L. GIVORD

INSECT TRANSMISSION AND NATURAL HOST RANGE OF OKRA MOSAÏC VIRUS IN THE IVORY COAST

Communication au « IV th International congress for virology »
30.08 au 6.09 1978

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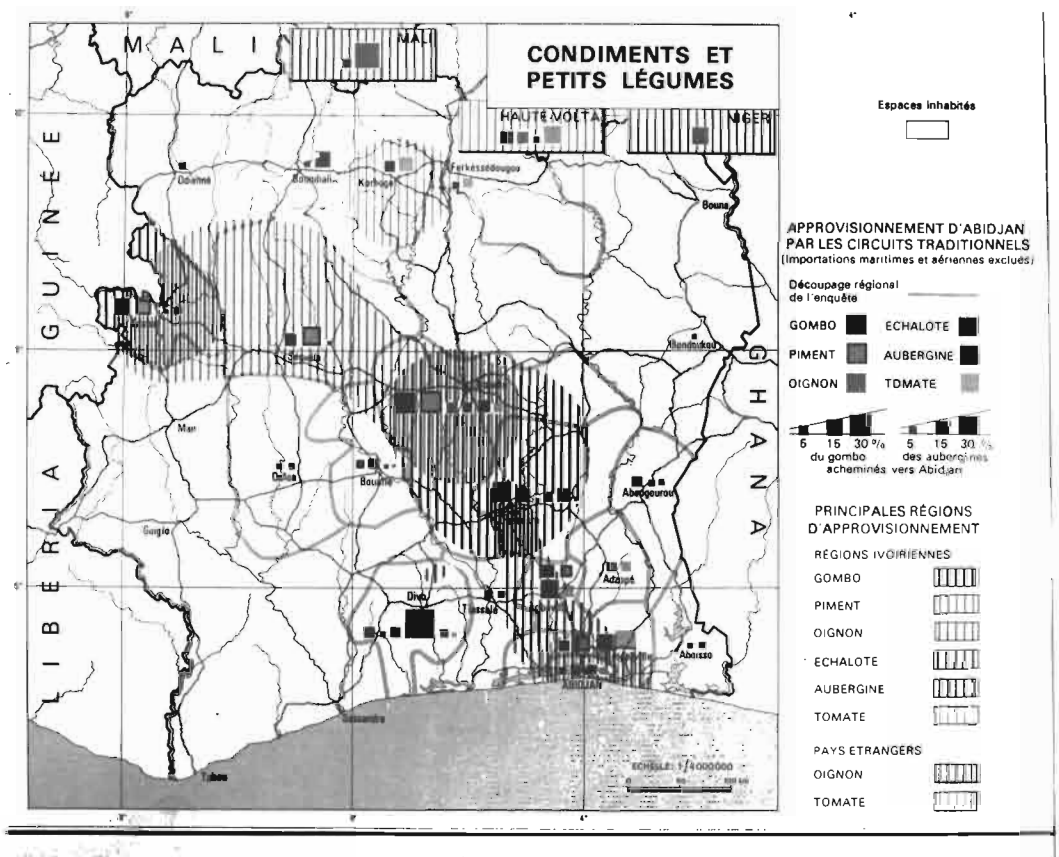

Map no C1 b, Ivory Coast Atlas (1972)

INSECT TRANSMISSION AND NATURAL HOST RANGE OF OKRA MOSAIC VIRUS IN THE IVORY COAST

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30 Août au 6 Septembre 1978
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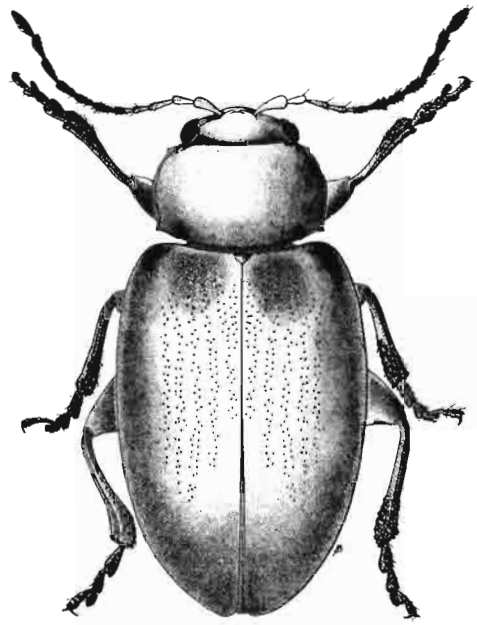
Okra (*Abelmoschus esculentus*, formerly *Hibiscus esculentus*) is a market-garden plant whose fruits the people of the Ivory Coast enjoy as a constituent of their national dish, foutou, which also contains yams, cassava, or bananas.

