

Occurrence of insect pests and activity of selected natural enemies on sugarcane crop in Northern dry zone of Karnataka

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ABSTRACT

Studies showed the evidences of high populations of pests on sugarcane viz., early shoot borer (*Chilo infuscatellus* Snell), root grub (*Holotrichia serrata* Fabricus), woolly aphid (*Ceratovacuna lanigera* Zehnter), scale on sugarcane during 2014. Generally, the incidence of woolly aphid, scales and natural enemies was not appeared during seedling stage of crop since it require cold climate and high relative humidity (80-95) and moderate temperature (19 to 30°C). Therefore more population density of woolly aphid, scales and natural enemies was gradually increased during vegetative stage. Roving survey indicated that, higher dead heart percent damage of early shoot borer was recorded in Athani while, lower population of early shoot borer was noticed in Vijayapur taluka. The lowest population of root grub was recorded in Vijayapur taluk while the highest population of root grub was recorded in Athani taluka during the Seedling stage. Similarly, the lowest population of woolly aphid was recorded in Muddebihal taluk while the highest population of woolly aphid was recorded in Athani taluka. The higher population of scales was recorded in Basavana Bagewadi talukas while lower population of scales was noticed in Bilagi taluka. Maximum population of *Micromusigoratus* and *Dipha aphidivora* was recorded in Jamakhandi and Basavana Bagewadi taluks, while minimum population of *M.igoratus* and *D. aphidivora* was recorded in Bilagi and Muddebihal talukas.

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INTRODUCTION

Sugarcane is an important cash crop in India and plays pivotal role in both agricultural and industrial economy of the country. India is one of the largest producers of sugar competing with Brazil in India.

Sugarcane is cultivated over an area of 5.35 million hectare and the production is estimated to be about 355 million tonnes with productivity of 66.36 tonnes per hectares. The country need to produce more than 320 million tonnes of sugarcane to cater to the crushing requirement of the sugar factories (Anonymous, 2013a).

Virtually there are two sugarcane belts in the country hardly distinct agro-climatic conditions. The tropical belt comprises of Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh, Gujarat and Kerala. The sub-tropical belt, where a larger part of the cane area lies, comprises of Uttar Pradesh, Punjab, Haryana, Bihar and North Eastern states. The yield levels in tropical zone are quite high (100-120 t/ha) compared to sub-tropical zone (40-50 t/ha) (Anonymous, 2013b).

Greater attention is given only in improving the sugar cane yield and not much in managing the cane trash. In India approximately 6.5 million tonnes of sugar cane trash are being produced every year and most of the residues are usually burnt in the field due to lack of proper composting techniques (Anonymous, 2013a).

In sugarcane ecosystem the pests are classified into three categories viz., internode borers, sucking pests and soil inhabiting pests. Internode borers like *Chilo infuscatellus* Snell (early shoot borer), *Scirpophaga excerptalis* Walker (top shoot borer), *Chilo sacchariphagus indicus* Kapur (internode stem borer), sucking pests are *Ceratovacuna lanigera* Zehnter (woollyaphid), *Pyrilla perpusilla* Walker (sugarcane leaf hopper), *Saccharicoccus sacchari* Cockerell (mealy bug), *Melanaspis glomeratus* Green (scale) and soil inhabiting pests like *Odontotermes obesus* Rhamb (termite) and *Holotrichia serrata* Fabricus (root grub) are the important pests of sugarcane in Indian situations (Vasantharaj and Ramamurthy, 2011).

MATERIAL AND METHODS

A roving survey was taken under from seedling to harvesting stage of Sugarcane crop in Vijayapuar, Bagalkote and Belagavi districts during 2014-15. All the five taluks of Vijayapura district (Vijayapura, Basavana-Bagewadi, Indi, Muddebihal and Sindagi) three talukas of Bagalkote district (Jamakhandi, Mudhol and Bilagi) and one taluka of Belagavi district (Athani) were surveyed two to seven villages and five crops in each of these villages were selected and from each crop twenty five plants were selected for recording the observations.

