



E-ISSN: 2320-7078

P-ISSN: 2349-6800

[www.entomoljournal.com](http://www.entomoljournal.com)

JEZS 2020; 8(4): 2100-2104

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Received: 08-05-2020

Accepted: 10-06-2020

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## Seasonal incidence of phytophagous mites infesting different varieties of sugarcane crop (*Saccharum officinarum*: Poaceae)

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### Abstract

A study was conducted to know the incidence of phytophagous mite pests on different varieties of sugarcane crop viz., Co 86032, Co 62175, CoVC 99463, Co 419, Co 8371, CoM 0265, Co 92005, Co 7804 and VCF 0517, at ZARS, V. C. Farm, Mandya. Sugarcane crop was known to be attacked by three important phytophagous mites during its life cycle. These include, a red spider mite *Oligonychus indicus* (Family: Tetranychidae), sugarcane rust mite *Abacarus sacchari* and sugarcane blister mite *Aceria sacchari* (Family: Eriophyiidae). The incidence and abundance of *Oligonychus indicus* was observed from 30 days after planting and continued up to 120 days in all the varieties. Co 419 was found to be highly susceptible and Co 0323 harbored lowest population of *Oligonychus indicus*. The incidence of sugarcane rust mite, *Abacarus sacchari* was initiated from 90 days *i.e.* third month after planting and remained till 250 days after planting. The high incidence was recorded in VCF 0517 and lowest in Co 0323. Likewise, the incidence of sugarcane blister mite, *Aceria sacchari* was observed from 90 days after planting upto harvest of the crop. The varieties, Co 419, Co 62175 and Co 8371 had more blister counts and the varieties, Co 0323 and Co 92005 had less number of blister counts. During the study period, these phytophagous mites were known to be suppressed by the different natural enemies which include phytoseiid mites (*Amblyseius spp.*, *Neoseiulus longispinosus* and *Euseius spp.*), predatory coccinellids (*Stethorus spp.*) and predatory thrips (*Scolothrips rhagebianus*)

**Keywords:** Sugarcane varieties, *oligonychus indicus*, *abacarus sacchari*, *aceria sacchari*, natural enemies

### Introduction

Sugarcane is an important commercial crop of Indian agriculture and is grown extensively throughout the world. The hostile climate characterized by seasonal extremities supports moderate crop growth but high pest abundance. Insect pests attack sugarcane from planting to harvest and these include borers, sucking pests, defoliators, subterranean pests. Likewise, sugarcane crop is also attacked by a variety of phytophagous mites<sup>[2]</sup> belonging to the families Tetranychidae, Tarsonemidae and Eriophyiidae and are considered as minor pests<sup>[9]</sup>. About 30 species of phytophagous mites have been reported attacking sugarcane<sup>[3]</sup>. Among these, *Oligonychus indicus*, *Aceria sacchari* and *Abacarus sacchari* are known to cause considerable damage to the sugarcane crop. Therefore, the management efficiency can be enhanced by understanding the population dynamics at critical stages of different sugarcane varieties and meticulously analysis could be done to reduce unnecessary application of insecticides.

### Material and methods

#### Monitoring of *Oligonychus indicus* (Tetranychidae: Acarina) and *Abacarus sacchari* (Eriophyiidae: Acarina)

The present investigations were carried out at College of Agriculture, Mandya, Karnataka during 2016. Geographically, Mandya is situated in Southern dry region (Zone-6) of Karnataka at 12° 32' N latitude, 76° 53' E longitude and 690 m above mean sea level. The average annual rainfall is 751 mm confined to monsoon from June to November with occasional showers in pre-monsoon period (March-May). The maximum rainfall was received in September and October months. The mean maximum temperature and minimum temperature varies between 28-35°C and 14-16° C, respectively.

The sugarcane varieties planted in three different months were used for the observation. Nine sugarcane varieties viz., Co 86032, Co 62175, CoVC 99463, Co 419, Co 8371, CoM 0265, Co

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92005, Co 7804 and VCF 0517 were planted in January 2016 at Zonal Agriculture Research Station, V C Farm, Mandya. Again, seven sugarcane varieties viz., Co 62175, Co 86032, Co 419 Co 92005, Co 7804, CoVC 99463 and VCF 0517 were planted in February 2016 and later eight sugarcane varieties viz., Co 86032, Co 62175, CoVC 99463, Co 419, Co 8371, CoM 0265, Co 0323 and VCF 0517 were planted in March 2016. All agronomic practices were carried out as per the package of practice recommended for sugarcane cultivation by UAS, Bangalore [1]. The population of sugarcane spider mites, *O. indicus* and *Abacarus sacchari* were monitored on these varieties.