First slide : You can see the map of the Ivory Coast ; green stripes shows the distribution of okra crops supplying the Abidjan market.

A tymovirus, called okra mosaic virus, discolours the leaves and retards the growth of the plants of almost all the crops of okra which we have examined in the Ivory Coast.

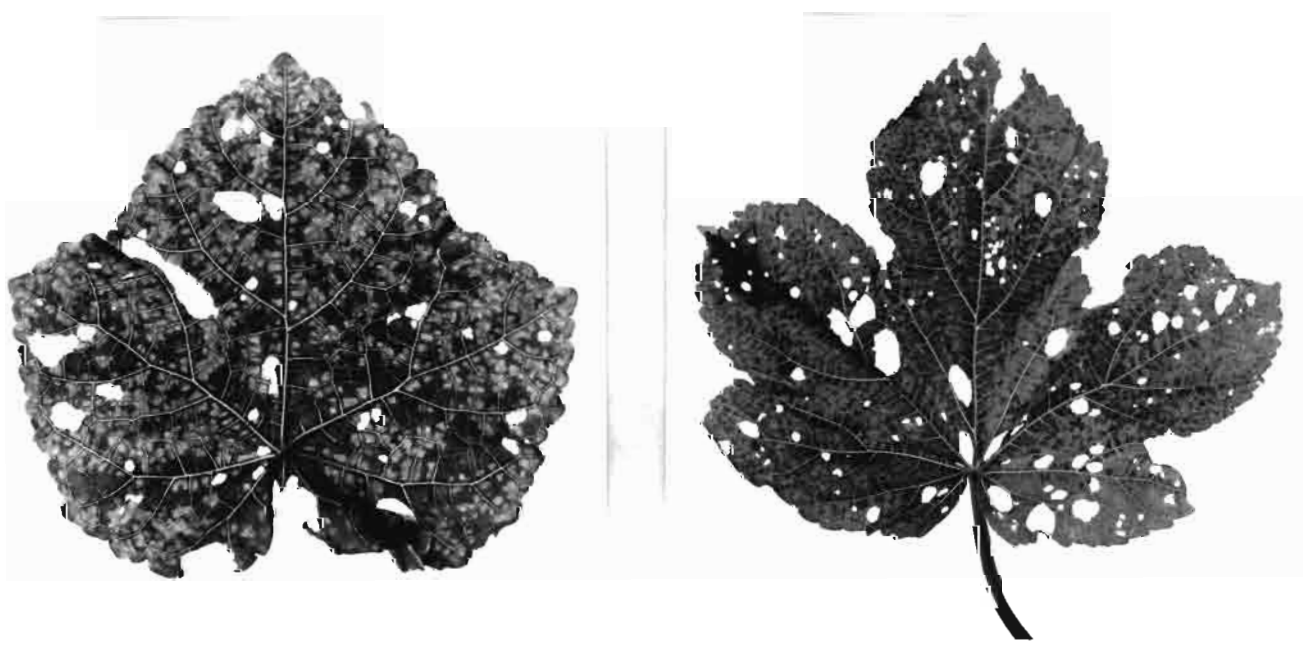
Next slides (x 2) : okra leaf showing symptoms of Okra mosaic virus (OMV) (mosaic and vein banding).

In Ivory Coast, okra is grown in all the vegetable patches, often together with other market-garden plants, notably *Corchorus olitorius* (Tiliaceae, "Nalta Jute") and *Hibiscus sabdariffa* (Malvaceae, "Roselle"). Often on these two plants there are also some vein-banding or mosaic symptoms. These vegetable patches are often close to the brush and are not well kept : there are always weeds growing among the vegetables or at the edges, and some of these weeds sometimes also show signs of infection, notably *Borreria intricans* (Rubiaceae)



The vector : *Podagrica decolorata*

Duvivier Halticinae - Chrysomelidae.



