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INVESTIGATIONS OF CASSAVA MITES OF TANAJOA COMPLEX AND THEIR NATURAL ENEMIES IN THE NEOTROPICS

(Recherches sur les acariens du complex Tanajoa chez le manioc et sur les ennemies naturels dans les néotropiques)

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SUMMARY

Surveys for cassava mites and their natural enemies in the Caribbean, Central and South America have revealed at least fourteen Tetranychid mites and a fairly large predator complex including fourteen Phytoseiids, three Cecidomyiids, seven Coccinellids, four Staphylinids, an Anthocorid and a Thysanopteron. Several of the predators, especially *Thyphlodromalus* spp., *Oligota* spp., *Stethorus* sp. and *Feltiella* spp., appreciably reduce host numbers and are recommended for trials against *Mononychellus tanajoa* complex in Africa.

RESUME

Des enquêtes sur les acariens et leurs ennemies naturels dans la Caraïbe, l'Amérique Centrale et du Sud ont révélé au moins quatorze acariens Tetranychidae et un assez large complexe de prédateurs dont quatorze Phytoseiidae, trois Cecidomyiidae, sept Coccinellidae, quatre Staphylinidae, trois Anthocaridae et un Thysanoptère. Plusieurs des prédateurs, spécialement Typhlodromalus spp., Oligota spp., Stethorus sp. et Feltiella sp., réduisent significativement le nom des hôtes et se recommandent pour des essais contre le complexe Mononychellus tanajoa en Afrique.

Since its discovery in Uganda in 1971 *Monochellus tanajoa* Bondar has rapidly spread and is now present in almost all the cassava growing countries in tropical Africa. Bondar (1938) had described it from Brazil. Doreste (1981), split it into three : *manihot, progresivus* and *tanajoa*. YASEEN et al (1982) and FLECHTMANN (pers comm) report the presence of *progresivus* and *tanajoa* in East Africa (Kenya) and West Africa (Nigeria).

In Africa, the mites of *tanajoa* complex defoliate cassava plants, and yield losses of up to 46 per cent have been reported (NYIIRA, 1975, 1976). In the Neotropics they were little known until their discovery in Africa. Predators are considered to play a considerable role in regulating the mite populations. Investigations were made in the Caribbean, Central America and South America for the cassava mites and their predators with a view to evaluate them for introduction into the Afrotropics.

Cassava mites

The Tetranychid mites encountered during these surveys are given in Table 1.

These have revealed a very wide distribution of mites of *tanajoa* complex. YASEEN (1977) and YASEEN & BENNETT (1977) have given the biology and ecology of these in Trinidad. The mite populations are greatly influenced by climatic conditions with peak numbers occurring during the dry season March - June and September - October. However, during drought in 1978, the host plants were stunted resulting in a partial defoliation and adversely affecting numbers of the mites. The onset of wet season invigorates plant growth and development of new leaves in turn stimulates growth of mite population attaining peak densities by the middle of June without any pronounced fluctuations up to the middle of July, when they collapse under influence of sustained heavy rains. a minor peak develops during the short dry season in September.

Predators

Several predators were recorded during the surveys. These included fourteen predaceous mites of the family Phytoseiidae, three Cecidomyiids, seven Coccinellids, four Staphylinids, an Anthocorid and a Thysanopteron. Details of the predators are given in Table 2.

Table 1. Tetranychid mites collected on cassava during surveys in the Neotropics (1974-1981)

Tetranychids	Distribution
Mononychellus bondari Paschoal	Brazil
M. caribbeanae McGregor	Bahamas, Barbados, Brazil Colombia, Guyana, Mexico, Nicaragua, Panama, Peru, St Kitts, Surinam, Trinidad, Tobago, Venezuela
M. manihoti Doreste	Trinidad, Venezuela
M. mcgregori (Flechtmann & Baker)	Brazil, Colombia, Ecuador, Peru, Trinidad
M. progresivus Doreste	Bolivia, Colombia, Paraguay, Trinidad, Venezuela
M. tanajoa (Bondar)	*Bahamas, Brazil, Colombia, *Guyana, Mexico, *Paraguay, Surinam, Trinidad, Tobago, Venezuela
Oligonychus peruvianus (McGregor)	Colombia, Ecuador, Trinidad Venezuela
Tetranychus bastosi Tuttle, Baker & Sales	Bolivia
T. cinnabarinus (Boisduval)	Montserrat, Colombia, Paraguay
T. sp. probably *cinnabarinus* (Boisduval)	Peru
T. tumidus (Banks)	Mexico, Trinidad
T. urticae (Koch)	Colombia, Guyana, Surinam, Trinidad
T. sp. probably *urticae*	Colombia, Peru
Tetranychus sp.	Bahamas, Bolivia, Mexico, Nicaragua

*Determinations of *M. tanajoa* from these countries now need confirmation

Table 2. Predators of *M. tanajoa* and related cassava mites encountered during surveys in the Neotropics (1974-1981)

Predators	Distribution
Phytoseiidae	
Amblyseius largoensis Muma	Tobago
Euseisus brazilli El Banhway	Ecuador
E. concordis (Chant)	Tobago
E. fructicolus (Gonzalez & Schuster)	Paraguay
E. hibisci (Chant)	Bahamas
E. vivax (Chant & Baker)	Venezuela
Euseius sp.	Trinidad
Noeseiulus idaeus Denmark & Muma	Paraguay
Phytoseiulus macropilis Banks	Peru
Thyphlodromalus aripo De Leon	Guyana
T. horatii De Leon	Bolivia, Brazil, Guyana, Surinam
T. limonicus (Garman & McGregor)	Bolivia, Brazil, Colombia, Ecuador, Guyana, French Guyana, Trinidad, Mexico, Surinam, Venezuela
T. peregrinus (Muma)	Ecuador, Guyana, Surinam
T. rapax (De Leon)	Colombia, Trinidad, Peru
Cecidomyiidae	
Anthrocnodax sp.	Colombia
Feltiella sp.	Trinidad, Bahamas, Colombia, Mexico, Venezuela, Montserrat
Gen. et sp. indet.	Barbados, St Kitts, Trinidad
Coccinellidae	
Delphastus argentinicus Nonemacher	Guyana, Surinam
D. sp. nr. *pusillus* (Le Conte)	Paraguay
Diomus sp. nr. *tenuis* Brethes	Paraguay
Stethorus darwini (Brethes)	Guyana, Surinam
Stethorus sp.	Peru
S. utilis (Horn) *S.* sp. or spp.	Colombia, Nicaragua, Trinida Venezuela

