of crop growth and population gradually increased as the plant reached from vegetative phase to reproductive phase. Thereafter, the population began to decline at the end of cropping season. These results indicated that the availability of squares to the mirid bug differs with growth of the cotton plant.

The present findings are in close agreement with the observations of Hosseini *et al.* (2002) [4] who reported that *Creontiade pallidus* (Rambur) population was lower in cotton in the beginning of season and increased in later season. In late sown fields, severe damage was caused by second generation population during flowering stage and third generation on boll stage. Prakash (2012) [7] reported that incidence of mirid bug in irrigated cotton was noticed from September and gradually increased in the month of November and December with a peak population of mirid bug in the month of November. Further, Harish (2015) [3] reported that the incidence of mirid bug started from square formation stage and peak incidence was coincided with the peak square formation stage at October 3rd week (43th MSMW) on different genotypes and continued to exist throughout the reproductive phase of crop. The earlier reports of Ravi (2007) [9], Rohini (2009) [10], Shalini (2010) [11] and Patil *et al.* (2010) [6], Vinaykumar (2013) [14] are in line with present findings.

Square damage due to mirid bug

The damaged squares during first year of 2016-17 were recorded from 37th MSW with 8.16 per cent and slowly increased from 38th to 43rd standard week with 9.06 to 17.48 per cent damage (Table 1) and reached peak of 25.20 per cent square damage at 48th MSW. Thereafter the per cent damage decreased from 49th MSW (19.31) to 8th MSW (0.61).

During second year of 2017-18, the damaged squares by mirid bugs were observed at 37th MSW (7.27%) and the damage slowly increased from 38th to 47th standard week reaching a peak at 48th MSW (22.27%). Thereafter the per cent damage decreased from 49th MSW to 8th MSW (Table 1).

The pooled data indicated that the squares damage started during 37th MSW (7.74%) and slowly increased from 8.49 to 21.17 per cent from 38th to 47th standard week and reached a peak at 48th MSW (23.76%). Thereafter the damage decreased to downward trend from 9.37 to 0.31 per cent from 49th MSW to 8th MSW (Table 1). The present findings are in close agreement with the observations of Shalini (2010) [11] who reported that the peak square damage (22.30%) was recorded at third week of November. The least square shedding (0.12%) was registered during February last week. The earlier report of Rohini (2009) [10] is in line with present findings.

Natural enemies

Among the natural enemies recorded during first year, the population of coccinellids was noticed throughout the season starting from 33rd MSW (0.20/ plant) reaching a peak at 51st MSW (1.20) and gradually declined from 52nd to till harvesting period 10th MSW (Table 2). The chrysoperla activity commenced from 36th MSW (0.20 chrysoperla/plant) with two peaks at 42nd MSW (1.26) and 45th MSW (1.01) and continued up to 3rd MSW (0.36). The incidence of spiders was recorded from 38th MSW (0.50/plant) to 4th MSW (0.20). Two peak populations of spiders were noticed at 42nd MSW and 48th MSW.

The population of coccinellids during the second year was observed throughout the season starting from 33rd MSW (0.20/ plant) to 10th MSW (0.20) with a peak at 49th MSW (1.20) (Table 2). The chrysoperla activity commenced from 36th MSW (0.20/plant) with two peaks at 42nd MSW (1.28/ plant) and 45th MSW (1.02/ plant). The populations of spiders were recorded from 36th MSW to 4th MSW with two peaks at 43rd MSW (1.20) and 46th MSW (1.22).

The pooled data indicated that peak incidence of coccinellids was recorded at 49th MSW (1.16%), chrysoperla at 42nd MSW (1.27%) and spiders were recorded at 44th MSW (1.60%). Coccinellid population was noticed throughout the cropping season till harvest at 10th MSW. The chrysoperla activity commenced from 36th MSW and continued up to 5th MSW. The population of spiders was noticed from 36th MSW and continued up to 4th MSW. The favourable environment to the

coccinellids was obviously due to availability of insects inhabiting as a food source for build up of predators before the targeted host appear on cotton (Table 2).

