

GROWTH OF THE MITE *MONONYCHELLUS TANAJOA*
(ACARI: TETRANYCHIDAE) ON ALTERNATIVE PLANT HOSTS
IN NORTHEASTERN BRAZIL

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Cassava, *Manihot esculenta* Crantz (Euphorbiaceae), is one of the main food crops cultivated by small land holders in tropical areas of South America and Africa (CIAT 1990). It is also grown on a large scale in Thailand, Indonesia and several other Asian countries. The cassava green mite, *Mononychellus tanajoa* (Bondar), is one of the most destructive pests of this crop in parts of South America and Africa where it can cause yield losses of up to 80%, depending mostly upon the age of the plants when the heaviest attacks occur (CIAT 1976, Veiga 1985, Yaninek & Herren 1988).

M. tanajoa has been commonly considered as an oligophagous species restricted to attacking plants of the genus *Manihot*, and its biology has been studied only on cassava leaves as food substrate (Murphy et al. 1984, Yaninek et al. 1989). However, Tuttle et al. (1977) reported the occurrence of *M. tanajoa* on *Cucurbita pepo* L. (Cucurbitaceae), *Lycopersicum esculentum* Mill (Solanaceae) and *Sechium edule* (Jacq.) (Cucurbitaceae) in the State of Ceará, northeastern Brazil, without referring to its actual feeding on those plants. Our unpublished field observations in several states of northeastern Brazil also reported it on *Passiflora cincinnata* Mart (Passifloraceae), *Manihot pseudoglaziovii* Pax. et K. Hoffm. (Euphorbiaceae), *Pavonia cancellata* Cav. (Malvaceae), *Solanum erianthum* D. Don. (Solanaceae), *Bauhinia forficata* Link (Caesalpinaceae), *Borreria verticillata* G.F.W. Meyer (Rubiaceae), *Macroptilium martii* Benth. (Fabaceae), *Solanum paniculatum* L. (Solanaceae), *Emilia sonchifolia* DC. (Asteraceae) and *Canavalia brasiliensis* Mart. ex Benth. (Fabaceae). Apparently, *M. tanajoa* was only temporarily found on most of those plants after reaching very high numbers on cassava and dispersing by the wind to nearby vegetation.

However, all stages of *M. tanajoa* were repeatedly found on *P. cincinnata* and *M. pseudoglaziovii* even when the mite was not abundant on cassava, indicating that it was developing on those plants. Both *P. cincinnata* and *M. pseudoglaziovii* are common perennial, evergreen native plants of northeastern Brazil, found in large numbers in the cassava growing region.

The objective of this work was to compare the relative suitabilities of *P. cincinnata*, *M. pseudoglaziovii*, cassava (*M. esculenta*) and the leguminous common bean (*Phaseolus vulgaris* L.) as host plants of *M. tanajoa*. The last plant was chosen as a control on which *M. tanajoa* has never been reported, and on which it was not expected to perform well. The work was conducted under laboratory conditions in Petrolina, State of Pernambuco, at 24 ± 2 °C, 65 ± 10 %RH and a photoperiod of 13:11 (L:D).

Initially, 150 female *M. tanajoa* collected from cassava plants in Petrolina were transferred to rearing units made of pieces of cassava leaves (3×3 cm) placed lower side up on a foam mat maintained inside a plastic tray (20 cm in diam and 3 cm high) containing distilled water. The borders of the pieces of cassava leaves were covered with a band of cotton wool to prevent mites from escaping and to avoid leaf dehydration.

Eggs laid within 16 h were collected and isolated onto 80 rearing units made of mature, healthy leaves of each plant substrate tested. Determination of the duration of the immature stages was based on daily observations at 8:00 AM and 3:00 PM. Recently emerged adult females were paired with field-collected adult males. New males were introduced onto the rearing units whenever the previous ones died. Observations on oviposition were conducted daily at 8:00 AM, and progeny was reared to adulthood for sex ratio determination. Immatures and adults were transferred to new arenas every third day. Values of intrinsic rate of increase were determined by first calculating the approximate indexes, and then using Lotka's equation to correct the values (Birch 1948). One-way ANOVAs were used to detect significant treatment differences and Tukey's tests ($p < 0.05$) were used for comparisons of mean durations of the immature phase and of longevities.

Development from egg to adult occurred on all substrates tested. However, significant differences existed between plant treatments for both females ($F = 35.73$; $df = 3,64$, $p < 0.05$) and males ($F = 5.11$, $df = 3,20$, $p < 0.05$) in relation to duration of the immature phase (egg to adult). For females, duration on cassava (14.5 ± 0.2 days, mean \pm standard) was not significantly different from duration on *M. pseudoglaziovii* (15.3 ± 0.4), these in turn were significantly shorter than on the other two plants. The duration in days on *P. cincinnata* (19.4 ± 0.5) was significantly longer than on common bean (17.3 ± 0.4). For males, the only significant difference was between the duration on *M. pseudoglaziovii* (12.7 ± 1.2) and *P. cincinnata* (16.8 ± 0.4).

Survivorship was considerably higher on cassava (79%) than on other plants (29 - 39%). Most mortality occurred at the protonymphal stage on both *P. cincinnata* and common bean. About 57% of the mites reaching adulthood on cassava were females, whereas on other plants, 74 - 78% were females (Table 1). As all mites came from the same source, this result indicates that the survivorship of males was more severely affected by the quality of the food source than the survivorship of females.

