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RESEARCH PAPER

An update of mirid bug infestation in *Bt* cotton fields of Haveri and Dharwad districts of Karnataka, India

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Abstract: *Mirid bug*s are important sucking *insect* pests of *Bt* cotton ecosystem in Karnataka. The substantial symptoms and damage inflicted by mirid bugs leads to significant economic losses to the cotton crop. To have an updated understanding about the pest, roving field surveys were conducted during 2023-24 in cotton ecosystem of Haveri (Ranebennur, Haveri, Bydagi, Savanur) and Dharwad (Dharwad, Hubballi, Kalaghatagi) districts, of Karnataka. The highest number of mirid bug incidence, square shedding, boll shedding, parrot beaked bolls and bolls with scars were noted in Haveri district (5.10 ± 2.52 bugs/ 5 squares), (1.90± 1.67 squares/plant), (1.54± 0.38 bolls/plant), (3.14± 0.75 bolls/plant) and (4.37± 0.52 bolls/ plant), respectively. However, the incidence of the pest in Dharwad district found significantly lower than the Haveri district (3.88±2.02 bugs/ 5 squares), (1.02±0.82 squares/plant), (0.89±0.29 bolls/plant), (2.38 ± 0.13 bolls/plant) and (3.07± 0.53 bolls/plant). Among different taluks, Haveri taluk cotton fields exhibited the highest incidence, followed by Byadagi and the lowest incidence was observed in Kalghatagi taluk. Across various cotton cultivars, the highest mirid bug incidence and associated damage was recorded in BGII cotton hybrid MRC-7351, while the lowest in US-7067. These findings underscore the necessity for targeted pest management strategies in cotton ecosystems to mitigate mirid bug incidence effectively.

Key words: Boll, Cotton, Mirid bug, Parrot beaking, Scar, Square shedding

Introduction

Cotton (*Gossypium* spp.), is a natural fiber and cash crop which plays a crucial role in the global economy and society. It contributes about 22 per cent of global cotton production. India ranked second in cotton production in 2023-24, with 323.11 lakh bales and a productivity of 441 kg/ha (AICRP on Cotton, 2024).

Large scale cultivation of *Bt* cotton in 2002 marked a transformative period, enhancing yields particularly against lepidopteron pests while simultaneously heightening susceptibility to sucking pests (Tabashnik *et al*., 2010). Among these, mirid bugs have emerged as a serious threat to cotton production in Karnataka, India.

The mirid bug, *Creontiades biseratense* (Distant), found appearing in Karnataka since 2005 and posing a threat to the *Bt* cotton cultivation in several parts of the state (Patil *et al.,* 2006 ; Udikeri, 2008). Additionally, this pest has been reported in Tamil Nadu, Andhra Pradesh and Maharashtra (Surulivelu and Dhara Jothi, 2007). In a short span mirid bugs could spread to many districts in Karnataka (Rohini *et al*., 2009). Further, three species of mirid bugs were found attacking *Bt* cotton in Karnataka *viz Campylomma livida* and *C. biseratense* of which *C. biseratense* was the most prevalent and serves as a key pest, especially in Karnataka (Udikeri *et al.,* 2011). *Helopeltis theivora* Waterhouse was reported infesting cotton for the first time (Dharajothi *et al.,* 2018). Additionally, *apicalis* (Fiber) also reported at Chamarajanagar (Sahana *et al.,* 2022).

In the northern part of Karnataka, particularly in the Dharwad and Haveri districts, cotton is the predominant commercial crop. Despite this, most of the cotton growers remain unaware of the mirid bug and its detrimental impact on the crop. During 2013 there was outbreak of mirid bugs in *Bt* cotton in Haveri, Davanagere districts causing heavy loss (Udikeri *et al*., 2016). After outbreak there has been much attention towards management of this pest, but continuous monitoring could not be seen. Hence, it was essential to have an update on status of mirid bug *C. biseratense* incidence in these two districts.

