

Current status of cassava green mite biological control in Africa with reference to Tanzania

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Background

- ◆ The cassava green mite: *Mononychellus tanajoa* (Bondar) (Acarina: Tetranychidae)
- ◆ First reported in the early 1970s from Uganda, East Africa.
- ◆ By 1985, *M. tanajoa* had spread to more than 27 countries in the cassava belt of Africa including Tanzania, and today covers almost all the countries where cassava is cultivated.
- ◆ *M. tanajoa* threatens production of cassava in many marginal areas where cassava is often the last crop available for harvest after all other crops have failed.
- ◆ Yield losses are estimated between 30-50% in a continent where the crop had been relatively free of major arthropod pests.
- ◆ This mite is now widely recognised as the most serious arthropod pest of cassava in Africa since the control of the cassava mealybug, *Phenacoccus manihoti* (Mat-Ferr) by the exotic parasite, *Apoanagyrus lopezi*

Why CGM became a pest in Africa?

- ◆ Before it was introduced in Africa, almost nothing was known of the pest except a description of the species in 1938 in Bahia, Brazil.
- ◆ The pest only attracted attention in the early 1970s when it was found in Uganda. In the neotropics from where it was introduced into Africa, cassava is relatively tolerant of indigenous pests, particularly on local adapted cassava varieties used in the traditional farming systems.
- ◆ The introduction of *M. tanajoa* into Africa without its natural enemies, which keep the pest under control in the neotropics, is the main reason why *M. tanajoa* became so quickly a widespread problem in Africa. In addition, many countries were without expertise when the pest arrived and hence suffered great losses.
- ◆ Control measures started with the use of chemicals but were quickly dropped considering the cost to farmers and the danger of poisoning in countries where cassava leaves are consumed as vegetables. Control efforts were later shifted to breeding
 - ◆ for host plant resistance and particularly to classical biological control.

Cassava Green Mite Project

Based on the successful control of the cassava mealy bug *P. manihoti* by the exotic parasitoid *A. lopezi*, the Biological Control Program (BCP) of the International Institute of Tropical Agriculture (IITA) initiated a project in 1984 to control CGM in Africa. The project, known as Cassava Green Mite Project was located in Nigeria until 1988 after which it was moved to the Republic of Benin, West Africa, where the Biological Control Centre for Africa was established.

Foreign exploration and Experimental releases (1984-89, 1989-1998)

- ◆ Predatory mites of the family Phytoseiidae were immediately identified as the most promising natural enemies of CGM. Hence, foreign exploration was begun by IITA in the neotropics in collaboration with EMBRAPA (Empresa Brasileira de Pesquisa Agropecuária) and CIAT (Centro Internacional de Agricultura Tropical). More than 50 species were found and shipped to IITA for evaluation after undergoing quarantine.
- ◆ Between 1984 and 1989, 9 Colombian species (Table 1) were tested in > 341 sites in different agronomic and ecological conditions in 10 countries. None became established probably because of lack of alternative food sources during low CGM populations and period of inadequate climatic conditions especially low relative humidity.
- ◆ In 1989, foreign exploration was shifted to Brazil, which has more similar agro-meteorological conditions than Africa where CGM is a problem. Six (6) predatory species (Table 2) were found as promising and tested in 365 sites in 11 countries between 1989 and 1995. Three of the six species became established: *Neoseiulus idaeus*, *Typhlodromalus manihoti*, and *Typhlodromalus aripo*.
- ◆ Continuous releases and follow-ups of the three predatory mites released in various agro-ecological conditions in several countries especially in West Africa immediately showed the superiority of *T. aripo* over *N. idaeus* and *T. manihoti*.

Table 1. Release and Recovery of Colombian Phytoseiids in Africa 1984-1989: none permanently established

Species	No. countries	No. shipped	Sites	Recovery frequency
<i>Galendromus annectens</i>	10	516,728	41	0.13
<i>Neoseiulus anonymous</i>	10	1,921,580	68	0.30
<i>N. californicus</i>	8	443,512	30	0.28
<i>N. idaeus</i>	10	1,819,779	81	0.47
<i>Typhlodromalus manihoti</i>	6	86,077	24	0.19
Other species: <i>Amblyseius aerialis</i> , <i>Euseius concordis</i> , <i>Proprioseiopsis mexicanus</i> , <i>Typhlodromalus tenuisatus</i> : 3,457,750 released.				

