

HOST PLANT RESISTANCE TO WHITEFLIES IN CASSAVA

Anthony C. Bellotti, Bernardo Arias V., Carlos Iglesias, Edgar Barrera.

CIAT, A.A. 6713 Cali, Colombia

INTRODUCTION

As direct-feeding pests of plant viruses, whiteflies constitute a major problem in cassava production in the Neotropics and Africa. The largest complex is in the Neotropics where 11 species are reported: *Aleurotrachelus socialis* is the predominant species in northern South America and *Aleurothrixus aepim* predominates in Brazil. *Bemisia tabaci* has a pan-tropical distribution and as the vector of Africa Cassava Mosaic Disease (ACMD) causes severe crop losses in Africa. ACMD is not found in the Neotropics, and until recently the *B. tabaci* biotypes found in the Americas did not feed on cassava. Since the early 1990's, however, a new biotype (B) of *B. tabaci*, considered by some to be a separate species (*B. argentifolia*) has been found feeding on cassava in the Neotropics and ACMD now poses a serious threat.

Leaf feeding by high populations of *A. socialis* will cause yield reduction. There is a correlation between duration of attack and yield loss. Infestations of 1, 6, and 11 months resulted in a 5, 42 and 79% reduction in yield.

Two methods of control are being pursued at CIAT, host plant resistance (HPR) and biological control. Recent successes in HPR for *A. socialis* are reported in this presentation.

Locality	No. Clones Evaluated ²	No. Promissory Clones 1 to 3.5	No. Selected Clones 1 to 1.5	No. Advanced Clones
CIAT (Palmita)	6872	1511	109	—
Espinal (Tolima)	3030	359	111	5
Villavicencio (Meta)	167	61	3	—
Pivijay (Magdalena)	124	12	2	—
Total Germoplasm Evaluated	>5,000	845	225	5

¹ CIAT Germoplasm bank about 6000 clones
² Evaluation scale: 1=No whiteflies - no damage
6 = > 5000 whiteflies/leaf, necrosis, defoliation, sooty mold
³ Some clones evaluated more than once



More than 5000 clones evaluated



HPR

Resistance mechanism studies were done under greenhouse and growth chamber conditions. Potted cassava plants were infested from a greenhouse *A. socialis* colony. Oviposition, nymphal and pupal development and mortality were measured through daily observations using a stereomicroscope.



RESULTS

Evaluation of the CIAT cassava germoplasm bank has resulted in the identification of several sources of resistance. The clone MEcu 72 consistently expresses the highest levels of resistance. More recently the clones MEcu 64, MPer 335, MPer 415 and the hybrids CM8424-6, CM8424-33, CM8424-4 have also been identified as having levels of resistance comparable to MEcu 72.

MEcu 72 and other selected clones were used in a crossing program to provide high-yielding, whitefly resistance clones, which showed no significant differences in yield between insecticide-treated and non-treated plots under high whitefly pressure. The resistant hybrids CG489-34, CG489-31 and CG489-23 are presently being evaluated by CORPOICA (Colombian Institute of Agronomy) for possible release to cassava producers.

Clone	Yield (T/ha)		
	Protected	Nonprotected	% Reduction
Progeny			
CG 489-34	30 FG	29 GH	3
CG 489-23	39 C	35 DE	9
CG 489-31	29 GHI	26 IJK	10
Regional variety			
Reg. Quindío	25 LJK	17 L	31
Sustainable control			
CMC-40	53 A	26 LJK	52
H 305-122	42 B	9 M	79
Crosses: MEcu 72 (R) x MEcu 12 (T)			

In greenhouse, field and laboratory studies, *A. socialis* feeding on resistant clones had less oviposition, longer development periods, reduced size and higher mortality than those feeding on susceptible ones. *A. socialis* nymphal instars feeding on MEcu 72 suffered 72.5% mortality.

Ovipositional preference of *Aleurotrachelus socialis* on seven cassava clones in Tolima, Col.

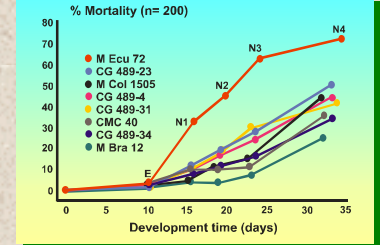
Clone	No. leaves observed	Average eggs per leaf ¹ <i>A. socialis</i>
MEcu 12	92	51.2A
CMC-40	57	75.2A
CG 489-23	54	69.7AB
Mcol 1505	70	55.3A
MEcu 72	75	40.4B
CG 489-31	102	20.6C
CG 489-34	77	19.6C

¹ T-test (0.05) and Ryan test (0.05). Values with same letter are not significantly different

Life cycle, development time egg to adult, duration of *Aleurotrachelus socialis* on eight cassava clones in the growth chamber (28° C ± 1°; RH 70% ± 10).

Clone	No. Observations	Average duration (Days)	S.D.
MEcu 72	55	34.4B	1.79
CG 489-31	115	33.6B	1.91
CG 489-4	112	33.2B	1.88
CG 489-34	131	33.1B	2.29
CG 489-23	100	33.1B	1.78
MEcu 12	150	32.1C	1.69
CMC-40	132	32.0C	1.93
Mcol 1505	110	31.9C	1.99

Values with same letter are not significantly different (P=0.05, Ryan multiple F-test).

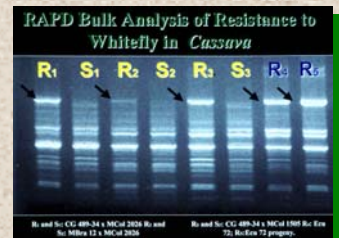


We have developed progenies from crosses between resistant and susceptible genotypes in order to tag regions in the cassava molecular map associated with the resistance. Bulks DNA from the most resistant and the most susceptible individuals within each family were characterized with the use of RAPD's. A band produced with the primer OP-P3 showed tight linkage with whitefly resistance, representing the basis for the molecular mapping of their resistance, and its use in breeding.

Bulks for Evaluation with Raps of Whiteflies Resistant in Cassava

Crosses	Progeny ¹	Figure
CG 489-34 x Mcol 2026	148	Lane 1,2
MEcu 12 x Mcol 2026	149	Lane 3,4
CG 489-34 x Mcol 1505	108	Lane 5,6
R MEcu 72	1	Lane 7
Bulk CG 489	3	Lane 8

¹ 10 individuals by bulk



METHODS

The CIAT cassava germplasm bank contains nearly 6,000 accessions. This germplasm is being systematically evaluated in the field with natural whitefly infestations at four locations in Colombia. Highest populations are consistently found in Tolima and at CIAT and most germplasm evaluations have been at these two sites. Several (3 to 5) evaluation are made during each crop cycle, using a 1 to 6 damage and whitefly (immatures and pupae) population scale.

Damage : 1 = no leaf damage
4 = apical leaves curled and twisted, yellow-green mottled appearance
6 = considerable leaf necrosis and defoliation, sooty mold on mid and lower leaves.

Population: 1 = no whitefly stages present
4 = 501 to 2000 individuals per leaf
6 = > 5000 per leaf

Aleurotrachelus socialis mechanical damage



AFRICAN CASSAVA MOSAIC DISEASE