Material and methods

Roving field surveys have been conducted to know the status of mirid bugs infestation in cotton ecosystem of Haveri and Dharwad districts [Northern Transitional Zone of Karnataka, Zone-8] (Fig. 1) thrice in the cropping season during 2023-24. In Haveri district four taluks (Ranebennur, Haveri,

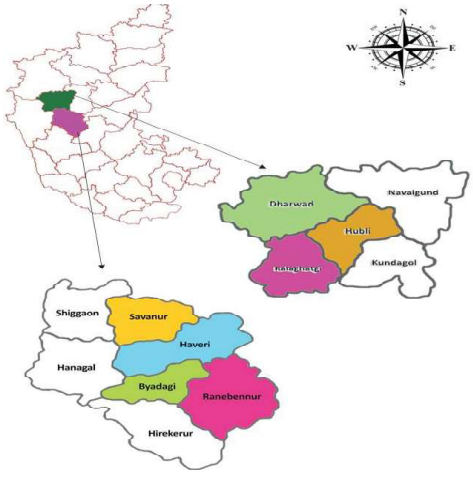

Fig 1. Field survey locations of mirid bug incidence in *Bt* cotton across Dharwad and Haveri districts of Karnataka

Table 1. Mirid bugs incidence and damage on *Bt*-cotton at different crop growth stages in Dharwad district

Taluk	Village	No. of mirid bugs/ 5 squares			No. of square shedding/ plant			No. of bolls shedding /plant		Parrot beaked bolls/plant		Bolls with scar /plant	
		S1	S2	S3	S1	S2	S3	S2	S3	S2	S3	S2	S3
Dharwad	Narendra	2.45	7.45	4.78	0.83	3.00	0.55	1.70	0.83	3.02	2.89	4.30	3.50
	Amminabhavi	2.15	6.98	4.08	0.61	2.50	0.74	1.45	0.78	2.92	2.55	3.95	3.05
	Mean±S.D.	2.30 ± 0.21	7.21 ± 0.34	4.43 ± 0.49	0.72 ± 0.16	2.75 ± 0.35	0.65 ± 0.13	1.58 ± 0.18	0.81± 0.04	2.97 ± 0.07	2.72 ± 0.24	4.13± 0.25	3.28 ± 0.32
Hubballi	Hebsur	1.97	6.30	3.90	0.65	2.70	0.53	1.20	0.74	2.70	2.56	4.02	3.23
	Kusugal	2.03	5.43	3.86	0.76	2.20	0.47	0.95	0.70	2.40	2.30	3.44	2.80
Mean±S.D.		2.00 ± 0.04	5.86 ± 0.62	3.88 ± 0.03	0.71 ± 0.08	2.45 ± 0.35	0.50 ± 0.04	1.08 ± 0.18	0.72 ± 0.03	2.55 ± 0.21	2.43 ± 0.18	3.73 ± 0.41	3.02± 0.30
Kalaghatagi	Dhumavada	1.63	5.23	3.03	0.37	0.76	0.39	0.58	0.47	2.20	1.92	2.87	2.00
	Junjanbail	1.43	4.45	2.67	0.39	0.66	0.26	0.68	0.58	1.60	1.50	2.10	1.60
Mean±S.D.		1.53 ± 0.14	4.84 ± 0.55	2.85± 0.25	0.38 ± 0.01	0.71± 0.07	0.33 ± 0.09	0.63 ± 0.07	0.53 ± 0.08	1.90 ± 0.42	1.71 ± 0.30	2.49 ± 0.54	1.80 ± 0.28
District mean±S.D		1.94 ± 0.39	5.97 ± 1.19	3.72 ± 0.80	0.60 ± 0.19	1.97 ± 1.10	0.49 ± 0.16	1.09 ± 0.47	0.68 ± 0.14	2.47 ± 0.54	2.29 ± 0.52	3.45 ± 0.86	2.70 ± 0.79
Seasonal mean±S.D		3.88 ±2.02			1.02 ±0.82			0.89 ±0.29		2.38 ±0.13		3.07 ±0.53	

S1: Square initiation S2: Peak flowering, S3: Boll maturitystage

Byadagi and Savanur) and in Dharwad three taluks (Dharwad, Hubballi and Kalaghatagi) were considered based on the area under cotton crop. Two villages were selected from each taluk. In each village two fields were surveyed for the occurrence mirid bugs.