The crop was cultivated by following all the recommended practices except the plant protection measures. The crop was allowed for natural infestation of the mites. The observations on the presence of phytophagous mites and their predators were taken at fortnightly interval starting from 30 days after planting.

To record the number of mites, 5 sugarcane plants were selected randomly from each variety. From each plant, 3 leaves one each from the top, middle and bottom were collected. The leaves were brought to the laboratory in labeled polyethylene covers and the stem end of the leaves was firmly tied by a rubber band. In the laboratory, the number of active stages of *O. indicus* and *Abacarus sacchari* on each leaf was counted under stereo binocular microscope. From each leaf, the observations were made at three different spots of 2 cm<sup>2</sup> size and the number of active stages was recorded and finally the mite population was expressed as the mean number per 2 cm<sup>2</sup> of leaf area. The number of phytoseiid predatory mites, predatory thrips and predatory coccinellids on entire leaf was also recorded simultaneously.

The weather parameters viz., maximum and minimum temperature (°C), rainfall (mm) was recorded with the help of meteorological observatory at College of Agriculture, V C Farm, Mandya during the period of investigation to know the influence of weather parameters on the population dynamics.

#### Monitoring of blister mite, *Aceria sacchari* (Eriophyiidae: Acarina)

The eriophyid mite was found to feed on the inner side of the leaf sheath and form a circular blotch on the leaf sheath. The incidence of blister mite was monitored in the same varieties used for monitoring *O. indicus* at Zonal Agriculture Research

Station, V C Farm, Mandya. The observation was recorded on the presence of number of young blisters found on the leaf sheath from 10 randomly selected canes and was expressed as an average number of blisters per cane.

## Results and discussion

### Incidence of the sugarcane spider mite, *O. indicus*:

Initially, the red spider mite, *Oligonychus indicus* incidence and abundance was observed from 30 days after planting and continued up to 120 days after planting in all the varieties. The peak activity of *O. indicus* was found to be abundant in the crop planted during January and the activity of mites was very low when sugarcane was planted in the month of March. Among the varieties, the variety Co 419 planted in the month of January harboured more number of mite population in the month of March (1.67 active stages/2 cm<sup>2</sup> leaf area) while the same variety when planted in the month of February had moderate level of incidence but reached its peak during April (1.56 active stages/2 cm<sup>2</sup> leaf area). When the planting was carried out in the month of March, the activity of mites still reduced and the buildup of population was found to be very less in April (0.22 active stages/2 cm<sup>2</sup> leaf area). This trend was followed in almost all the varieties. Thus, the population was found to be highest in the crop planted during January compared to February and March plantings (Table 1, 2 and 3). These results were similar to the findings of Gubbaiah and Chakravarthy (2002) [5], where they reported moderate levels of incidence of *Oligonychus sp.* on sugarcane from Mandya region and they also found the unusual outbreak of mite on Co 419, Co 8371 and Co 62175 in Mandya with the peak activity in the month of May, but in the present investigation the peak activity was noticed between February to April which was due to the early occurrence of pre-monsoon showers. Lal (1982) [7] also found that peak activity of spider mites from January to April. The population of *O. indicus* was practically very low or absent from June to December and there after gradual increase in the incidence was noticed.

There was a linear relationship between the mite population and abiotic factors that showed a negative correlation with the relative humidity, rainfall and number of rainy days but showed positive relation with the maximum temperature. From this it was found that abiotic factors play a major role on the incidence and abundance of the mite, *O. indicus* in sugarcane (Table 4).

**Table 1:** Incidence of *Oligonychus indicus* on different sugarcane varieties when planted during January 2016

Sugarcane varieties	February	March	April	May	June	Average
Co 62175	0.00	0.89	0.31	0.02	0.00	0.24
Co 86032	0.67	0.62	0.08	0.01	0.05	0.29
CoVC 99463	0.00	1.07	0.26	1.00	0.00	0.47
Co 419	0.23	1.67	0.25	0.03	0.00	0.44
VCF 0517	0.13	1.06	1.55	0.03	0.00	0.55
Co 7804	0.00	0.13	0.43	0.07	0.00	0.13
Co 92005	0.03	0.26	0.07	0.00	0.00	0.07
CoM 0265	0.00	0.19	0.07	0.00	0.00	0.05
Co 8371	0.20	1.53	0.43	0.00	0.00	0.43
Co 0323	0.03	0.00	0.00	0.00	0.00	0.006
Average	0.129	0.742	0.345	0.113	0.005	

