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Seasonal Incidence and Influence of Weather Factors on the Population Dynamics of Sugarcane Web Mite, *Schizotetranchyus andropogoni* Hirst on Sugarcane

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A B S T R A C T

A study was conducted to assess the population dynamics of sugarcane web mite, *Schizotetranchyus andropogoni* Hirst during June 2017 to May 2018 in field condition at Sugarcane Research Station (SRS), Cuddalore district. The population density of sugarcane web mite, *S. andropogoni* of mite touched its peak (10.45 mites / 2cm^2 area of leaf) during the first week of May 2018 (18th SMW) and the mite population declined during the first week of September 2017 (35th SMW) to last week of December 2017 (8.43 to 4.53 mites / 2cm^2 area of leaf). The web mite population had a significant positive correlation with maximum temperature (r = 0.927**), minimum temperature (r = 0.774**) and a negative correlation with relative humidity (r = -0. 729**) and rainfall (r = -0. 312*) and non-significant positive correlation with wind velocity (0.107^{NS})

Introduction

Sugarcane, *Saccharum officinarum* L. is one of the most important sources of cane sugar in the world which is cultivated in India. India is the original land of origin of *Saccharum* species. The world largest producer of sugarcane is Brazil followed by India. Sugarcane is cultivated in an area is 26.2 million ha, 1877.10 MT with the production in the world coupled with the productivity of 70.77 tonnes/ha. Whereas Indian scenario in quiet different i.e., sugarcane is cultivated in an area of 5.42 million ha, with a production of 4.11 million tonnes and a productivity of 81.50 tonnes/ha (Anonymous, 2018). The

important zones for sugarcane cultivation in India are Tropical and Subtropical regions which are grouped into five agro-climatic zones, mainly for varietal development. They are North Western Zone, North Central Zone, North Eastern Zone, Peninsular Zone and Coastal Zone. Plant-inhabiting mites are important components of agro ecosystems, and they exhibit diverse feeding habits including phytophagous, predatory, mycophagous and saprophytic species (Hoy, 2011). Sugarcane is attacked by a variety of mite species falling under the major phytophagous families *viz*., Tetranychidae, Tarsonemidae, and Eriophyoidea. In general the mites are considered as minor pests. Among these nine species of superfamily Eriophyoidea have been reported on sugarcane, they are *Abacarus delhiensis*, *A. queenslandienis*, *A. doctus*, *A. sacchari*, *Aceria sacchari*, *A. merwei*, *Cathetacarus spontaneae*, *Catarhinus sacchari* and *Diptacus sacchari* (Ozman – Sullivan *et al.*, 2006). The incidence of these mite species as pest was first recorded by Hirst (1926). Banerjee (1988) recorded *S. andropogoni* (Hirst) as a serious pest of sugarcane in India, besides several insect pests. Apart from insect pests, mites cause considerable yield loss (up to 20-30 %) on sugarcane (Ghoshal and Barman, 2012). In present investigation the population dynamics of web mite, *S. andropogoni* Hirst and influence of weather factors on mite population dynamics of sugarcane has been investigated in this study.

Materials and Methods

The influence of weather parameters on the population dynamics of *S. andropogoni* on sugarcane variety (Co 86032) was studied at Sugarcane Research Station (SRS), Cuddalore, TNAU during June 2017 to May 2018. To monitor the population fluctuation of *S. andropogoni* ten plants were tagged at random in the field and the observations of mite population was recorded three leaves. On the population was recorded at weekly interval. These were labelled and brought to the laboratory for observation and counting of mite. After that ten leaf bits were cut each measuring approximately 2 cm^2 area which were utilized for counting under a stereo zoom microscope. The weather parameters *viz*., maximum temperature (^{0}C), minimum temperature (^{0}C), relative humidity (%), rainfall (mm), wind velocity (km/hr) were gathered from the automatic weather station maintained at Sugarcane Research Station, Cuddalore. The correlation and regression was worked out based on the influence of weather factors on population density of sugarcane leaf mite adopting the method as suggested by Goulden (1972).

Results and Discussion

The field investigation revealed (Table 1) that the occurrence of sugarcane web mite, *S. andropogoni* throughout the season. However the population density ranged from 4.53 to 10.45 / 2cm^2 area of leaf, during June 2017 to May 2018. The density of mite reached its peak (10.45 mites / 2cm^2 area of leaf) during first week of May 2018 (18th SMW) which declined during first week of September 2017 (35th SMW) to last week of December 2017 (8.43 to 4.53 mites / 2cm^2 area of leaf) and this low population of mite can be attributed to the prevalence of moderate temperature (maximum and minimum) and high relative humidity coupled with high rainfall (Fig. 1).

