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SEASONAL TREND OF GREEN SPIDER MITE, *MONONYCHELLUS TANAJOA* POPULATION ON CASSAVA, *MANIHOT ESCULENTA* AND ITS RELATIONSHIP WITH WEATHER FACTORS AT MOOR PLANTATION

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Abstract—The population of green spider mite *Mononychellus tanajoa* (Bondar) was monitored on cassava for 52 weeks (mid October 1979 to mid October 1980) at Moor Plantation, Ibadan, Nigeria. Mite population was found to be high in the dry season (80.1 ± 57.7 per leaf) and low in the wet season (15.2 ± 13.5). There was a linear relationship between mite population and the weather factors investigated. The relationship was positive in the cases of temperature and radiation, and negative in those of rainfall and humidity. The high mite population in the dry season was attributed to the high temperature (27.9 ± 1.26°C) and radiation (39.1 ± 7.86) conditions which favoured development of the different stages in the life cycle of the mite. The low population in the wet season was attributed to the adverse effects of high rainfall (56.31 ± 33.14 mm) and humidity (87.29 ± 2.36%) on the mites. Seasonal fluctuations in mite population was attributed to the physiological condition of the host plant.

Key Words: Cassava, *Manihot esculenta* (Crantz), green spider mite, *Mononychellus tanajoa* (Bondar), seasonal trend of mite population, meteorological data, linear relationship, temperature, radiation, rainfall, humidity, physiological conditions, mortality, predators

INTRODUCTION

The green spider mite (GSM) *Mononychellus tanajoa* (Bondar), hereafter referred to as GSM, is a new pest of cassava in Nigeria. Its outbreak was first noticed around Ikeja, near Lagos, in February 1979 (Akinlosotu and Leuschner, 1981). Before then, the pest has been reported from the East and Central African countries of Uganda, Kenya, Tanzania, Zanzibar, Rwanda, Burundi, Zaire and the Republic of Congo (Nyiira, 1972, 1975, 1977; Ngangaji, 1975, Nwanze, 1978).

The mite initially attacks the young shoots of cassava including leaves and stem. The attack moves from the top young leaves to the lower and more mature ones, causing severe reduction in the leaf surface area under heavy mite population conditions, and, defoliation and shoot die-back may occur (Leuschner *et al.*, 1980; Hahn *et al.*, 1980). Yield loss of up to 46% has been attributed to the mite (Nyiira, 1975).

Since the discovery of the pest in Nigeria, some aspects of its biology and control have been studied by Muaka-Toko and Leuschner (1980). In their laboratory work, they studied the development of the different stages in the life cycle of the mite under 22, 28 and 35°C temperature conditions and found that oviposition was highest at 28°C, hatchability was highest at 22°C, while developmental period was faster as temperature increased from 22 to 35°C. In their field work, they found that some cassava clones among those evaluated for resistance, sustained lower mite populations than others while none was resistant. Elsewhere, it has been established that weather and climatic conditions are responsible for seasonal changes in GSM population, and that the mite population was high during periods of dry and warm weather, and low under the wet season conditions (Nyiira, 1972, 1975; Yaseen, 1975). The present paper reports studies conducted at Moor Plantation, Ibadan, Nigeria to establish the seasonal trend of GSM population, its relationship with weather factors and, the peak periods of infestation of the pest.

MATERIALS AND METHODS

A 25 × 50 m observation plot of cassava variety TMS 30395 was established on Moor Plantation in July 1979. The cassava cuttings were planted at a spacing of 1 m apart along ridges. No fertilizer, herbicide or insecticide was applied.

Sampling of cassava leaves for mites began on 24 October 1979. The sampling method was similar to that of Nyiira (1972) and Yaseen (1975). The fifth leaf from the top of each of 10 randomly selected plants were harvested in separate polythene bags between 7.30 and 8.30 hr on Wednesdays. The number of mites on each leaf was counted under an M5A Wild (Heerbrugg) stereo microscope. Eggs were not counted in this work since their population trend has been found to be similar to those of immature and mature mites (Nyiira, 1972).

