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ENVIRONMENTAL EFFECT ON SUGARCANE LEAF MITE, *SCHIZOTETRANYCHUS ANDROPOGONI* (HIRST) ON SUGARCANE ECO-SYSTEM

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ABSTRACT

Field experiment was carried out during 2011 on effect of weather factors on sugarcane leaf mite, *Schizotetranychus andropogoni* (Hirst.) on sugarcane eco-system. The population was observed till the mite population occurs. The maximum mean population of egg and nymph 7.59 and 3.36 was recorded per colony per leaf in the month of June 2011. The maximum mean population of adult mite 5.22 was recorded in the last week of July 2011.

The non-significant relation was observed in adult mite influence in respect to temperature (-2.51) and rainfall (0.44). The significant relation was recorded in mean relative humidity (4.80). The webs size showed significant influence of temperature (3.51) and non significant relation in relative humidity (-2.65) and rainfall (-2.02). The population of mites per colony performed significant relation in relative humidity and mean temperature and total rainfall showed non significant relation. Relative humidity and temperature appeared to be regulatory factor for mite population. The overall conclusions the temperature and relative humidity have great influence in the population buildup this mite.

INTRODUCTION

Saccharum officinarum L is one of the most important sources of sugar in the world. Globally sugarcane is cultivated over an area of 26 million ha with a production of 1778 million tones and productivity of 69 tones per ha (FAOSTAT, 2012). The present area of sugarcane in India is about 4 million ha with a total production of about 230-300 million tones per year (Singh, 2013)

The existence of this mite was first time recorded and described by Hirst (1926). Banerjee (1988) reported *Schizotetranychus andropogoni* (Hirst) or web mite or Sugarcane leaf mite is a serious pest of sugarcane in India among the several insect pests. Among other serious pests, mites also cause considerable yield loss up to 20-30 % in sugarcane due to this mite (Ghoshal and Barman, 2012). The mites feeding on leaves causes the appearance of white blotches, which covered webs and turn brown and finally leaves, are blown off. The colonies appear grayish due to webbing, cast skins and soil particles caught in the webbing on the under surface of the leaf (Singh and Raghuraman, 2011). Gupta (1985) reported that thousands of mites were seen on the undersurface of leaves making small oval colonies covered with thin webs and arranged irregularly on either sides of mid rib. All the stages of mites in varying numbers (5-117) may be seen in the colonies numbering 1300-1500 per leaf. Gerson (1985) discussed a perusal of the scant data on webbing by members of other Prostigmatid families suggested that this excretion initially served to protect eggs, for mat finding and for hunting. Webs protect mites and entire colonies from being blown off by winds and wetted by rains (Singh and Raghuraman, 2011). The survival of webbed colonies in the plants under adverse climatic conditions contributes to their subsequent rapid population increase (Davis, 1952). Cast moults and dirt particles, accumulating in and on webs, may increase the protectiveness on the silk cover (Reeves, 1963). No information is available on weather factors in relation to this mite. A study was undertaken to provide information about the influence of weather factors on sugarcane leaf mite, *S. andropogoni* at Varanasi.

MATERIALS AND METHODS

The influence of environmental factors was studied on population dynamics of *S. andropogoni* during 2011 in sugarcane eco-system. The five plants and leaves per plant were selected randomly and plucked weekly for recording the data on mite population. After pooling the plucked leaves brought to the laboratory for counting the mites. Sugarcane leaf mites usually found on the lower side of the leaves under fine web colonies (Fig. 1.). The size of web colony were measured and then opened for counting the number of mites under a stereo binocular microscope. The weather data were collected from Meteorology laboratory of our university. Influence of weather factors on population density of this sugarcane leaf mite was calculated statistically (Snedecor, 1956).

RESULTS AND DISCUSSION

Influence of environmental factors on *Schizotetranychus andropogoni* (Hirst)

The influence of environment on *S. andropogoni* recorded on sugarcane ecosystems in different months during June to August 2011. The minimum mite population in form of egg, nymph and adult (5.14, 2.97 and 3.19 mites per colony per leaf) in same time web size and mites per colony (4.35 mm and 83.45 mites). The weather factors starts influencing from June 2011 and reached its peaks egg, nymph and adult (7.59, 3.36 and 5.22 mites per colony per leaf) and web size and mites per colony (5.29 mm and 137.03 mites) during the July 2011, respectively. Mite eggs, nymphs and adult were recorded maximum during 15-21, 22-28 June and 20-26 July 2011 respectively. The large size of mite web and biggest colony were observed during 8-14 June and 20-26 July 2011 (5.29 mm and 137.03 mites) respectively.