**Table 2:** Incidence of *Oligonychus indicus* on different sugarcane varieties when planted during February 2016

Sugarcane varieties	March	April	May	June	Average
Co 62175	0.89	0.31	0.03	0.00	0.31
Co 86032	0.15	0.46	0.04	0.00	0.16
CoVC 99463	1.07	0.26	0.00	0.00	0.33
Co 419	0.76	1.56	0.27	0.01	0.65
VCF 0517	0.81	0.18	0.07	0.00	0.27
Co 7804	0.19	0.60	0.00	0.00	0.20
Co 92005	0.08	1.38	0.00	0.00	0.37
CoM 0265	0.02	0.00	0.00	0.00	0.005
Co 8371	0.00	0.00	0.00	0.00	0.00
Co 0323	0.00	0.00	0.00	0.00	0.00

**Table 3:** Incidence of *Oligonychus indicus* on different sugarcane varieties when planted during March 2016

Sugarcane varieties	April	May	June	July	Average
Co 62175	0.48	0.20	0.03	0.00	0.18
Co 86032	0.23	0.05	0.00	0.00	0.07
CoVC 99463	0.16	0.00	0.00	0.00	0.04
Co 419	0.22	0.13	0.00	0.00	0.09
VCF 0517	0.89	0.02	0.00	0.00	0.22
Co 7804	0.00	0.00	0.00	0.00	0.00
Co 92005	0.00	0.00	0.00	0.00	0.00
CoM 0265	0.02	0.00	0.00	0.00	0.005
Co 8371	0.60	0.00	0.00	0.00	0.15
Co 0323	0.03	0.00	0.00	0.00	0.007

**Table 4:** Correlation between weather parameters and incidence of sugarcane spider mite, *O. indicus* and its predators

Weather parameters	Correlation with adults of <i>O. indicus</i>	Correlation with predators		
		Mites	Coccinelids	Thrips
No. of rainy days	-0.50*	-0.50*	-0.41	-0.36
Rainfall (mm)	-0.36	-0.36	-0.30	-0.26
Morning Relative humidity (%)	-0.49*	-0.43	-0.34	-0.35
Afternoon Relative humidity (%)	-0.10	-0.15	-0.24	-0.15
Max. Temperature (°C)	0.49*	0.50*	0.45	0.42
Min. Temperature (°C)	-0.62*	-0.61*	-0.47	-0.38
Sunshine hours day <sup>-1</sup>	0.32	-0.03	-0.36	0.37

\*Correlation is significant at 0.05 level

#### Incidence of sugarcane rust mite, *Abacarus sacchari*

The incidence of sugarcane rust mite, *Abacarus sacchari* was initiated from 90 days i.e. third month after planting and remained till 250 days after planting. When sugarcane was planted in the summer months, incidence was found to begin in the month of April i.e., 90 days after planting and attained its peak in the month of May-June i.e., from 150 to 180 days after planting. *A. sacchari* infestation was present in all the ten varieties, but the level of incidence varied among the varieties. Among the ten varieties, the high incidence was

recorded in VCF 0517 (1.67 mites/2 cm<sup>2</sup> leaf area) and lowest in Co 0323 (0.02 mites/2 cm<sup>2</sup> leaf area) (Table 5). This mite is gaining importance because of introduction of the variety VCF 0517 in the Mandya region. The population of this mite fluctuates throughout the cropping season. A little work on this mite was done in United States and they found that the symptoms on sugarcane cultivar were specific and the population was found throughout the year (Nuessly *et al.*, 2015) [6].

**Table 5:** Incidence of *Abacarus sacchari* on different sugarcane varieties planted during January 2016 at V. C. Farm, Mandya

Month	Varieties	VCF 0517	CoVC 99463	CoM 0265	Co 0323	Co 92005	Co 86032	Co 8371	Co 7804	Co 62175	Co 419
	Interval	No. per 2 cm <sup>2</sup> area of leaf									
March	First fortnight	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Second fortnight	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
April	First fortnight	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
	Second fortnight	3.31	0.06	0.00	0.00	0.11	0.28	0.33	0.00	0.13	0.82
May	First fortnight	2.40	0.22	0.08	0.02	0.11	0.00	0.00	0.00	0.00	0.02
	Second fortnight	6.91	0.85	0.48	0.06	0.75	0.62	1.93	0.55	0.26	2.42
June	First fortnight	2.46	0.26	0.06	0.10	0.08	0.48	0.28	0.62	0.26	0.97
	Second fortnight	3.82	0.26	0.06	0.09	0.28	0.44	0.57	0.22	0.13	1.22

