The International Exchange and Testing of Cassava Germ Plasm in Africa

Proceedings of an interdisciplinary workshop held at IITA, Ibadan, Nigeria 17-21 November 1975

Editors: Eugene Terry and Reginald MacIntyre

Cosponsored by the International Development Research Centre and the International Institute of Tropical Agriculture
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Advances in Research on the Economic Significance of the Green Cassava Mite (Mononychellus tanajoa) in Uganda

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The green cassava mite Mononychellus tanajoa was probably accidentally introduced into Uganda during recent years. The first documented outbreak was around Kampala (Nyiira 1972). Since 1972 the pest has covered wide areas including Kenya, Congo Brazzaville, Burundi, and possibly Rwanda.

Prior to its discovery in Uganda there was little concern over mites as pests of cassava, although existence of the pest was recognized.

Nyiira (1975a) shows that spider mites infest cassava in South and Central America, the Caribbean Zone, Asia, and Africa. The species include: Tetranychus urticae (= T. telarius), T. bimaculatus, T. cinnabarinus, T. timidius, Mononychellus tanajoa, M. carribeanae, M. planki, M. chenosetosus, M. bondari, M. planby, and Oligonychus gossypii. Together, they form what is now known as the cassava mite complex.

Although all have been recorded on cassava, some are of minor economic consequence. Mononychellus tanajoa is considered a potential threat to cassava cultivation throughout the African tropics. Other Mononychellus species and T. cinnabarinus could attain economic pest status as cassava becomes more widely cultivated.

Economic importance

Mononychellus tanajoa feeds on the undersurface of the cassava leaves. The infested leaves develop mottling, and a bronzed, mosaic appearance. On close examination, the bronze mosaic appearance is due to the yellow spots resembling pin-point pricks inflicted by the mite's feeding. The damage is chiefly to top leaves, although under severe infestation, stems get scarified and die back. Severely infested leaves drop off while the young cassava stems damaged by the mite turn rusty and rough. The damage to leaves and stems interferes with photosynthesis activity of the plants, and that, combined with the dropping off of leaves, may lead to reduced tuber yield.

Host range

Host plants of the green cassava mite in Uganda include the following: Manihot species: esculenta, utilissima, glaziovii, dichotoma, heptapylla, piahyensis, and cartagenesis. In Brazil, the green cassava mite also breeds and multiplies on Manihot api. The mite is apparently restricted to Manihot species. It is possible, however, that its hosts may include other Euphorbiaceae.

Natural enemies

The most common natural enemies of the green cassava mites in Uganda include Oligota (Staphylinidae) and Stethorus (Coccinellidae) species and the Phytoseiidae mite complex. Other predators include Syrphus (Diptera: Syrphidae), Chrysopa (Neuroptera: Anthocoridae), Thrips (Thysanoptera: Thripidae), Geocoris (Hemiptera: Chrysopidae), Orius insidiosus (Hemiptera: Lygaeidae), and spiders (Aranea).

A brief look at the potential of predators as control agents of the green cassava mite showed them to be effective and favourable.

In Trinidad, the Commonwealth Institute of Biological Control carried out a similar survey. They identified Typhlodromalus limonicus and T. rapax as abundant and important predators of general Mononychellus. They also encountered thrips and Cecidomyiidae (probably Feltiella sp.) associated with Mononychellus.

These initial findings suggest that natural enemies of M. tanajoa are of sufficient importance to merit
further investigation for application of control of the green cassava mite.

**Life history**

The green cassava mite is very small (average length 350 μ). Its egg is about half the size of the adult. Adult females lay the eggs on the undersurface of the leaves. Initially, the eggs are deposited along the midrib and along the veins. As the female population increases, the eggs are deposited at random.

The eggs when first deposited are transparent and spherical. As incubation progresses the eggs look glassy and eventually the colour of pale straw just before hatching.

The number of eggs laid per female varies, the average at an uncontrolled mean temperature of 23°C being 3.4 per female per day. The incubation period is 4–5 days at 16–32°C. The hatchability percentage ranges from 25 to 100%. The nymph period at Kawanda Research Station (at 16–20°C) is 8–13 days.

The egg-laying life span averages 19 days in the laboratory at uncontrolled temperatures, and the mean longevity of females is 30 days.

**Aerial dispersal**

A reasonably consistent activity pattern by green cassava mites was recorded between 24 and 29°C in slight air currents. Strong winds do not influence aerial migration, although water, other insects, and various animals contribute greatly to their movement.

Nyiira (1975b) discussed the importance of meteorological factors in the development, migration, and dispersal of the green cassava mite. With sufficient knowledge of the aerobiological activity of the green cassava mite, a warning system for countries free of the pest might be developed. Such a system would greatly assist planning of control activities.

**Seasonal abundance**

Mite population density is highest during the driest periods, and high-humidity conditions tend to suppress major outbreaks and damage. In rainy conditions the population of mites decreases. The reduction in the population in wet weather may be due to a physiological phenomenon linked with the development habits of the mite, or a result of mechanical destruction of the mite stages.