Role of environmental factors

The interaction of environmental factors were analyzed and represented in correlation coefficient, regression coefficient and significance. The existence of mite shows the positive significant relations between eggs, nymphs, adults and web size and mite colony (Fig. 1.) with temperature. The maximum mite population (egg, nymph, adult) (7.59, 3.36 and 5.22 mites per colony per leaf), the web size and its colony influence, (5.29 mm and 137.03 mites) were recorded with average atmospheric temperature 31.50°C in July 2011.

The significant correlation (r = 0.7249 and -0.8083) between mite egg influence with temperature and rainfalls. While the mean relative humidity have non-significant negative correlation coefficient (r = 0.5422). The correlation coefficient, regression coefficient and 2 t2 value in the respect of temperature and rainfall shows significant relation and in relative humidity showed the non-significant. During the entire period of June to August 2011, variation observed in the respect to temperature 34.28 °C to 28.46 °C, respect to relative humidity 87 to 37.93 per cent and total rainfall 0 to 22.66 mm. The egg of mite was found to be on the lower side of the leaf during rainy period.

The significant correlation (r = -0.7111) shows influence of temperature and relative humidity at the same time the total rainfalls have non significant correlation coefficient (r = 0.0988). The adult mite, web size and mite colony shows positive and significant correlation with weather factors like temperature and relative humidity. The web size is bigger (5.29 mm) when the temperature is high (34.28 °C). It means the temperature favours increasing the web size. The web size of mite was found to be on the lower side of the leaf during rainy period.

Mites occur in colonies, first along midribs of leaves. Later they spread away from the midrib and up the plant to higher leaves webbing indicates the presence of mite. High temperature (30.05 °C) and relative humidity (80%) accelerated number of mite per colony population (137.03)

Table 1: Influence of weather factors on mites, *S. andropogoni,* web and colony on sugarcane leaves during 2011

Weeks	Mean no. of population/ colony/leaf			Mean no of web size/leaf + (mm)	Mean no. of mite/colony	Mean temperature (°C)	Mean relative humidity (%)	Total Rainfall (mm)
	Eggs	Nymphs	Adult					
08 - 14 June	7.55	2.97	3.19	5.29	83.45	34.28	37.93	0
15 - 21 June	7.59	3.24	3.82	4.79	87.00	33.01	55.14	0
22 - 28 June	5.14	3.36	4.57	4.57	124.37	28.81	79.00	15.66
29 June - 05 July	5.15	3.14	3.93	4.35	114.08	29.46	75.93	22.66
06 - 12 July	6.97	3.35	4.28	4.44	130.22	30.10	73.57	3.97
13 - 9 July	5.99	3.10	4.21	4.76	121.85	31.32	70.07	3.28
20 - 26 July	6.91	3.16	5.22	4.86	137.03	30.71	80.00	10.28
27 - 02 August	7.26	3.29	4.95	4.75	132.84	30.31	80.85	2.71
03 - 09 August	6.05	3.33	4.89	4.63	124.05	28.46	87.00	4.14

+ - Average of five leaves

Table 2: Interaction of weather factors with mites, *S. andropogoni,* web and colony on sugarcane leaves during 2011

Interaction with weather factors	Value of correlation coefficient (r)	Regression coefficient	Value of (t)	Significance at 5%
No. of eggs of mite × mean temperature	0.7249	0.36497	2.78*	S
No. of eggs of mite × mean relative humidity	-0.5422	-0.03362	-1.70	NS
No. of eggs of mite × total rainfall	-0.8083	-0.10043	3.63*	S
No of nymph × mean temperature	-0.7111	-0.04939	2.78*	S
No of nymph × mean relative humidity	0.6818	0.00583	2.46*	S
No of nymph × total rainfall	0.0988	0.00169	0.26	NS
No. of adult mite × mean temperature	-0.6888	-0.23116	-2.51*	NS
No. of adult mite × mean relative humidity	0.8762	0.03621	4.80**	S
No. of adult mite × total rainfall	0.1664	0.01379	0.44	NS
Mite web size × mean temperature	0.7989	0.11438	3.51**	S
Mite web size × mean relative humidity	-0.7089	-0.01250	-2.65*	NS
Mite web size × total rainfall	-0.6087	-0.02151	-2.02	NS
No. of mite per colony × mean temperature	-0.7667	-7.76199	-3.15*	NS
No. of mite per colony × mean relative humidity	0.8897	1.10938	5.156**	S
No. of mite per colony × total rainfall	0.3194	0.79830s	0.89	NS