From the present investigation, it is evident that the web mite, *S. andropogoni* population on sugarcane had a significant positive correlation with maximum temperature (r = 0.927**), minimum temperature (r = 0.774**) and a negative correlation with relative humidity (r = -0. 729**) and rainfall (r = -0. 312*) and non-significant positive correlation with wind velocity (0.107^{NS}) (Table 2).

Fig.1 Population dynamics of sugarcane web mite, *S. andropogoni* on sugarcance relation with weather paramaters (During June 2017 – May 2018)

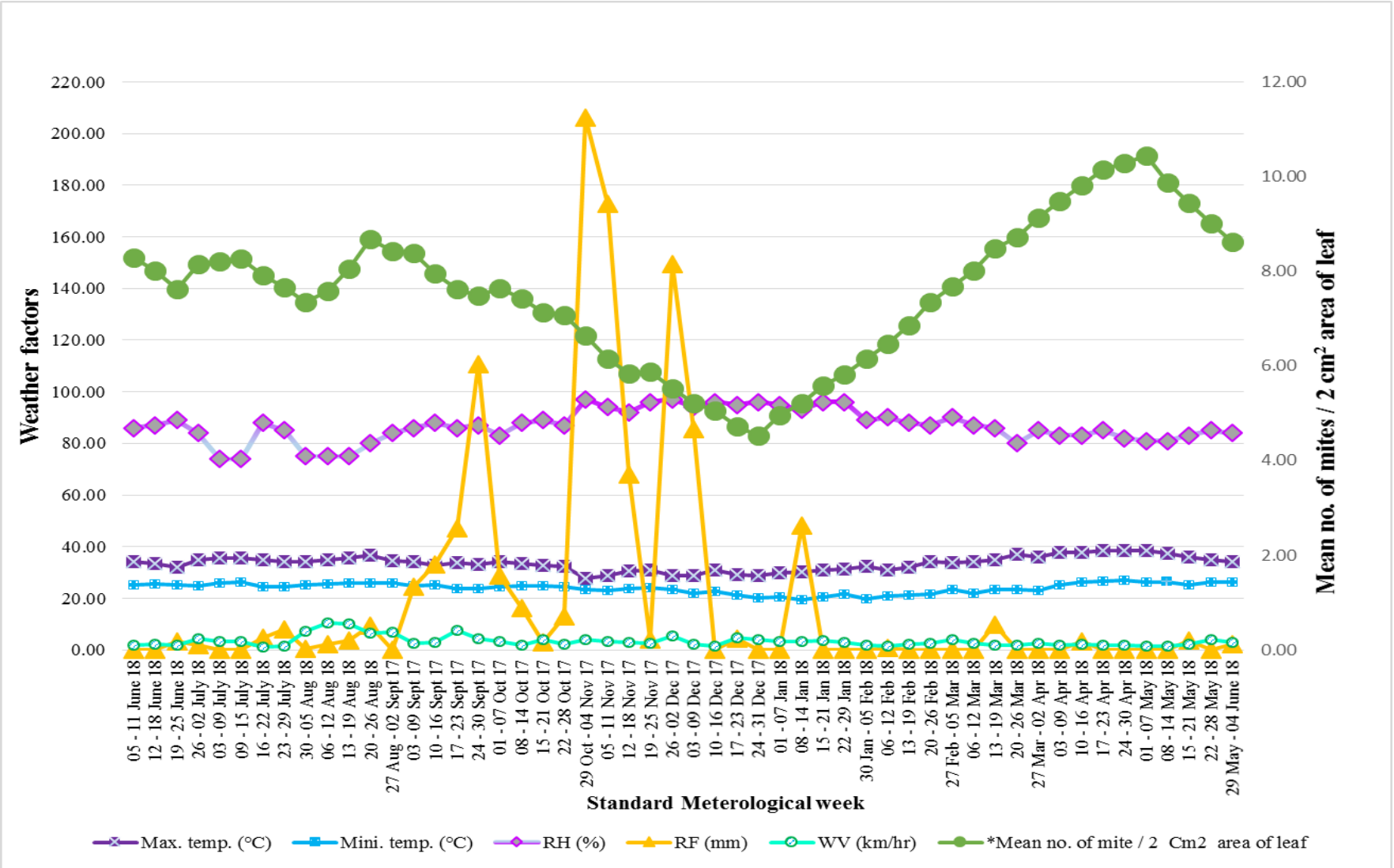

Table.1 Influence of weather parameters on sugarcane web mite, *S. andropogoni* on sugarcance (Location: Sugarcane Research Station, Cuddalore (TNAU) during June 2017 – May 2018)