Observations were recorded at different crop growth stages of seedling (tillering), vegetative (growth) and reproductive (maturity) phase by recording the number of pests viz., early shoot borer, woolly aphid, scales and root grubs. Simultaneously observations on natural enemies were also recorded.

RESULTS AND DISCUSSION

The roving survey conducted in various villages indicated the activity of pests like early shoot borer, root grub, woolly aphid, scales and natural enemies (Table 1 and 2).

During seedling stage of the crop, the mean percentage of dead heart due to early shoot borer ranged from 4.00 to 11.2 per cent. The highest percentage of dead heart due to early shoot borer was observed in Athani (11.20%) and Mudhol taluk (10.00%). The lowest incidence of 4.00 per cent dead heart was recorded in Vijayapur taluk.

During seedling stage of the crop, the mean number of root grub ranged from 0.40 to 3.06 grubs/cm². The maximum population density of root grub was observed in Athani (3.06 grubs/cm²) and was followed by Jamakhandi (2.58 grubs/cm²). The lowest population density of 0.4 grubs/cm² was recorded in Vijayapur.

The incidence of woolly aphid, scales and natural enemies was not appeared during seedling stage of crop. Because it requires cold climate and high relative humidity (80-95) and moderate temperature (19 to 30°C). Therefore, more population density of woolly aphid, scales and natural enemies was gradually increased during vegetative stage.

During vegetative stage of the crop, the mean number of woolly aphid ranged from 15.0 to 41.10/2.5 sq.cm area. The maximum population density of woolly aphid was observed in Athani (41.10/2.5 sq.cm.) and was followed by Jamakhandi (33.00/2.5 sq.cm). The lowest population density of 16.7/2.5 sq.cm was recorded in Muddebihal and was followed by Sindagi (17/2.5 sq.cm) respectively (Table 3 and 4).

During vegetative stage of the crop, the mean number of scales ranged between 17.10 to 29.10/plant. The maximum population density of scales was observed in Basavana Bagewadi (29.10/leaf) and was followed by Mudhol (27.30/leaf). The lowest population density of scales 17.10/leaf was recorded in Bilagi and was followed by Sindagi (17.50/leaf), respectively.

During reproductive stage of the crop, the mean number of woolly aphid ranged from 10.60 to 23.50/2.5 sq.cm area. The maximum population density of woolly aphid was observed in Mudhol (23.15/2.5 sq.cm) and was followed by Muddebihal (19.10/2.5 sq.cm) and Indi (17.80/2.5 sq.cm). The lowest population density of woolly aphid 10.60/2.5 sq. cm was recorded in Vijayapur

Table 1: Incidence of different pests of sugarcane during seedling (tillering) phase in Vijayapura, Bagalakot and Belagavi district

Taluks	Villages	Early shoot borer (% dead hearts)	Root grub (grubs/sq.m)
Vijayapura	Mamadapur	5.60	0.56
	Babaleshwar	3.20	0.36
	Khatizapur	2.40	0.28
	Sangapur	4.00	0.36
	Yakkundi	4.80	1.00
	Galagali	1.60	0.24
	Savanalli	6.40	0.00
	Mean	4.00	0.4
Basavana	Kolhar	7.20	1.12
Bagewadi	Jainapur	8.00	1.08
	Kupakaddi	8.80	1.24
	Ronihal	9.60	1.42
	Nidagundi	6.40	1.72
	Mean	8.00	1.32
Sindagi	Almel	12.0	0.00
	Devaranavadagi	6.20	1.82
	Devarahippargi	7.20	1.92
	Aheri	1.60	1.36
	Malaghan	10.4	1.92
	Mean	7.48	1.40
Indi	Bhairunagi	11.2	0.00
	Chadachan	7.20	1.44
	Havinal	8.00	2.24
	Revatagoan	3.20	2.40
	Mean	7.40	1.52
Muddebihal	Kolur	9.60	2.56
	Bidarkandi	8.80	2.84
	Geddalmari	7.20	2.24
	Mean	8.53	2.54
Jamakhandi	Siddapur	10.4	2.96
	Kumbarhalla	9.60	3.16
	Jakanur	8.00	1.96
	Kankanawadi	7.20	2.24
	Mean	8.80	2.58
Mudhol	Lokapur	9.60	1.72
	Madarakhandi	10.4	3.00
	Mean	10	2.36
Bilagi	Linganal	11.2	0.00
	Teggi	6.40	1.84
	Mean	8.80	0.92
Athani	Shegunashi	12.0	2.96
	Sirahatti	10.4	3.16
	Mean	11.2	3.06