Figure 1: Sugarcane leaf mite, *Schizotetranychus andropogoni* (Hirst), its web and colony under its fine web on sugarcane

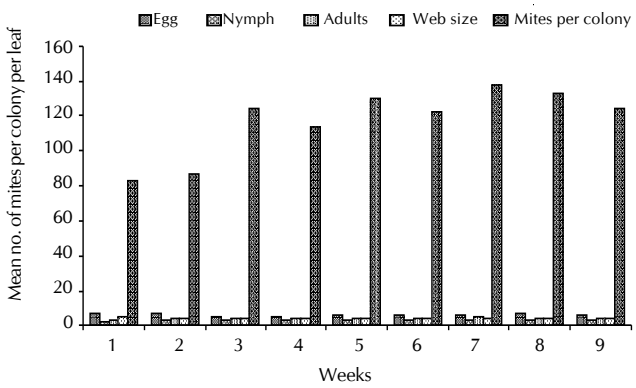

Figure 2: Population of sugarcane leaf mite, *S. andropogoni* on leaves during 2011

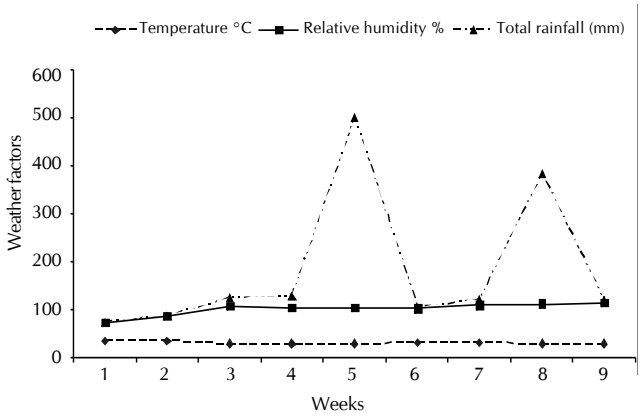

Figure 3: Weather factors during mite population on sugarcane eco-system in 2011

per sugarcane leaf. Nevertheless, rainfalls (10.18 mm) do not have any effect on the mite colony. The number of colony of mite was found to be on the lower side of the leaf during rainy period. Mite's infestations commonly began along field borders, and spread quickly throughout the field.

In the present investigation, the egg of mite shows significant relation in temperature, rainfall and non-significant relation with relative humidity. The nymph, adult, web size and colony of mite showed non-significant relation with rainfall and significant relation in temperature and relative humidity. The existence of sugarcane leaf mite is negligible due to the rain and temperature is the main regulatory factor for increasing the mite population.

Response of *Schizotetranychus andropogoni* (Hirst)

The maximum mite egg laid (7.59 mites per colony per leaf) in the month of 3rd week of June at 33.01°C mean temperature and mean relative humidity 55.14 %, showed significant relation at 5 % level with mean temperature and total rainfall.

The population of nymph and adult of sugarcane leaf mite showed significant relation at 5 % level were high (3.36 and 5.22 mites per colony per leaf) in 2nd week and 4th week of July at (30.10 °C and 30.71°C) mean temperature and mean RH (73.57 and 80.00 %) respectively (Fig. 2 and 3). The web size (5.29 mm) and mite colony (137.03) both has significant relation with mean temperature (34.28 °C and 30.71 °C) and mean RH (37.93 and 80.00 %) respectively. Banerjee (1988) reported that this mite develops quickly at high temperature. Life cycle is completed in 7-10 day depending upon temperature and humidity. Rahman and Sapra (1940) reported that life cycle of *Paratetranychus indicus* Hirst took 4.5 – 6 days in males and 5.5-7 days in females. Gupta, Dhooria and Sidhu (1974) studied the biology of *Oligonychus indicus* at five different tempretures (25°, 27.5°, 30°, 30.5° and 35 °C) and on three different food (sugarcane, sorghum and maize) and found that maize was the best food and 30 °C was the most favourable temperature because of the minimum time taken to complete the life cycle and high fecundity of both fertized and unfertilized females on this food and temperature. In this experiment all, the different stages of sugarcane mite and web size and its mite colony are influenced by the aboitic factors. Different mite stages have significant relation to temperature including web size and mite colony (Fig. 1.). The relative humidity has non-significant relation to the egg of sugarcane mite but with others have significant relation.

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