# BIOECOLOGICAL STUDIES ON THE CASSAVA MITE *MONONYCHELLUS TANAJOA* (Bondar) (Acarina: Tetranychidae)

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## SUMMARY

Two mites, *Mononychellus tanajoa* and *Tetranychus telarius* attack cassava in Uganda. The former is a recent introduction and is causing severe damage during the dry seasons. Biological studies suggest a possibility for biological control by either *Stetnorus* sp. or *Oligota* sp. The use of acaricides present continuing problems and it is concluded that carefully conceived integrated control will be necessary.

## RESUME

Deux acariens, *Mononycellus tanajoa* et *Tetranychus telarius* attaquent le manioc en Ouganda. Le premier, d'apparition récente cause des dégâts importants pendant la soison sèche, Des études biologiques indiquent la possibilité de lutte biologique soit par *Stetnorus* sp. ou *Oligota* sp.

L'utilisation d'acaricides entraine des problèmes permanents et on tire la conclusion qu'il sera nécessaire de concevoir une lutte prudente et intégrée.

## RESUMEN

Dos ácaros, *Mononychellus tanajoa* y *Tetranychus telarius* atacan a la yuca en Uganda. El primero es una introducción reciente y causa daños severos durante las estaciones secas, Los estudios biológicos sugieren la posibilidad de controlarlos biológicamente bien sea con *Stetnorus* sp. o con *Oligota* sp. el uso de acaricidas presenta problemas continuos y se concluye que es necesario un cuidadoso control concebido de manera integral.

## INTRODUCTION

The green cassava mite, *Mononychellus tanajoa* Bondarl is a neotropical species. It is believed to have been introduced into the Ethiopian region of Africa in 1971. It belongs to the Caribbeanae group of mites (Paschoal[6]) characterized by irregular, anastomised striae at the mediodorsal portion of propodosoma, around the setae bases and at other hysterrosomal areas. They are further characterized by having clavate dorsal body setae and a conical stylophore with the anterior margin rounded and with longitudinal striae. The other Tetranychid pests of cassava are *Mononychus planki* (McGregor), *M. caribbeanae* (McGregor) and *Tetranychus cinnabarinus* (Boisduval). A very comprehensive key separating the more closely related species of this group has been provided by Paschoal[6].

Although both *M. tanajoa* and *Tetranychus telarius* L. (= *T. urticae*) attack cassava in Uganda, their identity and damage are quite distinct. The former is green and smaller in size and attacks young leaves preferentially up to the thirteenth leaf. *T. telarius* is red and bigger in size and normally found on the old leaves.

## DAMAGE

Cassava leaves infested by *M. tanajoa* develop mosaic symptoms. The leaves show pin point pricks and mottling and fold dorsally without any signs of necrosis. Badly infested leaves drop off leaving only the apical growth. Severe damage to cassava occurs in the dry season but subsides during rainy periods.

## CLIMATOLOGY IN UGANDA

Temperature and humidity are well known to affect the survival and the reproductive potential of mites.

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The Lake Victoria and Western region zone of Uganda has two rainy seasons, from mid-March to May and from August to November with the peaks in April and November. Over most of the northern and eastern regions of Uganda, rainfall is sparse with more pronounced dry spells, the usual two rainy seasons between March and May and between August and November are less distinct, tending to merge into a monomodal pattern with increasing distance from the equator.

The mean temperatures over the whole of Uganda show little variation except those of the mountain districts of western and eastern Uganda. In the west and south, temperatures range between 9° C and 28° C while in the northern and eastern regions they range between 16° C and 35° C. Relative humidities are fairly low where temperatures are high and over 70% around the lake shores areas.

## DISTRIBUTION OF THE PEST

The green cassava mite is distributed in the neotropical region. It was first recorded in Brazil (Bondar[1]) where its damage was referred to by the natives as "tanajoa de Mandioca" meaning disease of the cassava. In addition to Brazil and Uganda, the known distribution covers Trinidad and possibly Colombia (Flechtmann, personal communication) and it is suspected to exist in Jamaica, Venezuela, Mexico and in the states adjacent and north of Brazil. There is a possibility of this mite spreading to countries surrounding Uganda because of its mode of dispersal.

