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Seasonal fluctuations in the population of *Aleurodicus dispersus* Russell (Homoptera: Aleyrodidae) on cassava plants in Benin City, Nigeria

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ABSTRACT: Populations of the spiraling whitefly, *Aleurodicus dispersus* Russell (Homoptera: Aleyrodidae), were monitored on cassava plants in five sites in Benin City, Nigeria from February, 1999 to January, 2001 (24 months). The study revealed higher abundance of the whitefly on the mature and old leaves than the young ones. Since the distribution followed the same trend on all the sites, analysis of variance test on the data showed that the spatial distribution of whiteflies was not significantly different ($P<0.05$) from each other at $P = 0.05$ level. Periods of high population of *A. dispersus* coincided with the dry seasons suggesting that the whiteflies are dry season pests. There was a negative correlation between *A. dispersus* populations and rainfall ($r = 0.48$) at 0.05 level.

Key Words: Cassava; Spiraling whitefly (*Aleurodicus dispersus*); Chlorosis; Seasonal fluctuation; Population.

Introduction

The spiraling whitefly, *Aleurodicus dispersus Russell* is a recent pest of cassava in Nigeria and in the West African sub-region (Neuenschwamder, 1994; Akinlodotu *et al*., 1993). *A. dispersus* originates from the Caribbean and central America. It was introduced to West Africa in 1992 (Neuenschwamder, 1994). The first outbreak in Nigeria occurred around Lagos and Ibadan in 1992 (Akinlosotu *et al*., 1993).

The pest feeds by sucking sap from the leaves, which cause chlorosis (disappearance of chloroplasts) resulting in premature defoliation (leaf fall). It also produces abundant honeydew which enhances the development of sooty mould. This not only inhibits photosynthesis but also blemishes the appearance of leaves and fruits and the honeydew further attracts other pests, including flies and ants (Waterhouse and Norris, 1989; Berlinger, 1986 and Akinlosotu *et al*., 1993).

Damage caused by the whitefly honeydew has provoked panic reactions and inappropriate control measures such as the felling of affected trees and in uncontrolled pesticide treatment (Akinlosotu *et al*., 1993). Such actions usually favour a rapid increase in whitefly populations as well as enhance harmful effects on the environment and human health (Berlinger, 1986).

Generally, young cassava plants are preferred to older ones (Leuschner *et al*., 1981). The younger the plant under whitefly attack, the more severe the defoliation and consequently the yield loss (Yaninek and Neuenschwander, 1986).

In view of the importance of cassava as a staple food for most Nigerians and with regard to enormous losses incurred due to pest attack, this study was undertaken to collect data on population trends of *A. dispersus* in relation to weather conditions. Such population data would be useful in planning any control strategy against the spiraling whitefly.

Materials and Methods

A cassava plot of 0.15 hectare located in each of five sites in Benin City, Nigeria, was used for this study. The five sites are:

1. University of Benin, Ugbowo campus
2. Idia College compound
3. Oregbeni Housing Estate
4. Immaculate Conception College, I.C.C. compound
5. Ogba village/farm.

Each cassava plot in each site was sub-divided into five (5) sub-plots. Each sub-plot contained 20 cassava stands. Sampling was done every month for 24 months beginning from February, 1999 to January, 2001. The cassava plants in each sub-plot were numbered 1 – 20 and five (5) plants on each sub-plot were randomly selected for sampling using a table of random numbers.

Spatial Distribution

For spatial distribution of *A. dispersus* on cassava plants, intra – plant sampling techniques of Jones and Parrelia (1984), which required sampling some leaves, in a chosen plot, were adopted in this study.

The leaves on each plant were numbered 0 – 23 from top of the plant to the bottom ("0" representing the unopened bud) and examined for the presence of the spiralling whiteflies by direct counting. From this arrangement, leaves 0 – 8; 9 – 17 and 18 – 23 corresponded to the young, mature and old leaves respectively. A total of 25 plants per cassava plot (125 plants altogether) were sampled on each sampling day and numbers of *A. dispersus* on each plant were recorded.

Seasonal Population Fluctuations.

Sampling programmes were undertaken as described above on the same cassava plots and on the same dates. Total numbers of *A. dispersus* adults on 25 plants sampled per cassava plot per sampling day were recorded. Meterological data of rainfall, temperature and relative humidity were obtained from the Geography Department, University of Benin. These factors were correlated with *A. dispersus* levels in the field. Analysis of variance test was carried out to find if there was any significant difference between fluctuations in the populations of *A. dispersus* on the five sites tested.