The observations were recorded three times during cropping period starting from square initiation (S1) and peak flowering stage (S2) and boll maturity stage (S3). Population of nymphs and adults of mirid bugs were counted from five squares/plant by top canopy searching method on 20 randomly selected plants in each field. Later the population was averaged to present as number of mirid bugs per 5 per squares. Similarly, damaged fruiting structures (bolls showing parrot beaking symptoms, scars symptoms, dropped squares and dropped tiny bolls) by mirid bugs were also recorded in twenty randomly selected plant on whole plant basis.

Results and discussion

At both Dharwad and Haveri districts the incidence of mirid bug incidence began during square initiation stage and the maximum incidence was observed during peak flowering stage. Further, the population of mirid bugs and their associated damage symptoms (square shedding, boll shedding, parrot beaked boll and boll scar) appeared to be high in Haveri district compared to Dharwad district (Fig. 2).

Mirid bug prevalence was noticed in all the stages with a peak population during peak flowering stage (S2) of the crop. From Table 1 it is evident that the average mirid bug

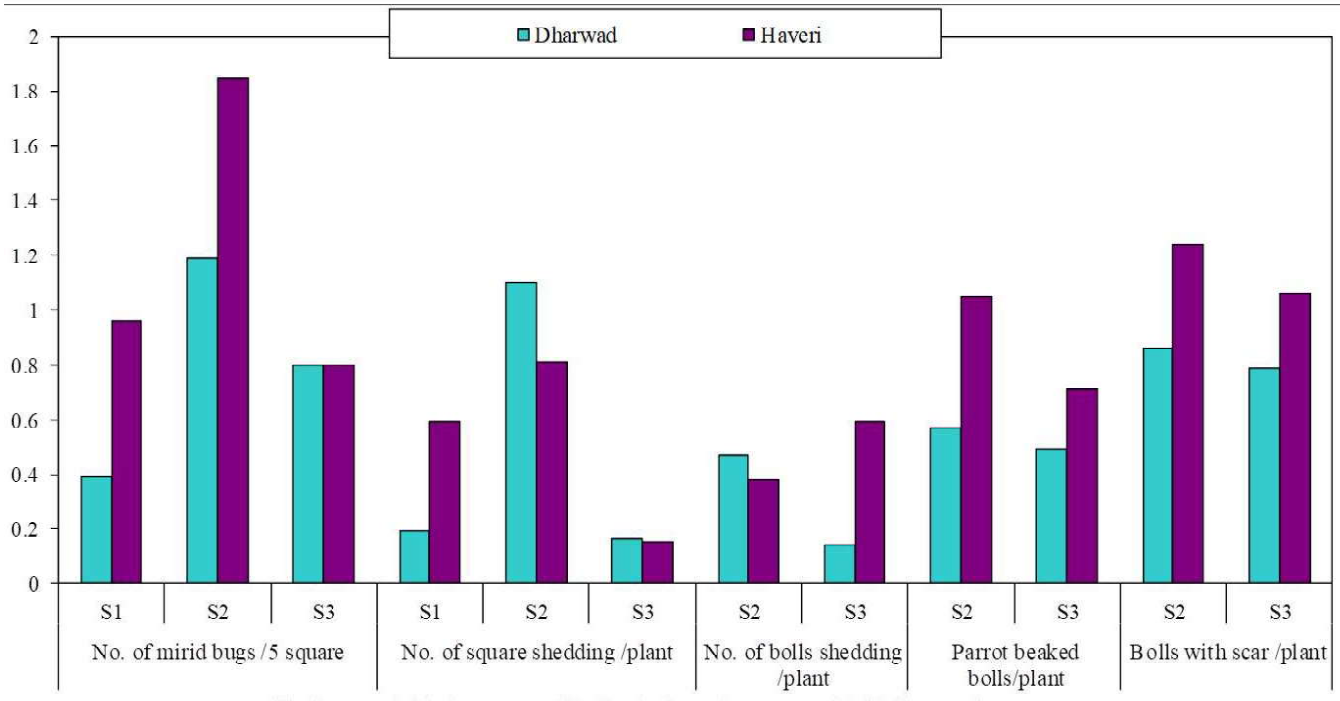

Fig 2. Mirid bugs incidence and fruiting body damage in *Bt* cotton at different stages of growth in Dharwad and Haveri districts