The symptoms : Vein banding and mosaic symptoms on leaves from diseased okra plants in the fields. The holes were made by the beetle.

and *Urena lobata* (Malvaceae). I have even found one stump of the tree *Blighia welwitschii* (Sapindaceae) whose shoots had some mosaic or vein-banding symptoms.

Next slide : table showing the list of plant species, their origin and families.

A small flea-beetle, *Podagrica decolorata* (Chrysomelidae, Halticinae), (next slide : outline drawing of *P. decolorata*) very often feeds on okra in large numbers, causing many holes in the leaves. The beetle also occurs frequently on "Nalta Jute" and sometimes on "Roselle". My first tests for transmission of okra mosaic virus by the flea-beetle from okra plant to okra plant were positive.

I shall describe the identification of these virus isolates, which all turned out to be okra mosaic virus, these and their various experiments on the transmission of okra mosaic virus by flea-beetles from okra to okra or to the other natural hosts of the virus.

I collected leaves showing symptoms in the fields and propagated viruses from them in "insect-proof" greenhouses on the variety "Clemson spineless" of okra.

Various isolates were inoculated onto three diagnostic plants, *Vinca rosea, Nicotiana glutinosa* and *Cucumis sativus* c v. vert long maraicher, in order to distinguish the two strains of OMV commonly found in the Ivory Coast: Cl strain from okra and HR strain from *Hibiscus rosasinensis*. In all cases the virus was re-transmitted to okra after passage on the other plants.

Specific antisera for the two strains of OMV were used in double diffusion and cross-absorption tests in agar gel to characterise the isolates. The isolates were purified by the usual methods for OMV and observed in the electron microscope.

The three types of experiment that I have just described, namely, differential hosts, serology and electron microscopy, show that it was strain C1 that naturally infected the five plant species.

For insect-transmission experiments, flea-beetles were collected in the fields and gardens of okra near our research station. In the laboratory they were fed on healthy okra for 8 days to eliminate natural virus contaminants. After four hours' fasting, they were placed on okra, or the other OMV-host plants, for a chosen virus-acquisition period and then transferred to healthy plants.

The next slide shows the amounts of virus transmission after various acquisition times. Varying the times between one half and two hours for acquisition, and between twenty-four to forty-eight hours for inoculation, made no difference on the transmission. Raising the acquisition time to 4 hours doubled the transmission compared with the former times, regardless of the inoculation time. On the other hand, after twenty-four hours of acquisition, the amount of transmission doubled when the inoculation time went up from twenty-four to forty-eight hours.

The change in transmission with time of inoculation shows that the flea-beetles acquired the virus in shorter time than they passed it on. For example, 16% transmission occurred after an acquisition period of half an hour. In the next slide we see that the same percentage of transmission occurred after an inoculation period of 2 to 4 hours. In all cases the maximum transmission efficiency was about sixty percent.

To determine the retention time of OMV in the flea-beetle, after an acquisition time of twenty-four to forty-eight hours, I transferred the insects daily onto fresh healthy okra. The next slide shows that the maximum retention time was six days.

The insect could transfer OMV from okra to the other natural host plants, and in the reverse direction, too.

To find out which of the three plants, okra, "Nalta Jute" and "Roselle", is preferred by the flea-beetle, I put the plants two species at a time in cages, with three repeats of each combination. I released ten insects into each cage, and observed the positions of the insects four times daily for seven days. The next slide shows that the flea-beetle liked "Nalta Jute" best, then okra, then "Roselle". (Slide off, please).

It follows from these results that OMV is transmitted naturally by the flea beetle *Podagrica decolorata* from okra to okra and to other natural host plants, of which there are obviously more than I mentioned here. The damp tropical climate allows okra to be grown without interruption throughout the year. When one crop is finished, one can often see the new okra sprouts coming up while the old okra plants remain undestroyed in the field, often virus-infected and still covered in vector insects. Even when the ground is well tilled, the insect takes refuge among the wild plants at the edges of the fields, or in the "Nalta Jute" or "Roselle" of neighbouring gardens. Often, plants of Nalta Jute are left in the ground for two years and can maintain the cycle of infection between successive okra crops. So the virus can survive from year to year without difficulty. Thus, one can understand why okra mosaic virus infects almost all the gardens and fields of the southern Ivory Coast.