Table 2 - continued

Predators	Distribution
Staphylinidae	
Oligota barbadorum Frank	Barbados
O. minuta Cam.	Antigua, Brazil, Bahamas Colombia, Cuba, Ecuador, French Guyana, Montserrat, Peru, St Kitts, Surinam, Trinidad, Tobago
O. pygmaea Sol.	Colombia, Mexico, Peru
Philonthus sp.	Brazil
Thysanoptera	
Unidentified	Trinidad
Anthocoridae	
Clidiastethus sp.	French Guyana

The predators especially *Oligata* spp., *Stethorus* spp. and the Phytoseiid, particularly *Typhlodromalus limonicus*, exert a significant influence in regulating population densities of the mite. YASEEN (1984) has investigated the biology and ecology of the Staphylinid *Oligota minuta*. Observations on *Typhlodromalus* spp. (*limonicus* and *rapax*) were made in some detail in 1978-80 in Trinidad. Both became scarse during the dry periods at a time when host density is usually increasing. Hight host populations and the corresponding increase in the density-dependent predator *O. minuta*, seem to disturb the activities of these Phytoseiids. Although Mc MURTHY et al. (1970) have mentioned Staphylinids and Coccinellids attacking Phytoseiid, predation by *O. minuta* and *Stethorus* spp. on Phytoseiid mites in this study was not observed. Rather, activities of the latter seem to be inhibited by the presence of the former. Phytoseiids are more abundant towards the end of July and early August after host infestations have started to decline and *Oligota* and other density-dependent predators have become less abundant. The mites seem to prefer cooler situations as they are more prevelent on the more mature infested leaves. Possibly the hirsute nature of the younger leaves inhibits the predatory mites. *Typhlodromalus* spp. usually rest in protected situations especially along the mid-rib and other major veins. Although they run rapidly, they seldom move far in the presence of abundant prey.

During periods of extreme prey scarcity, these predators feed on plant materials as do many other phytoseiids (MATHYS, 1958). In August when cassava was flowering, these were observed feeding on pollen. About 25 per cent of the flowers which were open contained Phytoseiid and 50 per cent of the partially opened flowers contained one or more Phytoseiids. YASEEN and BENNETT (1977) have reported a positive response of *M. tanajoa* to NPK. Counts of *T. limonicus* on plants in N, P, & K fertilized plots and an equal number of non-fertilized plants in an adjacent plot were made in November at a time when the predator was quite numerous and the host quite scarse.

The results are presented in Table 3.

It could not be determined conclusively of the higher numbers in both plots of variety 133-2 was coincidental or whether populations are regularly higher.

In the laboratory, Phytoseiids survived for 5-8 days when placed with *Tetranychus cinnabarinus* on bean leaf, placed in a non-ventilated closes tube with high humidity and for 5-6 days in open, well-ventilated tubes. The predator oviposited readily.

Table 3. Incidence of *Typhlodromalus limonicus* in fertilized and non-fertilized plots of cassava in Trinidad, November 1978

Cassava variety	Fertilized Plots*	Non-fertilized plots
133-2	37	49
Brown stick	11	7
Butter stick	11	11
Black stick	17	37

* Mites counted in six plants in each plot

Stethorus sp. ? *utilis*

In Trinidad this density-dependent Coccinellid appears sporadically, adults and larvae being abundant in several fields while frequently it is absent in others. both larvae and adults prey on Tetranychid mites and attack all stages. Eggs laid in clusters amongst infestations hatch in 2 days. The four larval instars are completed in 6-7 days. Larvae are very active and voracious consuming an average of 132 mites. Pupation occurs on the leaf. The adults on emergence, remain inactive for an hour or longer. Mating lasts for long periods and its frequently repeated. Females lay an average of 67 eggs in clusters of up to 11. Adults live up to 31 days and consume an average of 287 mites.

Feltiella sp.

This Cecidomyiid is also density-dependent. It appears in mite infestations in February-March when host populations are increasing. Adults have not been observed in cassava fields and observations at different times of day have failed to reveal their period of activity. Eggs are laid on the under surface of leaves often concealed by dead mites and other debris. The larvae on hatching, remain in protected situations, close to the mid-rib or other main veins, where host numbers are high. Some larvae construct protective cocoons of loosely woven fibres on the under surface of leaves. However, compared with the very large number of Cecidomyiid larvae per leaf, very few cocoons have been encountered suggesting that pupation may also occur elsewhere. Larval populations decline rapidly in July-August.

Discussion and conclusions

The investigation has revealed a fairly large complex of spider mites associated with cassava as well as several predators in the Neotropics. Several predators play significant roles in regulating the Tetranychid population. Both *Oligota minuta* and *Typhlodromalus limonicus* are widely distributed in the Neotropics and adapted to varying climatic conditions. they attack several species of host mites and trials in Africa are warranted. *Stethorus* and *Feltiella* are voracious predators, appreciably reduce dense host populations and also deserve trials against the hosts in areas of discovery.

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