Table 2. Mirid bugs incidence and damage on *Bt*-cotton at different crop growth stages in Haveri district

Taluk	Village	No. of mirid bugs/ 5 squares			No. of square shedding /plant			No. of bolls shedding /plant		Parrot beaked bolls/plant		Bolls with scar /plant	
		S1	S2	S3	S1	S2	S3	S2	S3	S2	S3	S2	S3
Haveri	Karjagi	4.15	10.55	5.43	2.40	5.40	0.68	3.00	1.88	5.40	3.50	6.10	5.40
	Devgiri	3.40	8.73	4.85	2.00	3.78	0.54	2.00	1.33	4.70	3.10	5.89	5.08
	Mean±S.D.	3.78±	9.64±	5.14±	2.20±	4.59±	0.61±	2.50±	1.61±	5.05±	3.30±	6.00±	5.24±
		0.53	1.29	0.41	0.28	1.15	0.10	0.71	0.39	0.49	0.28	0.15	0.23
Byadagi	Kadaramandalagi	3.03	9.38	5.40	1.87	4.21	0.30	1.98	1.68	4.10	2.97	5.43	4.60
	Ramgondanahalli	2.95	7.55	5.08	1.32	3.32	0.32	1.42	1.32	3.30	2.30	5.15	4.23
	Mean±S.D.	2.99±	8.46±	5.24±	1.60±	3.77±	3.95±	1.55±	1.65±	3.70±	2.64±	5.29±	4.42±
		0.05	1.29	0.23	0.39	0.63	1.06	0.18	0.47	0.57	0.47	0.20	0.26
Savanur	Hattimattur	1.52	4.70	3.83	0.90	2.87	0.43	1.00	0.73	2.70	1.80	3.30	2.93
	Mantagani	1.40	5.83	3.38	0.65	2.40	0.33	1.20	0.88	2.30	1.45	2.90	2.60
	Mean±S.D.	1.46±	5.26±	3.60±	0.78±	2.64±	0.38±	0.81±	1.10±	2.50 ±	1.63 ±	3.10±	2.77±
		0.08	0.80	0.32	0.18	0.33	0.07	0.11	0.14	0.28	0.25	0.28	0.23
Ranebennur	Kakol	2.43	8.38	4.98	1.24	4.70	0.43	2.20	1.15	3.65	3.00	4.95	3.80
	Asundi	3.05	6.93	5.48	1.65	3.20	0.75	1.78	1.08	3.20	2.78	4.20	3.40
	Mean±S.D.	2.74±	7.65±	5.23±	1.45±	3.95±	0.59±	1.12±	1.99±	3.43 ±	2.89 ±	4.58±	3.60±
		0.44	1.03	0.35	0.29	1.06	0.23	0.05	0.30	0.32	0.16	0.53	0.28
District mean±S.D.		2.74±	7.75±	4.80±	1.50±	3.74±	0.47±	1.27±	1.81±	3.67 ±	2.61 ±	4.74±	4.01±
		0.96	1.85	0.80	0.59	0.81	0.15	0.38	0.59	1.05	0.71	1.24	1.06
Seasonal mean±S.D.		5.10 ±2.52			1.90 ±1.67			1.54 ±0.38		3.14 ±0.75		4.37±0.52	

S1: Square initiation S2: Peak flowering, S3: Boll maturity stage

population (3.88 bugs/5 squares) at Dharwad district. However, the highest (5.10 bugs/5 squares) seasonal mean was observed in Haveri district (Table 2). During the square initiation stage (S1), Dharwad taluk exhibited a higher mirid population (2.30 bugs/5 squares) compared to other taluks. At the peak flowering stage (S2), fields in Dharwad taluk continued to show the highest mirid population (7.21 bugs/ 5 squares). By the boll maturity stage (S3), mirid populations decreased but Dharwad taluk (4.43 bugs/5 squares) still had the highest counts while Kalaghatagi taluk recorded the lowest population.