Standard meteorological week	Maximum temperature (°C)	Minimum temperature (°C)	Relative Humidity (%)	Rainfall (mm)	Wind velocity (km/hr)	*Mean no. of mite / 2 Cm^2 area of leaf
1	29.90	20.60	95.00	0.00	3.10	4.96
2	30.10	19.50	93.00	48.00	3.10	5.21
3	30.90	20.50	96.00	0.00	3.70	5.58
4	31.30	21.50	96.00	0.00	2.90	5.82
5	32.50	19.70	89.00	0.00	1.90	6.15
6	31.00	20.70	90.00	0.80	1.50	6.47
7	32.10	21.30	88.00	0.00	2.30	6.86
8	34.10	21.60	87.00	0.00	2.40	7.35
9	33.80	23.20	90.00	0.00	3.90	7.68
10	34.10	22.00	87.00	0.00	2.70	8.02
11	34.70	23.30	86.00	9.80	2.00	8.48
12	37.10	23.40	80.00	0.00	1.70	8.72
13	36.10	23.10	85.00	0.00	2.70	9.13
14	37.70	25.10	83.00	0.00	1.90	9.48
15	37.60	26.40	83.00	3.40	2.20	9.82
16	38.40	26.50	85.00	0.00	1.70	10.14
17	38.30	27.10	82.00	0.00	1.80	10.29
18	38.40	26.30	81.00	0.00	1.30	10.45
19	37.30	26.30	81.00	0.00	1.30	9.87
20	36.00	25.10	83.00	3.80	2.20	9.44
21	34.80	26.10	85.00	0.00	4.10	9.01
22	34.00	26.10	84.00	2.20	3.00	8.63
23	34.30	25.00	86.00	0.00	2.00	8.28
24	33.60	25.40	87.00	0.00	2.20	8.01
25	32.10	25.00	89.00	3.40	1.90	7.62
26	34.70	24.90	84.00	2.00	4.50	8.16
27	35.50	26.00	74.00	0.00	3.40	8.21

* Mean mite count / ten leaves at five tagged plants / plot

Table.1 Influence of weather parameters on sugarcane web mite, *S. andropogoni* on sugarcance (Location: Sugarcane Research Station, Cuddalore (TNAU) during June 2017 – May 2018) (Contd..)

Standard meteorological week	Maximum temperature (°C)	Minimum temperature (°C)	Relative Humidity (%)	Rainfall (mm)	Wind velocity (km/hr)	*Mean no. of mite / 2 Cm^2 area of leaf
28	35.50	26.30	74.00	0.00	3.30	8.27
29	34.90	24.30	88.00	4.60	1.00	7.92
30	34.20	24.50	85.00	8.00	1.40	7.66
31	34.00	25.20	75.00	0.30	7.30	7.35
32	34.80	25.70	75.00	2.20	10.60	7.58
33	35.60	25.90	75.00	3.80	10.10	8.05
34	36.70	25.90	80.00	9.20	6.60	8.68
35	34.57	25.91	84.00	0.00	6.80	8.43
36	34.23	24.71	86.00	24.60	2.70	8.38
37	32.64	25.17	88.00	33.20	2.80	7.96
38	33.77	23.83	86.00	47.20	7.70	7.63
39	33.22	23.83	87.00	110.60	4.20	7.48
40	34.26	24.54	83.00	28.60	3.10	7.65
41	33.47	24.86	88.00	16.20	1.90	7.42
42	32.84	24.91	89.00	2.80	4.00	7.13
43	32.20	24.51	87.00	13.00	2.30	7.07
44	27.74	23.23	97.00	206.00	4.10	6.65
45	28.65	22.90	94.00	172.60	3.30	6.16
46	30.65	23.90	92.00	68.00	2.80	5.83
47	30.80	24.20	96.00	4.00	2.50	5.88
48	28.75	23.50	97.00	149.40	5.40	5.52
49	28.85	22.00	94.00	85.60	2.20	5.21
50	30.80	22.70	96.00	0.00	1.60	5.05
51	29.00	21.30	95.00	4.40	4.60	4.72
52	28.65	20.10	96.00	0.00	3.90	4.53

Table.2 Correlation co-efficient (r), regression between weather parameters and mean number of *S. andropogoni* population (Location: Sugarcane Research Station, Cuddalore (TNAU) during June 2017 – May 2018)

Weather factors	Correlation co-efficient (r)	Regression equation value	R^2
Maximum temperature (^{0}C)	0.927**	Y = - 9.388 + 0.506X	0.859
Minimum temperature (^{0}C)	0.774**	Y = - 6.524 + 0.587X	0.599
Relative humidity (%)	-0.729**	Y = 22.968 – 0.178X	0.532
Rainfall (mm)	-0.312*	Y = 7.755– 0.011X	0.097
Wind velocity (km/hr)	0.107 NS	Y = 7.802 – 0.079X	0.012