The present results are closely corroborated with the findings of many workers, Harish (2015) [3] who reported that there was no much significant difference between natural enemies population across different genotypes. The population of coccinellids and chrysoperla reached peak during the November 2nd week (45th SMW) on all genotypes. However, the population of spiders was on higher side as compared to other natural enemies. The population of spiders reached peak during the November 1st week (44th SMW) in all genotypes. As the genotypes harboured the higher incidence of sucking pest complex that provided congenial condition for sustenance and multiplication of natural enemies and peak population of coccinellids and chrysoperla coincided with the higher population of insect pests.

Prasad and Rao (2008) [8] have noticed that the population of natural enemies was observed throughout the crop growth with peak occurrence during November month on different genotypes. However, Bhute *et al.* (2012) [1] noticed that the ladybird beetle population ranged from 0.10 to 3.50 per plant and the occurrence started from July 3rd week (31st SMW) (0.10/plant) and the highest population (3.50/plant) was observed in September 2nd week (37th SMW). The Chrysoperla population ranged from 0.15 to 1.70 per plant. The occurrence was noted from July 4th week (32nd SMW) and population rose to peak (1.70/plant) in September 2nd week (37th SMW). The predatory spider population ranged from 0.10 to 2.20 per plant and the occurrence of spider started from July 4th week (32nd SMW) and increased gradually to the peak (2.20/plant) in September 2nd week (37th SMW).

Weather parameters and natural enemies correlated with the population of mirid bug showed negative association with maximum temperature, minimum temperature and rainfall and showed no significant relationship with mirid bug whereas maximum and minimum relative humidity were positively correlated and showed no significant relationship. Correlation studies of natural enemies revealed that chrysoperla (0.823**) and spiders (0.912**) showed highly significant and positive correlation on mean number of mirid bugs while coccinellids (0.380*) showed positive with significant relationship. Linear regressions analysis indicated that weather parameters and natural enemies had an influence to an extent of 85.40 per cent (Table 3).

The present results are in agreement with the findings of Patil *et al.* (2010) [6] who reported severity of mirid bug incidence during October and November months which coincided with grand reproductive stage of crop growth. Similarly, in farmer fields, the incidence was observed to be persistent with relatively high during October. While, Further, present results are contradictory with the reports of Prakash (2012) [7] who opined that the population of mirid bug showed positive association with maximum temperature and negative relationship with minimum temperature, morning relative humidity, evening relative humidity and rainfall. The evening relative humidity showed significant negative relationship with bugs. Vinaykumar (2013) [14] reported that Weather parameters correlated with the population of mirid bug, showed negative association with all the weather parameters like maximum temperature (r = - 0.274), minimum temperature (r = – 0.373), mean relative humidity (r = - 0.566) and rainfall (r = - 0.379). During 47th standard week no rainfall was recorded and favoured the multiplication of mirid bug. Decrease in the bug population was noticed with the decreasing in maximum temperature, minimum temperature and mean relative humidity.

Table 1: Surveillance of mirid bug, *P. biseratense* in Bt Cotton

Meteorological Standard Week (MSW)	2016-17		2017-18		Pooled	
	No. of mirid bugs/5 squares	Damaged squares (%)	No. of mirid bugs/5 squares	Damaged squares (%)	No. of mirid bugs/5 squares	Damaged squares (%)
33	0.00	0.00	0.00	0.00	0.00	0.00
34	0.00	0.00	0.00	0.00	0.00	0.00
35	0.00	0.00	0.00	0.00	0.00	0.00
36	0.97	0.00	0.80	0.00	0.89	0.00
37	3.45	8.16	2.60	7.27	3.03	7.74
38	4.05	9.06	3.15	7.89	3.60	8.49
39	4.55	10.75	3.50	10.28	4.03	10.52
40	5.75	14.08	3.95	13.66	4.85	13.87
41	6.45	17.05	5.00	16.10	5.73	16.60
42	7.80	16.93	7.05	16.00	7.43	16.48
43	9.20	17.48	9.40	17.78	9.30	17.62
44	10.25	15.48	9.87	18.73	10.06	16.89
45	10.80	16.45	10.20	17.43	10.50	16.94
46	12.00	16.44	10.95	18.24	11.48	17.26
47	11.50	21.93	10.05	20.41	10.78	21.17
48	8.50	25.20	7.80	22.27	8.15	23.76
49	6.65	19.31	6.05	19.42	6.35	19.37
50	4.80	19.43	4.10	15.57	4.45	17.50
51	2.90	10.66	2.70	13.18	2.80	11.82
52	2.10	5.74	1.65	5.97	1.88	5.83
1	1.05	4.16	0.95	5.35	1.00	4.60
2	0.40	3.34	0.30	3.21	0.35	3.29
3	0.55	2.96	0.30	2.50	0.43	2.77
4	0.40	3.52	0.25	2.05	0.33	2.79
5	0.20	1.07	0.15	2.17	0.18	1.62
6	0.10	2.30	0.05	1.76	0.08	2.03