Phytochemical Analysis of Cassava Plant.

Phytochemical analysis of some host plants of *A. dispersus*, including cassava, common acalypha, orange and guava plants for percentage fats, carbohydrate and protein were carried out by the Benin – Owena River basin Authority and the University of Benin Joint Analysis laboratory. These nutrients were calculated from the young, mature and old leaves of each of the host plants as an index of spatial preference and dispersion of *A. dispersus.*

Results

Spatial Distribution

The extent to which *A. dispersus* were distributed on cassava leaves (from top to bottom) in the five study sites is shown in Table 1. *A. dispersus* was more abundant on leaves 9 – 17 than on leaves 0 – 8 and 18 – 23 in all the tested sites. There were also more whiteflies on leaves 18 – 23 than on leaves 0 – 8. Since the distribution followed the same trend on all the sites, Analysis of Variance test of the data showed that the spatial distribution of white flies was not significantly different ($P<0.05$) from each other at $P = 0.05$.

Table 1: Distribution of *A. dispersus* on cassava plants in Benin City, Nigeria.

	Leaf Number (Top-Bottom)	**Mean No. of whiteflies Per leaf**				
		UNIBEN	**Idia College**	**Oregbeni.**	**I.C.C.**	**Ogba**
	0 Leaf Bud	0.03	0.00	0.00	0.00	0.01
	1	0.01	0.04	0.00	0.00	0.00
	2	1.11	1.06	0.01	0.00	0.04
	3	1.00	1.08	0.12	0.06	0.40
Young leaves	4	1.06	1.22	0.40	0.40	1.02
	5	1.08	1.44	1.12	1.16	1.10
	6	1.09	1.80	1.22	1.10	1.12
	7	2.02	1.86	1.08	1.08	1.22
	8	2.62	2.00	1.02	1.22	1.70
	9	4.62	5.60	4.06	2.24	2.04
	10	5.10	8.20	4.16	4.84	2.24
	11	8.10	8.92	6.22	5.80	4.84
	12	9.50	9.08	8.32	8.44	5.70
Mature leaves	13	9.60	9.22	8.62	9.24	8.22
	14	8.30	9.36	9.20	8.82	9.40
	15	8.82	8.14	9.24	8.36	8.82
	16	8.65	6.22	9.62	9.08	8.36
	17	6.32	8.00	6.54	9.10	6.12
	18	6.22	5.06	9.08	8.80	6.32
	19	6.00	5.62	8.62	8.20	3.78
Old leaves	20	5.82	5.70	5.80	6.12	3.54
	21	5.70	5.24	5.84	6.32	2.70
	22	5.60	4.30	4.70	3.70	2.58
	23	4.82	4.00	4.72	2.70	2.22

Population Fluctuations

The pattern of population fluctuation in relation to weather conditions are summarized in Fig. 1 and 2.

Whitefly populations were high from February, 1999 to March, 1999 with *A. dispersus* having a density of between 20 and 30 whiteflies per leaf. There was a sharp decline in whitefly number between April and

September, 1999 followed by a rise in October, 1999 with insect attaining peak again in March, 2000. This peak was followed by another sharp decline in *A. dispersus* population between May, 2000 and September, 2000, only to pick up again from October, 2000 through January, 2001.

The periods of high population coincided with the dry season, suggesting that the spiraling whjteflies are dry season pests. When the whitefly numbers were correlated with weather factors of temperature, rainfall and relative humidity. However, there was a negative correlation between *A. dispersus* populations and rainfall (r = 0.48) at 0.05 level.

Table 2: Phytochemical analysis of host plants of *A. dispersus* for percentage fats, carbohydrate and protein.

S/No.	Part of leaf taken for analysis	% fat	% CHO	% Protein
1.	Cassava:			
	Young leaves	17.46	10.69	Nil
	Matured leaves	19.21	25.00	1.75
	Old leaves	20.53	10.35	Nil
2.	Acalypha:			
	Young leaves	8.00	9.60	1.75
	Matured leaves	13.01	25.61	Nil
	Old leaves	20.57	10.44	1.75
3.	Orange:			
	Young leaves	13.54	8.59	1.75
	Matured leaves	14.53	15.37	Nil
	Old leaves	15.35	10.61	1.75
4.	Guava:			
	Young leaves	13.55	2.29	Nil
	Matured leaves	14.61	6.56	Nil
	Old leaves	10.72	7.27	1.75

Courtesy:
Benin – Owena River Basin Authority and University of Benin Joint Analyses Laboratory, University of Benin, Benin City.