*Correlation is significant at 0.05% level (2 tailed)
**Correlation is significant at 0.01% level (2 tailed)
NS – Non significant

From the linear regression equation fit, it is evident that an increase in maximum temperature by 1^0C there was an increase of *S. andropogoni* population by 0.506 per cent. However an increase in relative humidity by one percent there was a decrease in *S. andropogoni* population by 0.178 per cent, however for every 1mm increase in rainfall, the mite population declined by 0.011 per cent. The Simple correlation worked out for wind velocity for web mite, *S. andropogoni* population revealed no significant impact on the population dynamics on sugarcane (Table 2).

The present findings are in conformity with the publications of Bairwa and Singh (2013) who studied the impact of weather parameters on sugarcane leaf mite, *S. andropogoni* (Hirst) and the maximum mean population of egg, nymph and adult mite was recorded (7.59, 3.36 and 5.22 / colony/ leaves) during June 2011 and July 2011 respectively. The temperature (-2.51) and rainfall (0.44) was non-significant co-relation were observed on mite influence and significant relation was recorded by relative humidity (4.80). The influence of temperature and relative humidity build up the population mite was recorded. Gupta (1975) reported that severe infestation of *S. andropogoni* (Hirst) on paddy, West Bengal during August – September 1972 which gradually declined during October and disappeared at the end of November. Verma (1976) conveyed that *S. andropogoni* (Hirst) was sporadic pest of sugarcane and in severe infestation 2500 – 3000 webs/leaf were observed in Lucknow, India. In autumn planted crop the live mite webs were maximum whereas minimum in crop planted during spring in Uttar Pradesh, during 1977 (Tewari *et al.*, 1982). In young and ratoon cane plants has moderate occurrence of spider mite, *Oligonychus* sp population in dry weather during September 2002 and also mite occurs in sugarcane varieties *viz.*, Co-419, Co-62175 and Co-8371 was recorded during March 2002 and reached peak in May 2002 in Mandya, Karnataka (Gubbaiah and Chakravarthy, 2002). In sorghum variety (Co 26) mite the population ranged from 12 to 55 / Cm^2 area of leaf during *Kharif* season at Coimbatore (Mohan and Karuppuchamy, 1987). Dubey *et al.*, (1988) reported that incidence of *Oligonychus indicus* population was high during hot weather condition (30°C), which prevailed during July. Sugarcane mite, *O. indicus* was active beginning from January and the maximum activity was recorded in May (Anonymous, 2002-2007). Deshmukh (2000) stated that the mite, *O. indicus* started

building up from 34th standard week (STW), third week of August (0.50 mites/2×2 cm leaf area) and high population of mite (5.37 mites/2×2 cm leaf area) was occurred during third week of October. During second week of December (50th STW) gradually declining of mite and also minimum mite population (1.10 mites/2×2 cm leaf area) was recorded. Kandibane *et al.*, (2009) reported that the *O. oryzae* population reached high during April - May (summer) and August - September (Pre North East monsoon) in Karaikal region and gradually declining of mite was observed during November, December and January. The weather factors were closely correlated with the fluctuation in mite was recorded. Swamiappan (1986) reported that high temperature (35°C maximum and 30°C minimum) and dry weather for 30 days before infestation were congenial for high population of paddy spider mite. In banana the *O. oryzae* population was maximum during second fortnight of March (10/10 cm^2 area) to first fortnight of June (16.6/10 cm^2 area) reaching the peak during first fortnight of May (26.67/10 cm^2) and the least population was recorded in first fortnight of January (0.63/10 cm^2) (Karmakar and Dey, 2004; Karmakar and Dey, 2006). Raghavendra *et al.*, (2017) reported the seasonal incidence of *Tetranychus urticae* Koch in jasmine and rose ecosystem. Initially the population of mite was least in third week of February and gradually increased in summer and maximum population was occurred during fourth week of May (34.69, 38.86 mites/leaflet). The fluctuation of mite population from 39th standard week to 52nd standard week and the minimum population (2.30, 3.50 mites/ leaflet) was recorded in last week of December. The correlation studies revealed that the maximum and minimum temperatures showed significant positive correlation, while morning relative humidity had a significant negative correlation, whereas evening relative humidity as well as rainfall exhibited non-significant negative correlation with *T. urticae* population in jasmine and rose ecosystem Hence the prevailing weather condition had a major impact on the population dynamics of *S. andropogoni* in sugarcane ecosystem as abiotic factors. A hot and dry weather has the growth and development of mite, whereas high rainfall and relative humidity suppressed the mite population build up, besides natural enemy activity.

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