July	First fortnight	2.06	0.98	0.15	0.08	0.31	0.44	0.56	0.10	0.42	1.04
	Second fortnight	2.11	0.53	0.11	0.00	0.11	0.28	0.44	0.13	0.84	0.88
August	First fortnight	2.56	1.01	0.56	0.00	0.08	0.04	0.53	0.25	0.22	0.97
	Second fortnight	0.62	0.28	0.26	0.00	0.13	0.51	0.44	0.20	0.15	0.13
September	First fortnight	0.11	0.03	0.00	0.00	0.00	0.42	0.08	0.04	0.08	0.12
	Second fortnight	0.23	0.06	0.06	0.00	0.00	0.53	0.13	0.04	0.08	0.17
October	First fortnight	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Second fortnight	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average		1.67	0.28	0.11	0.02	0.12	0.25	0.33	0.13	0.16	0.55

### Incidence of sugarcane sheath/ blister mite, *Aceria sacchari*

Likewise, the incidence of sugarcane blister mite, *Aceria sacchari* was observed from 90 days after planting upto harvest of the crop (Table 6). The peak incidence (3.20 blisters/cane) was noticed at 120 days *i.e* fourth month after planting. The varieties, Co 419, Co 62175 and Co 8371 had more blister counts of 2.36, 3.13 and 1.56 per cane, respectively and the varieties, Co 0323 and Co 92005 had less number of blister counts (0.09 blisters/cane) (Table 6). Puttarudraiah and Usman (1957) <sup>[10]</sup> reported the similar results and noticed this mite on sugarcane in Belgaum, Mandya and Bangalore districts. Both grown up and young canes including ratoon canes were subjected to infestation by this mite. *Aceria sacchari* is one of the lesser known pests of sugarcane so far, but it seemed to be spreading very fast. There was variation in the incidence that was observed on four varieties viz., Co 419, Co 449, Co 658 and Co 853. The

variety Co 658 had the highest incidence of blister mite followed by Co 419 while Co 449 had distinctly lower incidence and Co 853 was the least infested. It was observed that general increase in the incidence from fourth to seventh month (Cumulative count) and at tenth month the incidence was considerably low probably due to the freshly emerging leaves in the later stages of crop growth which is not being preferred by this mite.

The difference in the level of incidence of sugarcane blister mite, *Aceria sacchari* was reported in the present investigation. This may be due to altered physiological conditions of the varieties with the advancement of age has possibly influenced response to blister mite incidence. Sithanatham (1972) <sup>[11]</sup> reported that Co 419 plants which came up earlier are highly preferred due to more vigour thus better growth in early growth phase of the crop as observed at fourth month. It is thus evident that the preference varies as the crop ages by the blister mite for different varieties.

**Table 6:** Incidence of sugarcane blister mite, *Aceria sacchari* on different sugarcane varieties planted during January 2016 at V. C. Farm, Mandya

Varieties	90 DAP	105 DAP	120 DAP	135 DAS	150 DAP	165 DAP	180 DAP	195 DAP	210 DAP	225 DAP	240 DAP	255 DAP	270 DAP	Average no. of blister /cane	MAX	MIN	SD±
	No. of blister /cane																
VCF 0517	0.4	1.2	2.5	1.2	1.6	0.4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.63	2.5	0.0	0.79
CoVC 99463	0.1	1.2	2.8	1.6	1.7	0.3	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.60	2.8	0.0	0.91
Co 419	2.2	5.6	4.9	4.5	3.6	4.2	2.4	0.0	1.4	0.9	1.0	0.0	0.0	2.36	5.6	0.0	2.00
Co 62175	4.1	4.8	5.6	3.8	4.8	3.9	3.6	1.2	2.1	2.3	2.4	1.1	1.0	3.13	5.6	1.0	1.54
Co 86032	0.1	0.9	4.2	3.1	6.0	4.1	1.7	0.0	0.2	0.0	0.0	0.0	0.0	1.56	6.0	0.0	2.08
Co 8371	0.3	0.5	1.0	3.4	2.5	2.1	1.0	0.0	0.9	0.4	0.2	0.0	0.0	0.94	3.4	0.0	1.07
Co 7804	0.0	0.5	0.2	0.6	0.2	0.1	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.16	0.6	0.0	0.20
Co 92005	0.0	0.2	0.3	0.4	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.09	0.4	0.0	0.13
CoM 0265	0.0	0.0	0.1	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.09	0.6	0.0	0.20
Co 0323	0.9	0.6	0.4	0.5	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.24	0.9	0.0	0.34
Average	0.81	1.55	3.2	2.97	2.09	1.6	1.01	0.14	0.46	0.4	0.42	0.12	0.11	-	-	-	-