Contrastingly in Haveri district, during the square initiation stage (S1) Haveri taluk fields appeared to bear highest (3.78 bugs/ 5 squares) mirid bugs. At the peak flowering stage (S2) field at Haveri taluk again had the highest mirid population at 9.64 bugs/5 squares followed by Byadagi taluk at 8.46 bugs/ 5 squares. By the boll maturity stage (S3) mirid populations had declined. Cotton fields at Byadagi and Ranebennur taluk had the highest counts at 5.24 and 5.23 bugs / 5 squares, respectively. While fields at Savanur taluk recorded the lowest population in all three stages compared to other taluks.

The damaged fruiting body structures observed to be directly related to the intensity of mirid bug infestation observed during growth stages in all locations. Damage symptoms were most pronounced during the peak flowering stage in all the places as presented in Table 1and Table 2

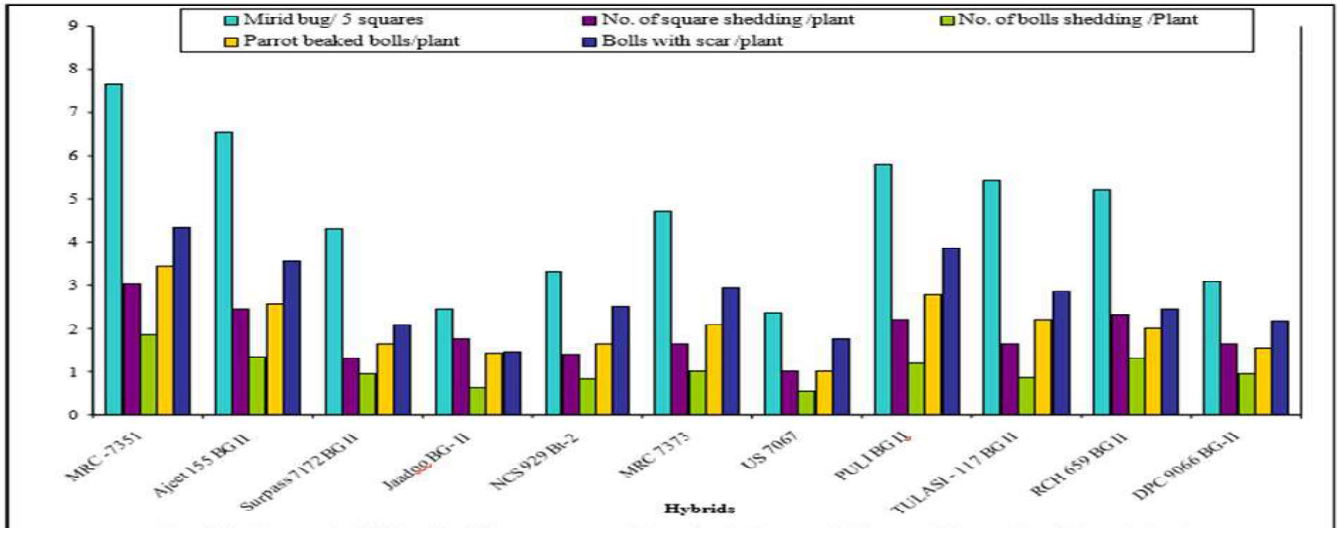

Fig 3. Incidence of mirid bug in different cotton cultivars in the farmers field across Dharwad and Haveri district

Table 3.Incidence of mirid bugs in different cotton cultivars in farmer's fields of Dharwad and Haveri districts

Hybrids	Mirid bug/5 squares	No. of square shedding /plant	No. of bolls shedding /Plant	Parrot beaked bolls/plant	Bolls with scar /plant
MRC -7351	7.65±1.64	3.02±0.65	1.89±0.84	3.45±0.27	4.34±0.56
Ajeet 155 BG II	6.54±2.14	2.44±0.87	1.34±0.64	2.56±0.22	3.56±0.33
Surpass 7172 BG II	4.29±0.52	1.32±0.57	0.97±0.61	1.67±0.44	2.10±0.95
Jaadoo BG- II	2.45±0.77	1.76±0.29	0.63±0.43	1.43±0.21	1.45±0.29
NCS 929 *Bt*-2	3.30±1.69	1.42±0.42	0.86 ±0.54	1.65±0.45	2.50±1.04
MRC 7373	4.73±2.12	1.65±0.23	1.02±0.64	2.10±0.22	2.96±0.29
US 7067	2.38±1.66	1.02±0.17	0.56±0.20	1.02±0.15	1.78±0.28
PULI BG II	5.78±1.66	2.21±0.32	1.22±0.67	2.78±0.11	3.87±1.76
TULASI - 117 BG II	5.43±0.25	1.66±0.83	0.88±0.10	2.20±0.23	2.87±0.87
RCH 659 BG II	5.21±0.08	2.32±0.78	1.32±0.33	2.02±0.45	2.44±0.54
DPC 9066 BG-II	3.09±0.18	1.67±0.32	0.98±0.32	1.54±0.62	2.18±0.34