and was followed by Sindagi 11.78 /2.5 sq.cm. taluk, respectively (Table 5 and 6).

During reproductive stage of the crop, the mean number of scales ranged from 10.90 to 27.40/leaf. The maximum population density of scales was observed in Mudhol (27.40/leaf) and was followed by Athani (24.60 /leaf) taluk. The lowest population density of 10.09 /leaf was recorded in Vijayapur followed by Indi (11.80/leaf) taluk.

So, from above results it can be concluded that, occurrence of woolly aphid and scales decreased during reproductive stage. Because cane become hard and sap is not available for survival of sucking pests so reduced during reproductive stage. Athani and Basavana Bagewadi taluka recorded maximum population of woolly aphid and scales insect pests population because of more area under cultivation of sugarcane and this may be due to climatic conditions of the locations also which results in favorable condition for insect pests development.

The present investigation was closely related with earlier reporters opined that, regular surveys conducted by Mann *et al.* (2006) revealed that, sugarcane pests like, stalk borer (*C. auricilius*), top borer (*S. excerptalis*), *Pyrilla perpusilla* (*Dictyophora pallidae*) and black bug (*Cavelirus excavatus* [Cavelirus excavatus] Distant) can be considered where key pests on sugarcane while early shoot borer (*Chilo infuscatellus*), root borer (*Emmalocera depressella* [*Polyochadepressella*] Swinhoe), white grub and whitefly (*Aleurolobus barodensis*) were considered as localized pests. Rao *et al.* (2009) made roving survey in sugarcane fields both in planted and ratoon crops revealed that, among various and insect and non insect pests, early shoot borer, internode borer, scale insect and mealybugs were considered as key pests, while whitefly, pyrilla, woolly aphid, red mite, yellow mite, white grub, termites and grasshoppers as localized pests and they also opined that, the suitable surveillance periods for different sugarcane pests *i.e.* march to may for early shoot borer, mealybugs and red mite, june to august for grasshopper, internode borer and yellow mite and june to october for grasshoppers, root grub, scale insect, termites, whitefly and woolly aphid.

C. auricilius, *C. sacchariphagus*, *S. excerptalis*, *Sesamia inferens* Walker and *Tetramoeras chistaceana* Snellen (sugarcane gray borer) were the important pests and responsible for maximum dead hearts

Table 2: Incidence of different sugarcanepests during vegetative(growth) phase in Vijayapura district