Phytochemical analysis for percentage fat, carbohydrate and protein in cassava plants in the study area shows that the mature and old leaves contained more nutrients than the young leaves (Table 2). Only the mature leaves of cassava contained protein (1.75%). However, the young leaves of cassava had enough fats (17.46%) and carbohydrate (10.69%) to attract the whiteflies, though they were concentrated on the mature and old leaves.

Discussion

Aleurodicus dispersus exhibited preference for cassava leaves of different ages. *A. dispersus* showed a preference for the mature and old leaves than the young ones on top of the plant. This preference may suggest an environmental requirement for survival. Lewis and Taylor (1967) pointed out that spatial arrangements of different organisms differ because their environmental requirements differ. The difference in biochemical (i.e., nutritional contents) and physical (i.e., toughness) characteristic of both young and mature leaves should also influence the distribution of whiteflies on the leaves. Indeed, most pests developed faster, longevity, survival and fecundity were superior when fed young and mature leaves than old ones.

Orakpor (1991) reported that the green spidermite, *Mononychellus tanajoa* developed faster when fed young cassava leaves because they contain greater quantity of fluid and nutritional materials, while the development of *Ologonychus gossiypii* (another species of spidermite) was faster on mature cassava leaves.

This study however does not agree with the above observations. Populations of *A. dispersus* were found to be more abundant on mature and old leaves than the young ones. This is due to the fact that the mature and old leaves of the tested cassava plants contained more nutrients than the young leaves as revealed by the phytochemical analysis of the plant at the Benin Owena River Basin Authority and the University of Benin Joint Analysis in Laboratory. Another reason for this may be because *A. dispersus* is a dry season pest; rain water easily decimates whitefly populations, hence they virtually disappear during the rainy season. To enhance survival, they hide under the broader mature or old leaves below, shielded by the younger leaves above. The whitefly therefore foregoes the softer younger leaves for the safety of the broader but older leaves below, shielded from the direct effect of rain water.

Fluctuations in the natural populations of *A. dispersus* were influenced by environmental factors such as temperature, relative humidity and rainfall. Lewis and Taylor (1967) stated that the influence of environmental factors like temperature and humidity cause population to fluctuate in size and position.

In this study, the populations of *A. dispersus* on the tested sites were negatively correlated with rainfall, indicating that increased rainfall favoured a drop in population of the insects. Reduction in whitefly population by rain has been reported by Waterhouse and Norris (1989). Similar effects by rain has also been reported in aphids (Dixon, 1973), the cassava mealybug, *Phenacoccus maninoti* Mat-Ferr (Iheagwam, 1981), the nettle caterpillar, *Latola viridissima* Holland (Igbinosa, 1985), the mango mealybug, *Rastrococcus invadens* Williams (Le Reu and Izigwel, 1990)and the spotted mites (Bradenburg and Kennedy, 1982).

One important way that rain water (excessive moisture) raises the death rate among natural populations of insects is in favouring the spread of epizootics of viral, fungal and bacterial diseases (Andrewartha and Birch, 1954). This factor probably contributed to the decline in whitefly populations during the rainy seasons. Also, adult *A. dispersus* are winged insects. When the wings get soaked by the rain, the whiteflies lose the ability to fly and are therefore easily washed away by water.

The result reported in this study suggests that adequate management of populations of the spiraling whitefly on cassava can be achieved through early planting of the crop. In Nigeria, cassava is planted all through the year. Since whitefly populations build up during the dry season, cassava plants planted late (i.e. after June/July) would be expected to suffer severe damage as they will be less than six months old by November, when the pest populations would be expected to rise. Studies by Orakpor, Iheagwam and Igbinosa (2000) have shown that cassava plants below seven months old are preferred to older ones by the spider mites.

Thus, it is recommended that cassava plants be planted between February and April such that they pass the susceptible stage during the rainy season when whitefly populations are usually low.

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