Meteorological data were collected for air-temperature, radiation (sunshine duration), rainfall and humidity throughout the duration of the studies. A correlation and regression analysis was performed on the

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Table 1. Mite population and meteorological data

Wks	Date of observation	Mean GSM $n = 10$ Leaves	Rainfall (mm)	Mean temperature (°C)	Radiation (hr)	Humidity (%)
1	24-10-79	8.83	105.2	26.79	32.3	84.43
2	1-11-79	8.66	77.3	26.12	23.4	85.88
3	7-11-79	5.83	119.8	27.16	37.2	85.50
4	14-11-79	20.33	0.0	26.78	32.2	87.42
5	21-11-79	53.10	0.0	27.64	38.0	84.85
6	28-11-79	49.60	43.0	28.00	31.3	86.28
7	5-12-79	137.60	0.0	26.00	38.2	81.57
8	12-12-79	54.10	0.0	25.07	52.7	68.85
9	19-12-79	65.77	0.0	25.71	42.9	87.71
10	26-12-79	75.40	0.0	27.00	37.9	89.43
11	2-1-80	98.50	0.0	25.92	27.5	80.43
12	9-1-80	33.60	0.0	27.92	37.1	87.85
13	16-1-80	18.00	0.0	27.28	29.4	85.57
14	23-1-80	11.85	0.0	29.21	42.5	81.85
15	30-1-80	28.90	17.0	28.57	46.0	82.14
16	6-2-80	25.62	0.0	29.07	52.3	79.29
17	13-2-80	39.50	0.0	29.21	24.9	80.28
18	20-2-80	44.10	9.5	28.92	41.4	80.28
19	27-2-80	104.25	0.0	29.00	25.2	78.48
20	5-3-80	28.20	39.0	29.00	31.9	79.28
21	12-3-80	66.50	0.0	29.21	37.7	80.00
22	19-3-80	235.00	0.0	29.35	43.9	77.71
23	26-3-80	155.40	26.2	28.21	45.2	78.28
24	2-4-80	110.30	18.0	29.64	40.9	77.14
25	9-4-80	103.50	33.5	29.07	32.1	82.71
26	16-4-80	220.60	3.3	28.42	43.6	79.14
27	23-4-80	125.30	72.2	28.00	51.4	80.28
28	30-4-80	110.10	27.0	27.28	47.3	84.29
29	7-5-80	86.90	59.1	27.21	43.9	83.00
30	14-5-80	60.90	22.7	27.35	37.7	84.28
31	21-5-80	55.40	35.6	27.50	47.0	82.57
32	28-5-80	14.10	54.3	26.07	22.7	86.00
33	4-6-80	6.30	46.0	26.42	34.3	87.28
34	11-6-80	2.90	47.4	27.43	52.5	83.85
35	18-6-80	10.20	100.5	26.93	39.6	87.28
36	25-6-80	11.70	87.5	26.50	24.1	85.43
37	2-7-80	1.80	11.1	26.07	27.4	86.00
38	9-7-80	41.90	2.8	25.07	15.3	87.28
39	16-7-80	35.60	2.5	24.70	15.6	88.57
40	23-7-80	23.50	54.1	24.42	8.5	89.14
41	30-7-80	7.80	80.2	25.28	10.4	89.42
42	6-8-80	8.80	41.3	21.20	9.6	88.85
43	13-8-80	15.90	60.8	25.50	16.3	88.28
44	20-8-80	20.40	65.4	25.21	13.0	91.28
45	27-8-80	6.50	139.1	25.57	17.3	89.42
46	3-9-80	7.30	33.7	25.78	16.3	87.85
47	10-9-80	20.60	88.9	26.00	21.7	88.28
48	17-9-80	14.60	74.0	25.35	14.6	89.85
49	24-9-80	13.20	69.0	30.60	30.6	89.42
50	2-10-80	5.40	70.8	25.87	24.6	87.25
51	8-10-80	4.50	58.7	25.91	42.5	82.83
52	15-10-80	6.10	15.2	26.85	40.1	84.14

data collected to determine the relationship between mite population and the weather factors.

RESULTS

The mite population and meteorological data collected are shown in Table 1. There were fluctuations in the mite population throughout the period of assessment; peak population periods occurred in December, February and March. Mite population was generally high in the dry season and low in the wet season (Table 2).

The correlation and regression analysis performed on the data showed that mite population was linearly related to the four weather factors studied (Table 3). The relationships were positive in the cases of temperature and radiation and negative in the cases of rainfall and humidity.

During the course of the studies, a predatory mite was encountered once, while a syrphid larval predator was observed on four occasions, and the numbers observed were 1, 3, 2 and 1 respectively. Both predatory species were encountered during the peak population periods of the mite.