Taluku	Villages	Early shoot borer (% dead hearts)	Root grub (grubs/sq.m)	Woolly aphid (2.5 cm ²)	Scale/leaf	Natural enemies/leaf	
						<i>Micromusigorotus</i>	<i>Diphaaphidivora</i>
Vijayapura	Mamadapur	0.00	0.00	27.3	15.0	3.0	1.0
	Babaleshwar	0.00	0.00	30.0	14.0	4.0	2.0
	Khatizapur	0.00	0.00	22.3	11.0	5.0	3.0
	Sangapur	0.00	0.00	26.6	21.0	1.0	1.0
	Yakkundi	0.00	0.00	27.3	23.3	2.0	2.0
	Galagali	0.00	0.00	31.6	24.3	1.0	3.0
	Savanalli	0.00	0.00	28.3	26.3	3.0	1.0
	Mean	0.00	0.00	27.6	19.2	2.71	1.85
Basavana	Kolhar	0.00	0.00	32.3	27.0	2.0	3.0
Bagewadi	Jainapur	0.00	0.00	31.6	29.0	1.0	2.0
	Kupakaddi	0.00	0.00	34.0	29.6	3.0	1.0
	Ronihal	0.00	0.00	25.0	30.0	2.0	4.0
	Nidagundi	0.00	0.00	36.6	30.3	1.0	1.0
	Mean	0.00	0.00	31.9	29.1	1.8	2.2
Sindagi	Almel	0.00	0.00	0.00	0.00	0.0	0.0
	Devaranavadagi	0.00	0.00	23.0	18.0	3.0	1.0
	Devarahippargi	0.00	0.00	26.0	19.3	2.0	2.0
	Aheri	0.00	0.00	36.0	20.6	1.0	1.0
	Malaghan	0.00	0.00	0.00	30.0	4.0	0.0
	Mean	0.00	0.00	17.0	17.5	2.0	0.8
	Indi	Bhairunagi	0.00	0.00	23.0	17.3	5.0
	Chadachan	0.00	0.00	37.0	30.6	2.0	1.0
	Havinal	0.00	0.00	38.0	31.3	1.0	1.0
	Revatagoan	0.00	0.00	16.3	15.0	1.0	2.0
	Mean	0.00	0.00	28.5	23.5	2.25	1.75
Muddebihal	Kolur	0.00	0.00	17.0	32.0	2.0	0.0
	Bidarkandi	0.00	0.00	18.0	33.0	3.0	1.0
	Geddalmari	0.00	0.00	15.3	0.00	2.0	1.0
	Mean	0.00	0.00	16.7	21.6	2.3	0.6

Table 3 : Incidence of different sugarcanepests during vegetative (growth) phase in Bagalakot and Belagavi district

Taluku	Villages	Early shoot borer (% dead hearts)	Root grub (grubs/sq.m)	Woolly aphid (2.5 cm ²)	Scales\ leaf	Natural enemies/ leaf	
						<i>Micromusigorotus</i>	<i>Diphaaphidivora</i>
Jamakhandi	Siddapur	0.00	0.00	39.0	23.3	4.0	2.0
	Kumbarhalla	0.00	0.00	43.0	34.0	2.0	1.0
	Jakanur	0.00	0.00	35.0	34.3	1.0	1.0
	Kankanawadi	0.00	0.00	15.0	0.00	4.0	0.0
	Mean	0.00	0.00	33.0	22.9	2.75	1.0
Mudhol	Lokapur	0.00	0.00	17.0	28.0	2.0	2.0
	Madarakhandi	0.00	0.00	42.0	26.6	1.0	1.0
	Mean	0.00	0.00	29.5	27.3	1.5	1.5
Bilagi	Linganal	0.00	0.00	23.0	34.3	1.0	1.0
	Teggi	0.00	0.00	28.3	0.00	1.0	1.0
	Mean	0.00	0.00	25.6	17.1	1.0	1.0
Athani	Shegunashi	0.00	0.00	41.6	0.00	3.0	2.0
	Sirahatti	0.00	0.00	40.6	38.0	1.0	1.0
	Mean	0.00	0.00	41.1	19	2.0	1.5

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Table 4 : Mean incidence of districts of sugarcane pests during different stages

District	Early shoot borer (% dead hearts)			Root grub (grubs/sq.m)			Woolly aphid (2.5 cm ²)			Scales/leaf			Natural enemies/ leaf					
													<i>Micromusigorotus</i>			<i>Diphaaphidivora</i>		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Vijayapura	7.02	0.00	0.00	1.46	0.00	0.00	0.00	24.3	15.1	0.00	22.1	13.7	0.00	2.21	1.15	0.00	1.44	0.97
Bagalakote	9.20	0.00	0.00	1.95	0.00	0.00	0.00	29.3	17.8	0.00	22.4	20.1	0.00	1.75	1.25	0.00	1.16	1.00
Belagavi	11.2	0.00	0.00	3.06	0.00	0.00	0.00	41.1	14.8	0.00	19.0	24.6	0.00	2.00	1.00	0.00	1.50	1.00

Seedling stage,

Vegetative stage,

Reproductive stage

Table 5: Incidence of different sugarcane pests during reproductive (maturity) phase in Vijayapura district