Les tableaux joints en annexe (n° 2, 3, 5 et 8) ont été projetés comme cela est indiqué dans le texte de la communication.

Table 2. *Transmission of OMV by five flea beetle groups with varied acquisition periods.*

Exp. n° [1]	Acquisition period [2]	Inoculation period [2]	Transmission results		Number of insects [4]
			number [3]	%	
1	0.5	24	9/50	18	3.6
2	0.5	48	9/58	16	3.6
3	1	24	10/57	18	
4	1	48	11/60	18	4.2
5	2	24	12/52	23	
6	2	48	12/59	20	4.4
7	4	24	24/60	40	
8	4	48	21/55	38	3.5
9	24	24	18/59	31	
10	24	48	35/58	60	3.0
11	48	48	1/48	2	3.8
12	48	48	4/53	8	
13	48	72	17/27	63	1.0
14	72	48	4/52	8	

[1] Experiments 11, 12 and 14 were carried out in the rainy season. [2]Acquisition and inoculation periods are indicated in hours ; before each experiment, a preacquisition starvation of 4 hours was carried out. [3]ratio of infected plants to the total number tested ; [4]average number of insects out of five still living at the end of the inoculation period.

Table 3. *Transmission of OMV by five flea beetle groups with varied inoculation periods.*

Acquisition period[1]	Inoculation period[1]	Transmission results[2]		Number of insects[4]
		number[3]	%	
24	1/2	2/60	3	5·0
24	1	0/60	0	4·9
24	2	9/60	15	4·8
24	4	6/57	11	4·5
24	24	18/59	31	
24	48	35/58	60	3.0

[1]Acquisition and inoculation periods are indicated in hours ; before each experiment, a preacquisition starvation of 4 hours was carried out. [2]All experiments were carried out in the dry season ; [3]ratio of infected plants to the total number tested ; [4]average number of insects out of five still living at the end of the inoculation period.

Table 5. *Retention of OMV by five* P. decolorata *groups tested on two okra seedlings at daily transfer with varied acquisition periods.*

Exp. n° [1]	Transfer (day) 1	2	3	4	5	6	7	8	9	10	11	12	13
Transmission[2]													
1	12/30	5/22	1/17	1/12	0/8	0/6	0/4	0/2					
2	25/61	3/37	0/24	0/18	0/12	0/9	0/6	0/4	0/3	0/2	0/2		
3	17/74	9/72	2/64	1/29	1/26	1/21	0/16	0/13	0/10	0/10	0/8	0/7	0/6
Insects[3]													
1	not counted												
2	2.8	2.9	3.6	3.7	3.5	2	3.5	3.5	3				
3	2.6	3.3	3.2	3.4	3.9	3.5	3.7	3.6	4.6	4.2	4.5	4.0	4.5

[1] in experiment 1, 2 and 3, the acquisition period was 24 h, 48 h and 24 h respectively, there was no preacquisition starvation ; [2] ratio of infected plants to the total number tested ; [3] average number of insects out of five still living at the end of the inoculation periods.

Table 8. *In vitro distribution of* P. decolorata *on three natural host species of OMV.*

Cage n°	Type of plant combination[1]	*P. decolorata* presence on species (expressed as % of total observations)	*P. decolorata* copulations on species (number of)
1	Okra	13	0
	C. olitorius	66	22
2	Okra	32	2
	C. olitorius	30	3
3	Okra	13	6
	C. olitorius	55	8
4	Okra	47	16
	H. sabdariffa	20	0
5	Okra	42	12
	H. sabdariffa	20	0
6	Okra	52	12
	H. sabdariffa	20	2
7	*C. olitorius*	48	5
	H. sabdariffa	24	0
8	*C. olitorius*	52	18
	H. sabdariffa	21	8
9	*C. olitorius*	57	14
	H. sabdariffa	22	1

[1]The plants were placed two by two in the same cylinder with ten insects. [2]The location of the beetle was noted four times a day for 7 days ; the observation of the insect on the cage wall or on the soil is not mentioned in the table.