Haveri district exhibited significantly higher levels of damage across all stages with an average of 1.90 squares shedding per plant, 1.54 bolls shedding per plant, 3.14 parrot beaked bolls per plant and 4.37 scarred bolls per plant. In Haveri district Haveri taluk had the highest fruiting body damage followed by Byadagi taluk. In comparison, fields at Dharwad district experienced lower levels of damage with an average of 1.02 squares shedding per plant 0.89 bolls shedding per plant, 2.38 parrot-beaked bolls per plant and 3.07 scarred bolls per plant. In Dharwad district, Dharwad taluk had the highest fruiting body damage as compare to other taluks.

Among the different BG-II *Bt* cotton cultivars (Table 3) MRC-7351 suffered with the higher mirid bug infestation and damage (average of 7.65 bugs/ 5 squares), square shedding (3.02), boll shedding (1.89), parrot-beaking (3.45) and bolls with scars (4.34) per plant. In contrast US 7067 had relatively lower incidence of mirid bugs (2.38 bugs/ 5 squares) with a least damage (1.02 square shedding/plant), (0.56 boll shedding per plant), (1.02 parrot-beaked bolls/plant) and (1.45 bolls with scars /plant) (Fig. 3). MRC-7351 has been highly susceptible to mirid bug infestation and reported by Udikeri *et al.* (2011), Prakash *et al.* (2013) and Rohith (2014) but still remains to widely cultivated probably due to high yielding, genetic potential. Lower incidence in US 7067 could be due to its lower cultivation by farmers and definitely not because of any type of resistance.

The higher incidence of mirid bug and damage in cotton fields at Haveri district in comparison to Dharwad district could be attributed to several factors. It might be due to large area under *Bt* cotton cultivation, staggered sowing and also cultivation of MRC-7351 cultivar by majority of the farmers. The observed severity has been thus due to variation in the local growing conditions across geographic locality in the district and availability of suitable environmental conditions for multiplication of mirid bug.

The staggered and continuation of cotton crop must have supported the sustained bug population in Haveri and Dharwad this is evidenced by higher square and boll shedding Vinaykumar (2013).

The current results are in concord with those of Udikeri *et al.* (2009) and Manohar *et al.* (2012) who reported that the population of mirids was more in Haveri (43.85 bugs/25 squares). Rohini *et al.* (2009), Vinaykumar (2013), Udikeri *et al.* 2016 and Vinayaka (2019) were also noticed that mirid incidence, square shedding and boll shedding was more in Haveri district followed by Dharwad.

However, the severity of infestation of mirid bugs and their damage appeared to be lower than that of 2013 outbreak. It indicates farmers have awareness about mirids as key pests of cotton now and prefer to check it. Acephate 75 SP, Profenophos 50 EC and Fipronil 5 SC have been recommended earlier with an ETL of 5 bugs/plant (Udikeri *et al.,* 2011, 2016). Along with it has been evident through present study that combination products *viz.,* Acephate 50 +Bifenthrin 10 WDG, Fipronil 4 + Acetamiprid 4 SC and Profenophos 40 EC +Fenpyroximate 2.5 EC are being used to check mirid bug incidence.

Conclusion

Field observation of 2023-24 season confirms persisting and widespread infestation mirid bug *C. biseratense* in *Bt* cottons grown in Haveri and Dharwad districts. The incidence and damage is more in Haveri district. The pest though appears to be at check, warrants continuous monitoring and specific management strategies.

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