Taluks	Villages	Early shoot borer (% dead hearts)	Root grub (grubs/sq.m)	Woolly aphid (2.5 cm ²)	Scale/leaf	Natural enemies/leaf		
						<i>Micromusigorotus</i>	<i>Diphaaphidivora</i>	
Vijayapura	Mamadapur	0.00	0.00	14.6	13.3	1.0	1.0	
	Babaleshwar	0.00	0.00	8.0	10.0	1.0	0.0	
	Khatizapur	0.00	0.00	0.0	11.6	0.0	1.0	
	Sangapur	0.00	0.00	9.3	0.0	1.0	0.0	
	Yakkundi	0.00	0.00	0.0	12.6	0.0	1.0	
	Galagali	0.00	0.00	21.6	14.0	2.0	1.0	
	Savanalli	0.00	0.00	21.3	15.0	2.0	2.0	
	Mean	0.00	0.00	10.6	10.9	1.0	0.8	
Basavana	Kolhar	0.00	0.00	16.6	16.0	1.0	1.0	
Bagewadi	Jainapur	0.00	0.00	20	0.00	2.0	1.0	
	Kupakaddi	0.00	0.00	0.00	16.6	0.0	0.0	
	Ronihal	0.00	0.00	21.6	20.6	2.0	1.0	
	Nidagundi	0.00	0.00	25.0	21.6	2.0	2.0	
	Mean	0.00	0.00	16.64	14.9	1.4	1.0	
	Sindagi	Almel	0.00	0.00	0.00	0.00	0.0	0.0
Sindagi	Devaranavadagi	0.00	0.00	17.3	22.6	1.0	1.0	
	Devarahippargi	0.00	0.00	23.3	17.3	2.0	2.0	
	Aheri	0.00	0.00	18.3	18.3	1.0	1.0	
	Malaghan	0.00	0.00	0.00	20.0	0.0	0.0	
	Mean	0.00	0.00	11.78	15.6	0.8	0.8	
	Indi	Bhairunagi	0.00	0.00	26.6	0.00	2.0	2.0
	Indi	Chadachan	0.00	0.00	18.0	23.0	1.0	1.0
Havinal		0.00	0.00	26.6	24.3	2.0	2.0	
Revatagoan		0.00	0.00	0.00	0.00	0.0	0.0	
Mean		0.00	0.00	17.8	11.8	1.25	1.25	
Muddebihal		Kolur	0.00	0.00	28.0	13.3	2.0	1.0
Muddebihal	Bidarkandi	0.00	0.00	29.3	15.0	2.0	1.0	
	Geddalmari	0.00	0.00	0.00	18.3	0.0	1.0	
	Mean	0.00	0.00	19.1	15.5	1.3	1.0	

in both young and mature cane. *Chilo* species (stalk borers) caused dead hearts only in young cane and later tunnel inside the cane stalks and damaged the internodes (Sallam *et al.*, 2010).

Natural enemies population:

The natural enemies *Micromusigoratus* and *Dipha aphidivora* were found in different taluks of Vijayapur, Bagalkote and Belagavi district during the survey. The population of predators was not appeared during seedling stage.

During vegetative stage of the crop, the mean number of natural enemies *Micromusigoratus* and *Dipha aphidivora* was ranged from 1.0 to 2.75 larvae/leaf and 0.6 to 2.20 /leaf. The maximum mum. The results were in agreement with the findings of Lingappa *et al.* (2004) reported that, sugarcane woolly aphid (SWA) was predated by brown lacewing (*M. igorotus* Banks) for the first time in India and elsewhere on both adult and larval stages of sugarcane woolly aphid. Each *M. igorotus* larva consumed significantly higher number of *Aphis craccivora* Koch (680.35) compared to *C. lanigera* (510.35) (Anonymous, 2006).