Table 2. Release and Recovery of Brazilian Phytoseiids in Africa 1989-1998

Species	No. countries	No. shipped	Sites	Recovery frequency
<i>Amblyseius aerialis</i>	1	731	1	0.0
<i>Neoseiulus anonymous</i>	1	108,403	3	0.0
<i>N. idaeus</i>	12	3,737,067	160	0.47
<i>Typhlodromalus manihoti</i>	10	1,946,101	133	0.44
<i>Typhlodromalus aripo</i>	16	203,587	87	0.90

Characteristics of the most performing Brazilian species

Neoseiulus idaeus

- Origin: Northeastern Brazil
- First released in Africa in 1989
 - Benin, Ghana, Kenya, Democratic Republic of Congo, and Zambia
- Establishment and spread:
 - Benin, Nigeria, and Kenya
 - < 0.1 km/year
- Impact on CGM and cassava root yield:
 - has not been measured
- Mass production: easily produced on tetranychid prey

Typhlodromalus manihoti

- Origin: Northeastern Brazil
- First released in Africa in 1989
 - Benin, Ghana, Kenya, and Zambia
- Establishment and spread:
 - Benin, Ghana, Nigeria, and Burundi
 - 2.5 km/year
- Impact on CGM and cassava root yield:
 - 67% less CGM, root yield difficult to assess
- Mass production: difficulties in identification and maintenance

Typhlodromalus aripo

- Origin: Northeastern Brazil
- First released in Africa:
 - October 1993 in Ikpindle, Southern Benin
- Establishment and spread:
 - 17 countries as of August 1999
 - up to 35 Km/year
- Impact on CGM and cassava root yield:
 - 50% < CGM, 30% > root yield, large economic gains
- Mass production: easily produced in-field and distributed using infested shoot tips
- Persistence: Several and continuous long-term observations of population dynamic studies on cassava green mite and *T. aripo* conducted in some countries in West Africa (Benin, Cameroon, Nigeria, Togo), Central Africa (Democratic Republic of Congo), and East Africa (Kenya, Tanzania, Uganda) across various ecological zones including rainforest, transition forest, moist savannah, in low and mid-altitude provide evidence over time of the stability of biological control.

Why slower spread in Central, East and Southern Africa?

- More efforts in West Africa

- Political problems and insecurity in Central Africa
- Some surveys yet to be made in parts of East and Southern Africa
- Unfavourable environmental conditions in mid- and high altitude sub humid zones
 - Cold temperatures and low relative humidity during dry seasons?
 - Plant defoliation?

Africa-Wide Implementation of CGM Biological Control

- Surveys, releases and follow-up monitoring of released species
- Foreign exploration
- Host plant preference and cultural practices
- Plant-pest-predator interactions
- Training and development of human resources
- Impact assessment

I. Surveys, Release and follow-up

- Conduct extensive surveys where not yet done to determine the damage caused by CGM before planning for releases
- New releases are made from shipments from IITA Benin or from multiplication fields where the predator is already present
- Monitor establishment, dispersal and spread after release
- Long term population dynamics and persistence studies

II. Foreign exploration

- Should continue for searching species adapted to mid- and high-altitude sub-humid zones, e.g. Zambia
 - Other strains/species of predators from CGM native range
 - New associations
 - More virulent *Neozygites* isolates from Brazil

III. Host plant preference and cultural practices

- Variety selection
- Field observations have shown that cassava varieties have some characteristics which make them to be or not to be preferred by *T. aripo*. Such characteristics include the size, compactness and the hairiness of the tips. Breeders can use these characteristics
- Intercropping/interplanting *T. aripo* preferred and non-preferred varieties

Preliminary results of experiments conducted in Benin and Nigeria indicate that interplanting *T. aripo* preferred and non-preferred varieties enhances *T. aripo* on non-preferred varieties when the population of *T. aripo* is high but has little or no effect on non-preferred when *T. aripo* populations are low

- Nursery plantation of *T. aripo* preferred varieties in areas with predominantly non-preferred varieties
- Select for "Stay-Green" varieties especially during the dry season

IV. Plant-pest-predator interactions

- Predator behaviour and distribution, persistence, colonization rates, multiple species interactions
- Interactions with other pests and diseases: e.g., CMD, whiteflies and nematodes

V. Impact assessment

- Impact on other pests and mites and cassava productivity
- Economic cost/benefit analysis
- Impact on non-target effects

VI. Training and development of human resources

- Assistance and support
- Farmer Field Schools
- In-country group, bench and post-graduate training

Collaborations and Networking: Project

Composition

- Staff

Dr. Rachid Hanna- Project Co-ordinator

Dr. Muaka Toko - Training/Liaison Co-ordinator

Mr. Desire Gnanvossou -Culture maintenance and laboratory bioassays

Mr. Alexix Onzo - Releases, follow-ups and impact assessment

Mr. Gregoire Paraiso -Mass production and technology development

Mr. Ignace Zannou -Mite taxonomy and curation

- **National Program Collaborators/institutions/contacts**

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Benin -C/o SPV Porto-Novo

Cameroon - Dr. Nelson Ntonifor, University of Buea

Dem. Rep. of Congo - Mr. Tata-Hangy, PRONAM/INERA, Bas-Congo

Ghana - C/o Root & Tuber Crop Res. Institute, Kumasi

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