## BIOLOGY

### Oviposition

Eggs are laid singly on the under surface of cassava leaves. Initial oviposition starts at the base of the leaves along the veins but later eggs are often randomly placed. The mean incubation period at a mean temperature of 22° C was 5.1 days whereas at 32° C it was 4.0 days. The preoviposition period ranges between 1–3 days.

### Fecundity and longevity

The average fecundity under room temperature (17–29° C) was 3.5 eggs per female per day. The total number of eggs laid per female durings its life, ranged between 35–111 eggs. Longevity of individuals varied between 22 and 35 days, with a mean longevity period of 30 days.

### Immature stages and reproduction rate

*M. tanajoa* has a life cycle similar to other tetranychid mites. The egg hatches into a larva which is characterized by having only 3 pairs of legs. This moults into a protonymph, and later to deuteronymph and adult. The duration of the stages from larva to adult ranges between 3–11 days at room temperature. Life history studies reported by Nyiira[4] indicate a net reproductive rate of 70.12 and an intrinsic rate of natural increase of 0.2498.

### Alternative host plants of *M. tanajoa*

Although the green cassava mite has long been known in Brazil on cassava, there is no record of alternative hosts. In Uganda, however, *Manihot glaziovii*, *M. cartagenensis* and *Manihot* sp. are recorded as wild hosts of the green cassava mite. *Euphorbia prunifolia* and *Euphorbia* sp. commonly used in Uganda for cattle hedges are closely observed as suspected hosts though confirmation of this suspicion is as yet lacking.

### Natural enemies

A predacious coccinelid *Stetnorus* sp. and a staphylinid *Oligota* sp. are very abundant and feed on all stages of the green cassava mite in Uganda. The species involved have not yet been identified. The common species of *Oligota* recorded feeding on adults of *M. tanajoa* in Trinidad was confirmed to be *O. minuta* (Bennett, personal communication). Other predators recorded feeding on the green cassava mite include Phytoseiidae mites (*Typhlodromus* sp.), *Orius* sp. (Anthocoridae), Arachnids, Syrphid fly larvae and Chrysopids.

### Predator populations

Greater predator populations are found where the population of the host mites is high. Initial trials indicated that higher predator and mite populations existed on the fifth to eighth leaves. Rain reduced both

predators and mites. It is possible that this effect on predators was both direct by physical destruction, and indirect by destruction of mites and depriving the predators of food causing their migration. *Oligota* sp. and *Stethorus* sp. migrated by flight while phytoseiid mites and arachnids depended on walking.

The egg laying potential of *Oligota* sp. and *Stethorus* sp. are being investigated through life history studies to enable comparisons to be made of the net reproduction rate and the intrinsic rate of natural increase of the predators and their hosts. According to McMurtry *et al.*[2], *Stethorus* spp. and *Oligota* spp. have a maximum daily rate at least as high as that of tetranychids, and considerably longer oviposition period. Their total fecundity rate is, therefore, considered greater. However, these authors show that phytoseiid mites seem to have a lower maximum daily egg deposition than do the tetranychids.

The microclimatic distribution of the more common predators of the cassava mite on plants is associated with the existence and abundance of the prey.

Although their macroclimatic distribution has not been fully studied there is a possibility that it is to a certain extent related to its prey, especially the spider mite host.

## MITE POPULATIONS

Observations and counts of eggs and adult mites carried out on leaves 1, 3, 5, 7, 9, 11, 13 and 15 or individual cassava trees established that the greatest populations of mites and their eggs occurred on leaves 5th to 8th.

The population trend of adult mites in time, showed that higher mite population density was related to several factors. These were the dry periods and the new leaf growths, and presence and quantity of chlorophyll. Dry periods were favourable for development of the mite. Heavier damage occurred during the dry period probably because of the rapid population build-up and severer destruction of leaves by mites extracting moisture from them. New leaf growth provided fresh food and areas for reproduction and support for high population densities.