7	0.15	0.61	0.00	0.00	0.08	0.30
8	0.00	0.00	0.00	0.59	0.00	0.31
9	0.05	0.00	0.00	0.00	0.03	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00
Seasonal Mean	3.82	13.90	3.36	14.23	3.59	14.05

Table 2: Surveillance of natural enemies in Bt Cotton

Meteorological Standard Week (MSW)	2016-17			2017-18			Pooled		
	Coccinellids	Chrysoperla	Spiders	Coccinellids	Chrysoperla	Spiders	Coccinellids	Chrysoperla	Spiders
33	0.20	0.00	0.00	0.20	0.00	0.00	0.20	0.00	0.00
34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	0.20	0.00	0.00	0.20	0.00	0.00	0.20	0.00	0.00
36	0.00	0.20	0.00	0.42	0.20	0.20	0.21	0.20	0.10
37	0.42	0.00	0.00	0.60	0.00	0.20	0.51	0.00	0.10
38	0.38	0.20	0.50	0.58	0.20	0.62	0.48	0.20	0.56
39	0.40	0.20	0.90	0.46	0.34	0.92	0.43	0.27	0.91
40	0.62	0.68	1.00	0.62	0.68	0.84	0.62	0.68	0.92
41	0.58	1.15	1.00	0.68	1.16	0.98	0.63	1.16	0.99
42	0.70	1.26	1.50	0.60	1.28	1.18	0.65	1.27	1.34
43	0.76	0.80	1.10	0.72	0.80	1.20	0.74	0.80	1.15
44	0.62	0.92	1.40	0.58	0.95	1.80	0.60	0.94	1.60
45	0.80	1.01	1.10	0.74	1.02	1.02	0.77	1.02	1.06
46	0.68	0.48	1.30	0.62	0.62	1.22	0.65	0.55	1.26
47	0.93	0.93	1.00	0.98	0.92	1.12	0.96	0.93	1.06
48	0.90	0.60	1.50	1.12	0.60	0.92	1.01	0.60	1.21
49	1.12	0.56	0.80	1.20	0.48	0.76	1.16	0.52	0.78
50	0.98	0.34	1.00	0.94	0.42	0.98	0.96	0.38	0.99
51	1.30	0.38	0.40	0.98	0.36	0.62	1.14	0.37	0.51
52	1.28	0.36	0.50	0.86	0.40	0.54	1.07	0.38	0.52
1	1.18	0.25	0.30	0.63	0.34	0.40	0.91	0.30	0.35
2	1.06	0.20	0.50	0.78	0.42	0.62	0.92	0.31	0.56
3	0.83	0.36	0.20	0.68	0.38	0.20	0.76	0.37	0.20
4	0.80	0.00	0.20	0.62	0.40	0.20	0.71	0.20	0.20
5	0.76	0.00	0.00	0.72	0.20	0.00	0.74	0.10	0.00
6	0.93	0.00	0.00	0.68	0.00	0.00	0.81	0.00	0.00
7	0.40	0.00	0.00	0.40	0.00	0.00	0.40	0.00	0.00
8	0.55	0.00	0.00	0.55	0.00	0.00	0.55	0.00	0.00
9	0.20	0.00	0.00	0.38	0.00	0.00	0.29	0.00	0.00
10	0.20	0.00	0.00	0.20	0.00	0.00	0.20	0.00	0.00
Seasonal Mean	0.66	0.36	0.54	0.62	0.41	0.55	0.64	0.38	0.55