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Table 2. Summary of mite population and weather records in the dry and wet seasons

	Mite population	Air temperature (°C)	Radiation (hr)	Rainfall (mm)	Humidity (%)
	Dry Season (Mid November–Mid May)				
Totals	2162.9	754.04	1055.1	370.5·	2208.39
Means	80.1	27.9	39.1	13.7	81.79
Standard deviation	57.74	1.26	7.86	20.0	4.30
	Wet Season (Mid May–Mid November)				
Totals	334.5	569.63	544.0	1238.9	1920.27
Means	15.2	25.89	24.73	56.31	87.29
Standard deviation	13.5	1.58	12.9	33.14	2.36

The attack of GSM on the host plant was very severe in the dry season. Defoliation alternated with development of new leaves until the rains become steady. Shoot-stems were also scarified. In the wet season, mite population remained low and there was no noticeable symptom of mite injury on the plants.

DISCUSSION

The trend of GSM population observed in the present studies indicates a seasonal trend characterized by high mite population in the dry season and low population in the wet season (Table 2). This trend confirmed the previous observations of Nyiira (1972) and Yaseen (1975). They attributed the cause of the drastic change in mite population in the two seasons to the favourable dry weather conditions in the dry season and the unfavourable heavy and persistent rainfall in the wet season. This conclusion is supported in the present studies by the linear relationships between mite population and the four weather factors (temperature, radiation, rainfall and humidity) (Table 3).

The positive linear relationship between mite population and temperature indicates that mite population will increase with increase in temperature. This prediction has been confirmed by the work of Muaka-Toko and Leuschner (1980). They found that mites develop faster as temperature increased from 22 to 35°C, and that oviposition was highest at 28°C, which is very close to the dry season average of 27.9°C in this area. Therefore, the dry season temperature condition must have contributed largely to the observed high mite population in the season. Similarly, the low temperature value of 25.89°C in the wet season (Table 2) must have contributed to low mite population.

The negative linear relationships between mite population and rainfall, and humidity indicates that mite population will decrease as these two weather factors increase in value. In a preliminary attempt to find out whether the rain washes off the mites from the plants, buckets were placed under the canopy of 10 randomly selected cassava plants when it was raining. When specimens of the water collected in the buckets were examined under the microscope they were found to be free of mites. It is therefore possible that rain affects the physiological development of the mites as suggested by Nyiira (1975).

High humidity prevailed throughout the period of observation, even though it was higher in the wet season (Table 2) than in the dry season. This implies that although there is a negative correlation between mite population and humidity, the weather factor must act with the high rainfall condition in the wet season to be responsible for low mite population, since it was also high in the dry season (Table 2). The negative effect of high relative humidity on mite oviposition has however been demonstrated by Nyiira (1975).

As for the observed fluctuations in mite population during the two seasons (dry and wet), such fluctuations may be attributed to the physiological condition of the infested plant, and the activities of the natural enemies (Yaseen, 1975). In the present work, there was severe reduction in the leaf surface area of the attacked cassava plants under high mite population pressure, and this could have led to the dispersal of mites, or induce mite mortality. Since only a very low number of the two predatory species (mite and

Table 3. Summary of correlation and regression analysis

Variables	Correlation coefficients (r)	Slopes (S)	Intercepts (I)
Y vs X_1	+0.4271*	14.0231	−328.9996
Y vs X_2	+0.408*	1.7814	−9.4891
Y vs X_3	−0.4122*	−0.5980	70.4628
Y vs X_4	−0.5882†	−8.3667	758.4293

Symbols used: Y, Mite population; X_1, Air temperature; X_2, Radiation; X_3, Rainfall; X_4, Humidity.
*Significant at 1% level.
†Significant at 0.1% level.

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syrphid larva) was observed, and only at the peak population periods, the predators could not have contributed much to the low mite population.

Finally, since it has been found in this work, and by other workers, that GSM population is high in the dry season due to the prevailing favourable weather conditions, and that damage to cassava is only pronounced in the dry season, it can be concluded that control measures for the pest must aim at keeping the pest population to a low level similar to that prevailing in the wet season when no noticeable damage was done to the host plant. It can also be inferred from the relationships between mite populations and the weather factors studied that prolonged periods of high temperature and radiation conditions might lead to an outbreak of GSM.

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