The major dispersal means by which the green cassava mites were spread were by airdrift and animal or human movement through the crop. Because of these modes of dispersal and the existence of wild alternative hosts it was difficult to devise any eradication programme as a means of control. The mites were responsive to morning warm temperatures and light winds, actively moving up the cassava stems and suspending themselves on self-produced silk thread from which they were easily blown off into air currents.

## RELATIONSHIP BETWEEN LEAF NUTRIENTS AND MITE POPULATIONS

The leaf nutrient percentage in leaves of three cassava cultivars when six months old is given in Table 1. Generally phosphorus, nitrogen and potassium content was greater in young leaves whereas calcium content was more in old leaves. The percentage of magnesium remained more or less constant in all the leaves.

The relation between nutrient content of leaves and mite population was negative for P, Ca, Mg, but positive for N and K. The correlation coefficient in each case was however very low and not statistically significant.

## RESISTANCE TO MITES OF CASSAVA CULTIVARS

Montaldo[3] reported differential resistance to spider mites in cassava cultivars in Venezuela. He showed that three cultivars were resistant to *Eotetranychus planki* McGregor (= *M. planki*). Studies in Uganda (Nyiira[5]) show that there is so far no primary resistance recorded in any of the cultivars presently grown. All cultivars however, recover from attack, especially during the rainy spell. There is an indication that some cultivars may be more tolerant than others, although they may not be the best yielding.

## ACARICIDES AND THEIR ECONOMIC IMPLICATION

Trials have been carried out to test the effect of kelthane, chlorobenzilate and rogor on the cassava mite populations. Acaricides were effective suppressants of the cassava mite. All the three acaricides had persistence that extended beyond three weeks, maintaining a percentage reduction of mite population above 80% after the initial application. Rogor and kelthane had longer persistence than chlorobenzilate. The difference in reduction of mites between kelthane and rogor was not statistically significant but they were both more effective than chlorobenzilate when assessed ten days after spraying and thereafter.

Although acaricides were found to be effective against *M. tanajoa*, they are expensive to apply to a crop like cassava which, although widely grown in Uganda, is not income-earning, usually being grown by peasant farmers for subsistence. Mites are also known to develop resistance to acaricides and so these chemicals provide only an uncertain control. Further, McMurtry *et al.*[2] have shown that acaricides have adverse effects on the predators of tetranychid mites, let alone the unknown, less obvious, but possibly detrimental

indirect influences. Similar observations were recorded during these trials including resurgences of the green cassava mites in areas where cassava had been sprayed with acaricides.

Whereas, therefore, the use of acaricides may be possible for the short term control of the green cassava mite, they do not seem to present a hopeful long-term solution to the country-wide infestation of cassava by *M. tanajoa*. The complexity of the problem calls for a carefully conceived integrated control programme in which a diversity of research scientists would participate –

## REFERENCES


1. Bondar, G. (1938) Notas Entomologicas de Bahia. *Rev. Ent.* 9, 441-9.
2. McMurtry, J.A., Huffaker, C.B. & van de Vrie, M. (1970) Ecology of Tetranychida mites and their natural enemies. A review. *Hilgardia* 40, 331-90.
3. Montaldo, A. (1972) La yuca. Trobajos sobre este cultivo con especial referencia a Venezuela *Oficina de communicaciones Agricolas Maracay edo Aragua.*
4. Nyiira, Z.M. (1973) Life history of *Mononychellus tanajoa* (Bondar) (Acarina: Tetranychidae). In preparation.
5. Nyiira, Z.M. (1973a) Report of investigation on cassava mite *Mononychellus tanajoa* (Bondar) for 1972. *Entomology section. Kawanda Research Station, Uganda.*
6. Paschoal, A.D. (1971) A review of the Caribbeanae group (Acarina: Tetranychidae) *Rev. Per. Entom.* 14, 177-9.


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**TABLE 1**

Nutrient % in leaves of three cassava cultivars when six months old

| Cultivar | P | N | K | M | Ca |
|---|---|---|---|---|---|
| Bukalasa | 0.26 | 5.03 | 1.11 | 0.09 | 0.64 |
| Mpologoma | 0.28 | 4.85 | 1.09 | 0.09 | 0.55 |
| Bintimisi | 0.30 | 5.96 | 1.24 | 0.13 | 0.66 |