Variation in the population density, followed over 12 months on three varieties of cassava, showed that mite populations remained low on all the varieties after 10 months irrespective of changes in weather conditions. Control measures may be unnecessary on infested cassava after 10 months. However, these results were not followed up to find out whether they had any bearing on planting time of the cassava.

**Effect on yield**

Different levels of infestation can result in over 40% loss in fresh tuber weight, as a result of green cassava mite attack (Table 1 and 2). The magnitude of the yield loss will depend on the age at which the crop is attacked and the number of mites involved. This aspect is under active study at this laboratory.

**Control measures**

Initial work (Nyiira 1972) on the control of cassava mites using chemicals indicated that the three acaricides tested (Kelthane (Dicofol), Chlorobenzilate (Akar), and Rogor (Dimethoate)) were effective against green cassava mites. Kelthane and Rogor were more persistent than chlorobenzilate. They provided sufficient protection for over 30 days.

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**Table 1.** Yield and quality components of cassava (variety Bukalasa 11) from green cassava mite attack compared to the unprotected cassava of the same variety.

<table>
<thead>
<tr>
<th>Component</th>
<th>Protected (sprayed)</th>
<th>Unprotected (unsprayed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean fresh yield per plant (kg) b</td>
<td>2.46</td>
<td>1.67</td>
</tr>
<tr>
<td>Estimated fresh tuber yield per hectare (kg/ha)</td>
<td>16.520</td>
<td>11.190</td>
</tr>
<tr>
<td>Mean diameter of tuber (at 12 months) (cm)</td>
<td>14.04</td>
<td>13.51</td>
</tr>
<tr>
<td>Mean length of tuber (at 12 months) (cm)</td>
<td>24.83</td>
<td>24.66</td>
</tr>
<tr>
<td>Mean no. of tubers per plant</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Quality (taste score e)</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Texture</td>
<td>Good</td>
<td>Good</td>
</tr>
</tbody>
</table>

a Sprayed with Rogor (Dimethoate).
b Based on 3-score scale: Good, Fair, Bad.
e Mean of tuber weight from 40 plants/treatment.
The mite population reduction after 2 weeks was over 70% in cassava treated with all three acaricides. The use of expensive acaricides against cassava mites is not feasible by peasant farmers in Uganda. Moreover, more severe mite infestation occurred after every application of chemicals. On further investigations, we found that the chemicals had an adverse effect on the common, abundant predators of the green cassava mites (Oligota, Stethorus, and Thyphlodromus).

Current results show that biological control agents can suppress the mite populations, particularly in the areas of bimodal rainfall (the southern zone of Uganda). Certain varieties of cassava can withstand infestation without much damage to leaves. If a variety is fast-maturing (therefore subject to fewer series of infestations), and fairly resistant or tolerant to the mite damage, coupled with biological control agents, the effect on that variety by the green cassava mite would be reduced.

Effective measures against the green cassava mite should, therefore, aim at an integrated control utilizing quick-maturing, resistant/tolerant varieties backed by a program of biological control.

References


Table 2. Tuber weight (kg) per plant recorded at different infestation levels in six replicates on cassava variety Bukalasa 11.

<table>
<thead>
<tr>
<th>Infestation levels (based on plots of 20 plants each)</th>
<th>0%</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.22a</td>
<td>2.25</td>
<td>1.95</td>
<td>2.34</td>
<td>2.02</td>
<td>1.95</td>
</tr>
<tr>
<td>2</td>
<td>2.72</td>
<td>3.10</td>
<td>2.27</td>
<td>1.99</td>
<td>1.48</td>
<td>2.56</td>
</tr>
<tr>
<td>3</td>
<td>2.63</td>
<td>2.93</td>
<td>2.22</td>
<td>2.29</td>
<td>1.61</td>
<td>1.98</td>
</tr>
<tr>
<td>4</td>
<td>2.59</td>
<td>2.26</td>
<td>1.97</td>
<td>1.99</td>
<td>1.78</td>
<td>1.03</td>
</tr>
<tr>
<td>5</td>
<td>2.18</td>
<td>1.71</td>
<td>2.15</td>
<td>1.43</td>
<td>1.56</td>
<td>1.54</td>
</tr>
<tr>
<td>6</td>
<td>2.41</td>
<td>2.05</td>
<td>3.16</td>
<td>2.17</td>
<td>1.75</td>
<td>1.69</td>
</tr>
<tr>
<td>Total</td>
<td>14.75</td>
<td>14.30</td>
<td>13.72</td>
<td>12.21</td>
<td>10.20</td>
<td>10.75</td>
</tr>
<tr>
<td>Mean</td>
<td>2.50</td>
<td>2.40</td>
<td>2.30</td>
<td>2.10</td>
<td>1.70</td>
<td>1.80</td>
</tr>
</tbody>
</table>

Notes: *Weight of tuber (kg) per plant from 20 plants per treatment per replicate. Difference between yield of different infestation levels significant at 1% level of probability.*