### Incidence of insect and mite predators on *Oligonychus indicus*

Among the predators, predatory mites were found to be dominant over the predatory thrips and coccinellids (Table: 7). A very low population of predatory coccinellids was found during the period of investigation. More number of coccinellids (0.039/leaf) were found on the varieties Co 419, Co 8371, Co 92005 and Co 62175 followed by Co 86032 (0.021/leaf). The predatory thrips were found to be high (0.095/leaf) in the variety Co 62175 followed by Co 419 (0.012/leaf) compared to other varieties. It was observed that

predatory mite population was found to be high (0.152/leaf) in VCF 0517 followed by Co 8371 (0.138/leaf). The lowest population (0.00/leaf) was found in Co 0323 and CoVC 99463. This indicates that the different planting time affects the population dynamics of red spider mites due to uncongeniality of climate conditions results in the discontinuity of food availability and to certain extent the predators play a role in keeping the population low. The pooled data on the incidence of active stages and number of eggs laid on popular sugar cane varieties at different canopy levels in sugarcane crop planted in January, February and

March 2016 are given in Table 30. Irrespective of the varieties, bottom canopy harbored maximum eggs and active stage (0.644 eggs and 0.369 active stages/2 cm<sup>2</sup> leaf area). The variety Co 419 harbored maximum population of active stages and eggs (0.64 eggs and 0.40 active stages/ 2 cm<sup>2</sup> leaf area) followed by Co 8371 (0.50 eggs and 0.33 active stages/2 cm<sup>2</sup> leaf area). Among the varieties Co 0323 harbored lowest population of active stages and eggs (0.05 eggs and 0.01 active stage/2 cm<sup>2</sup>) followed by CoM 0265 (0.05 eggs and 0.03 active stage/2 cm<sup>2</sup> leaf area). Among the predators, predatory mite population was found to be higher (0.152/leaf) in VCF 0517 followed by Co 8371(0.138/leaf). Nil population (0.00/leaf) was found in Co 0323 and CoVC 99463. Very low population of predatory coccinellids found feeding on *O. indicus* during the period of investigation. The population of predatory coccinellids ranging from zero to 0.039 coccinellids/leaf. More number of coccinellids (0.039/leaf) were found on the varieties like Co 419, Co 8371, Co 92005 and Co 62175 followed by Co 86032 (0.021/leaf). The predatory thrips were found to be high (0.095/leaf) in the variety Co 62175 followed by Co 419 (0.012/leaf) compared to all the varieties. Among the different predators, predatory mites were found to be dominant over the thrips and coccinellids.

**Table 7:** Abundance of predators on different sugarcane varieties planted during January, February and March 2016 at Zonal Agricultural Research Station, V. C. Farm, Mandya

Varieties	Predators/leaf		
	Coccinellids	Predatory Mites	Thrips
Co 62175	0.039	0.059	0.095
Co 86032	0.021	0.110	0.003
CoVC 99463	0.000	0.000	0.00
Co 419	0.039	0.079	0.012
Co 8371	0.039	0.138	0.00
Co 7804	0.000	0.125	0.00
Co 92005	0.039	0.099	0.00
Co 0323	0.00	0.00	0.00
CoM 0265	0.000	0.099	0.00
VCF 0517	0.000	0.152	0.00
Average	0.013	0.086	0.011

The results of the correlation study on the influence of abiotic factors on the predators revealed that number of rainy days and minimum temperature showed significant negative correlation ( $r = -0.50$  and  $-0.61$ ) with predatory mites whereas maximum temperature showed significant positive correlation ( $r = 0.50$ ) on the abundance of predatory mite. Likewise, the correlation study between the abiotic factors and the predatory coccinellid and thrips revealed a non-significant correlation with the abiotic factors (Table 4)

## Conclusion

Understanding the seasonal abundance and peak activity of phytophagous mites and considering the abundance of natural enemies, suitable management practices have to be meticulously designed to reduce the infestation below economic injury level. The decision of planting time can minimize the incidence of infestation. Importance should be given for the conservation of the natural enemies which indirectly maintains the quality of the canes as well maintains the environment.

## Acknowledgement

The authors gratefully acknowledge the scientists of AICRP on Sugarcane, ZARS, V. C. Farm, and Mandya for providing necessary facilities to carry out the experiments.

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