AFRICAN CASSAVA MOSAIC VIRUS: THE VIRUS, THE VECTOR, THE PLANT AND THE RESERVOIRS

D. Fargette, C. Fauquet, and J.-C. Thouvenel

Laboratoire de Phytovirologie, ORSTOM, BP V 51 Abidjan, Ivory Coast.

The ecology of African cassava mosaic virus (ACMV), is peculiar: the disease results from the encounter of a plant originating in South America (2) with a viral pathogen likely native to Africa. This pathogen, a geminivirus, is transmitted by man through the planting of diseased cuttings and by the whitefly Bemisia tabaci. We investigated yield losses in relation to the mode of infection. We studied the relationships between the "actors" involved in the disease spread: the virus, the vector, the plant and the reservoirs.

Yield losses. Dates of symptom appearance were recorded individually for 500 plants in two 1-ha fields planted in October 1982 and July 1983, respectively. Roots were weighed individually 12 months after planting. Results are shown below.

Date of symptom appearance (DAP)	<45	60	90	120	150	180	>195	H
Root weight (kg)								
Field 1 (mean)	1.33	2.13	2.39	2.60	2.85	2.93	2.60	2.70
Field 2 (mean)	1.32	3.42	4.60	3.95	5.26	5.62	5.39	5.0

Preliminary experiments showed that ACMV transmission through cuttings induced symptoms within 45 days after planting (DAP), whereas following whitefly inoculation, symptoms appear later. Highest yield reductions are observed in vegetatively infected cassava. In both trials, infection by vectors, even when it occurred early, had less effect. When infection is by B. tabaci, both experiments indicate that the earlier it occurs, the greater is the yield loss. After 120 DAP, yield of infected plants does not differ significantly from that of healthy cassava (H).

Reservoirs of ACMV. The reservoirs of ACMV were investigated by combining ELISA (4) and transmission tests. Based on these results, only two Euphorbiaceaes Manihot glaziovii and Jatropha multifida are, with a high degree of certainty, hosts of ACMV. However, epidemiological studies suggest that their role as reservoir of virus and vector is limited compared to the cultivated cassava, Manihot esculenta ("Development of the disease at a regional level," same issue).

Virus/vector/plant relationships. On each cassava, leaf position was counted from the youngest unfolded leaf (graded F1) downward to the older leaves(F2, F3...). Leaves F0 and F-1 were younger, smaller in size, and still folded. Maximum surface is usually reached at leaf F4. Surface does not increase further when aging (Fig. 1). On these aging leaves, we have followed:

- The concentration of virus, estimated by ELISA tests (A 405 nm). Maximum concentraton is reached on leaf F1 and virus content then decreases in older leaves. ACMV is not detectable in leaf F7 and in older leaves;

- Whitefly populations were periodically evaluated. The adult whiteflies are gathered on the younger leaves F-1 to F3. Very few adults were detected on the older leaves. Most larvae are located on leaves F5 to F7, as a result of the adult distribution;

- Sensitivity of aging leaves to ACMV has been evaluated by Storey & Nichols (3). They set groups of 100 whiteflies on leaves of different ages and observed the number of plants showing symptoms afterwards (Fig. 1). They concluded that the young growing leaves are susceptible to the disease, whereas the mature ones are not.

The young cassava leaves not only contain more virus but also are more susceptible to infection than mature ones. So the prevalence of Bemisia tabaci on the young growing leaves of cassava will help both the acquisition and inoculation and, thus, the field spread of ACMV. Surprisingly however, the percentage of individual B. tabaci in cassava fields which transmit ACMV, as established by infectivity tests, is usually very low (Fig. 1) when compared to viruses such as cowpea golden mosaic virus where transmission per individual may exceed 70% (1).

REFERENCES

1. Anno-Nyako, F. O., Vetten, H. J., Allen, D., and Thottappilly, G. 1983. Ann. Appl. Biol. 102:219-227.

2. Cours, G. 1951. Mem. Inst. Sci. Madagascar, ser. B, Biol. Veg. 3:203-416.

3. Storey, H. H., and Nichols, R. F. 1938. Ann. Appl. Biol. 25:790-806.

4. Thouvenel, J-C., Fargette, D., Fauquet, C., and Monsarrat, A. 1984. Proc. Sixth Inter. Trop. Root Crops Symp., 21-23 Feb. 1983. Lima, Peru. pp. 353-356.