The results are agreement with Sharanabasappa (2007) carried a study on biointensive management of Sugarcane woolly aphid by using predator *M. igorotus*. The study on the egg laying behaviour *M. igorotus* by using different substrates under choice and no choice

condition of revealed that under choice condition using white coloured cotton wool was significantly superior in terms of egg laid. Under no choice condition the preference of white coloured cotton, white thread, black thread and cotton + woolly matter significantly superior number of egg laid. the screening of genotypes against SWA showed Co 91010 was highly resistant. The highest number of *M. igoratus* were observed in Jamakhandi (2.75 l/plant) and was followed by Vijayapur (2.71 l/leaf). The minimum number of *M. igoratus* 1.0 l/leaf was recorded in Bilagi and was followed by Mudhol (1.5 l/leaf). The maximum number of *D. aphidivora* was observed in 2.2 l/leaf followed by Vijayapur (1.85 l/leaf). The minimum number of *D. aphidivora* 0.60 l/leaf was recorded in Muddebihal and was followed by Sindagi (0.8 l/leaf), respectively.

During reproductive stage of the crop, the mean number of natural enemies *M. igoratus* and *D. aphidivora* were ranged from 0.8 to 1.5 l/leaf and 0.8 to 1.25 l/leaf. The maximum number of *M. igoratus* was observed in Bilagi (1.5 l/leaf) and was followed by Basavana Bagewadi (1.40 l/leaf). The minimum number of *M. igoratus* 0.8 l/leaf was recorded in Sindagi. The maximum number of *D. aphidivora* was observed in Indi (1.25 l/leaf). The minimum number of *D. aphidivora* 0.8 l/leaf was recorded in Sindagi and Vijayapur (0.8 l/leaf and 0.8l/leaf), respectively.

The results are in agreement with the findings of

Table 6: Incidence of different sugarcane pests during reproductive (maturity) phase in Bagalkot and Belagavi district

Taluks	Villages	Early shoot borer (% dead hearts)	Root grub (grubs/sq.m)	Woolly aphid (2.5 cm ²)	Scales/leaf	Natural enemies/ leaf	
						<i>Micromusigorotus</i>	<i>Diphaaphidivora</i>
Jamakhandi	Siddapur	0.00	0.00	30.0	20.6	2.0	2.0
	Kumbarhalla	0.00	0.00	0.00	25.0	0.0	0.0
	Jakanur	0.00	0.00	30.6	0.0	3.0	2.0
	Kankanawadi	0.00	0.00	0.00	26.0	0.0	0.0
	Mean	0.00	0.00	15.15	17.9	1.25	1.0
Mudhol	Lokapur	0.00	0.00	23.3	26.6	1.0	1.0
	Madarakhandi	0.00	0.00	23.0	28.3	1.0	1.0
	Mean	0.00	0.00	23.15	27.4	1.0	1.0
Bilagi	Linganal	0.00	0.00	30.3	0.00	3.0	2.0
	Teggi	0.00	0.00	0.00	30.0	0.0	0.0
	Mean	0.00	0.00	15.15	15.0	1.5	1.0
Athani	Shegunashi	0.00	0.00	29.6	30.6	2.0	2.0
	Sirahatti	0.00	0.00	0.00	18.6	0.0	0.0
	Mean	0.00	0.00	14.8	24.6	1.0	1.0

Lingappa *et al.* (2004), who reported that, sugarcane woolly aphid (SWA) was predated by brown lacewing (*M. igorotus* Banks) for the first time in India and elsewhere on both adult and larval stages of sugarcane woolly aphid. Further studies *M. igorotus* larva consumed significantly higher number of *Aphis craccivora* Koch (680.35) compared to *C. lanigera* (510.35) (Anonymous, 2006).

Basavaraj (2005) conducted a study on integrated management of sugarcane woolly aphid (SWA) and revealed that, the effect of insecticides on the predator *Diphaaphidivora* showed dichlorvos @ 0.076% was highly toxic and IPM (integrated pest management) module 1 comprising malathion 50 EC @ 2ml/l, paired row planting, application of fertilizer @ 250:75:185 kg NPK /ha, phorate 10 G @ 25 kg/ha at 150 days after planting was proved economically viable and ecofriendly amenable IPM model.

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