Table 3: Simple correlation and regression for mirid bug, *P. biseratense* with natural enemies and weather parameters (pooled)

	Correlation								R^2	Regression Equation
	Max. Temp	Min. Temp	RH Max	RH Min	Rainfall	Natural enemies/ plant				
						Coccinellids	Chrysoperla	Spiders		
Mean No. of mirid bugs/5 squares	-0.127	-0.015	0.185	0.173	-0.007	0.380*	0.823**	0.912**	85.40	$Y= -9.418 + 0.218 X_1 + 0.325 X_2 - 0.115 X_3 + 0.092 X_4 - 0.047 X_5 + 0.916 X_6 + 0.721 X_7 + 6.573 X_8$

References

1. Bhute NK, Bhosle BB, Bhede BV, More DG. Seasonal incidence of major sucking insect pests of Bt cotton and their natural enemies in Marathwada region, J Cotton Res. Dev. 2012; 26(2):238-242.
2. Hargreaves H. List of recorded cotton insects in the world, Harrisson and Sons Commonwealth. Inst, Ento., London: 1948, 50
3. Harish KMB. Dynamics and management of sucking pest complex in Bt cotton. M.Sc (Agri) Thesis, Uni. Agric. Sci., Dharwad, 2015.
4. Hosseini SM, Asadi HB, Kaunail K, Shojaii M, Hadi-ostvan. Study on bio-ecology of cotton shedder bug *Creontia despallidus* (Rambur). (Heteroptera: Miridae) in cotton fields of Khorassan. Iran J Agric. Sci. 2002; 8(2):9-10.
5. Patil BV, Bheemanna M, Patil SB, Udikeri SS, Hosmani A. Record of mirid bug, *Creontia desbiseratense* (Distant) on cotton from Karnataka, India. Insect Environ. 2006; 11(4):176-177.
6. Patil SB, Udikeri SS, Vandal NB, Modagi SA, Hirekurubar RB, Guruprasad GS. Population dynamics of *Creontiades biseratense* (Distant) (Miridae: Hemiptera) on Bt cotton in Dharwad district, Karnataka J. Agric. Sci., 2010; 23(1):157-158.
7. Prakash. Bio-Ecology and Management of Mirid Bug, *Poppiocapsidea (=Creontiades) biseratense* (Distant) (Hemiptera: Miridae) on bt cotton, M. Sc. (Agri) Thesis, Department of Agricultural Entomology, Univ. Agril. Sci., Raichur, Karnataka, India, 2012.
8. Prasad NVV, Hariprasad Rao N. Field evaluation of Bt cotton hybrids against insect pest complex under rainfed conditions, Indian J. Entomol. 2008; 70(4):330-336.
9. Ravi PR. Bio-ecology, loss estimation and management of Mirid bug, *Creontiades biseratense* (Distant)

(Hemiptera: Miridae) on Bt cotton. M. Sc. (Agri.) Thesis, Uni. Agric. Sci., Dharwad (India): 2007, 84.
10. Rohini RS, Mallapur CP, Udikeri SS. Incidence of mirid bug, *Creontiades biseratense* (Distant) on Bt cotton in Karnataka. Karnataka J. Agric. Sci. 2009; 22(3):680-681.
11. Shalini. Survey, crop loss estimation and management of mirid bug *Creontiades biseratense* (Distant) (Miridae: Hemiptera) in Bt cotton, M.Sc (Agri) Thesis, Department of Agricultural Entomology, UAS, Dharwad, Karnataka, India, 2010.
12. Udikeri SS, Kranthi S, Kranthi KR, Vandal N, Hallad A, Patil SB *et al*. Species diversity, pestiferous nature, bionomics and management of mirid bugs and flower bud maggots: the new key pests of Bt cottons, World Cotton Res. Conf. 2011; 5:203-209.
13. Udikeri SS. Mirid Menace - A potential emerging sucking pest problem in cotton. International Cotton Advisory Committee, Recorder, 2008; 26(4): p15.
14. Vinaykumar MM. Investigations on seasonal incidence and management of mirid bug, *Poppiocapsidea biseratense* Distant in Bt cotton. Ph. D Thesis, Univ. Agric. Sci., Dharwad, 2013.