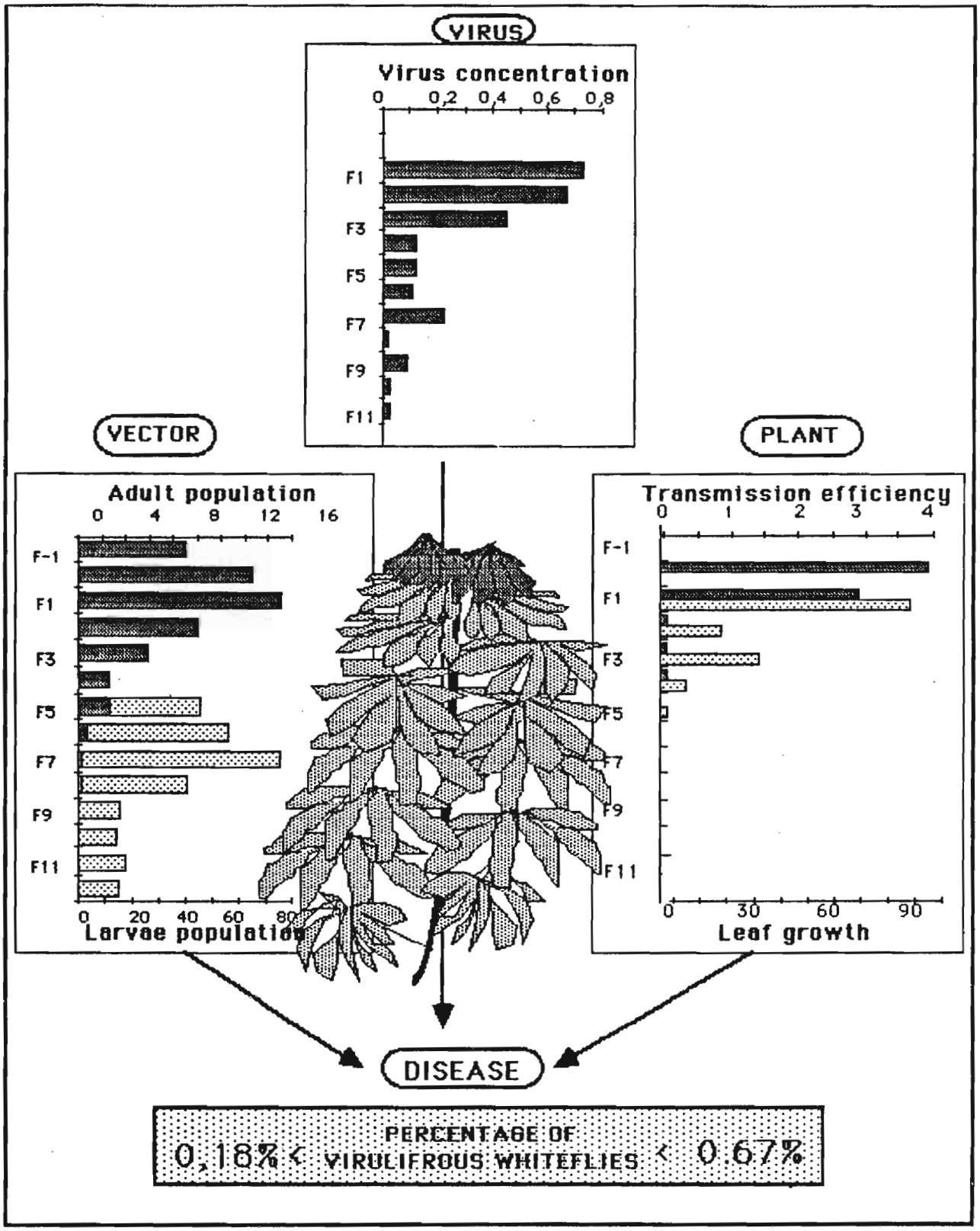

Fig. 1. For aging leaves are indicated: the ELISA absorbances (top of the figure), the number of whiteflies per leaf, adult and larvae (on the left), the sensitivity of the leaves to transmission and the surface leaf growth (on the right). Percentage of viruliferous whiteflies collected in the fields is indicated at the bottom.