The longevity in days of adult females differed significantly among host plants ($F = 25.40$; $df = 3,64$, $p < 0.05$). Longevity on *P. cincinnata* (14.9 ± 1.5) was not significantly different from longevity on cassava (14.8 ± 1.0). Longevity on *M. pseudoglaziovii* (9.8 ± 1.1) was significantly shorter than longevity on the former plants, but longer than longevity on common bean (4.0 ± 0.9).

Mean generation time was longer on *P. cincinnata* (Table 1). Intrinsic rate of increase was considerably higher on cassava ($r_m = 0.14$), but *M. tanajoa* also developed and reproduced on *M. pseudoglaziovii* ($r_m = 0.09$) and *P. cincinnata* ($r_m = 0.06$). Total

TABLE 1. BIOLOGICAL PARAMETERS OF *MONONYCHELLUS TANAJOA* MITES ON DIFFERENT PLANT SPECIES.

Parameters	<i>Manihot esculenta</i>	<i>Manihot pseudoglaziovii</i>	<i>Passiflora cincinnata</i>
Mean generation time ¹ (T)	24.7	21.2	30.2
Net reproductive rate (R)	25.1	6.2	5.3
Total fecundity (\pm SE)	41.8 ± 4.4	29.6 ± 3.7	19.5 ± 3.3
Sex ratio ²	0.57	0.78	0.77
Intrinsic rate of increase ³ (r_m)	0.14	0.09	0.06

¹Days

²Females/(Females + Males)

³Female/Female/Day

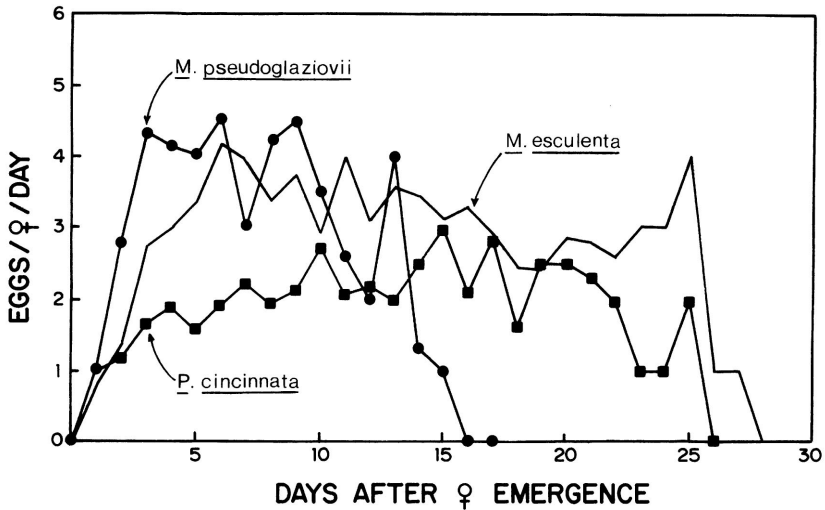


Fig. 1. Daily oviposition rates of the mite *Mononychellus tanajoa* on different plant substrates; calculations based on the total number of adult females present at the beginning of the observation period.

fecundity was lower on *P. cincinnata*, intermediate on *M. pseudoglaziovii* and highest on cassava. No oviposition occurred on common bean. Daily oviposition rates were about the same on cassava and *M. pseudoglaziovii* in the first 13 days of oviposition (Fig. 1), but they dropped rapidly to zero after that period on the latter and continued at high levels for another 12 days on the former. Oviposition rate on *P. cincinnata* was lower than on cassava, but the oviposition period was nearly as long. Eggs laid on *P. cincinnata* were considerably more fragile than on the two *Manihot* species, being disrupted very easily when handled with a brush.

Total duration of the immature phase of both sexes was comparable to results of previous studies (Murphy et al. 1984, Yaninek et al. 1989). Yaninek et al. (1989) studied the effect of season, cassava plant age and leaf age on the biology of *M. tanajoa*. They demonstrated that those factors did not significantly affect pre-adult development. The present study indicates that pre-adult development of this oligophagous mite can occur even on common bean, a plant which cannot sustain a population of that mite species. The practical significance of this result remains to be demonstrated because eggs are not oviposited on this host. Less preferred hosts could be important in maintaining *M. tanajoa* populations in the field. New colonies of tetranychid mites are known to start primarily with the arrival of dispersing pre-reproductive females onto new substrates and subsequent egg laying (Kennedy & Smitley 1985).

Yaninek et al. (1989) showed a significant effect of season, plant and leaf age on adults of *M. tanajoa*. As expected, the effect of the substrate on the adults was even more marked in the present study which compared different plant species. It was not surprising that *M. tanajoa* could reproduce on *Manihot* species other than cassava, as suggested by previous field surveys in northeastern Brazil (Bastos & Flechtmann 1985, Moraes & Flechtmann 1981). It was however unknown that it could reproduce on a plant species belonging to a different genus, *P. cincinnata*, commonly found in northeastern Brazil. Both of those plants are found in the cassava growing region throughout the year. The results of this study suggest the importance of those plants

as reservoirs of *M. tanajoa* and their possible role in maintaining local populations of that pest when cassava is not available or when its leaves are not physiologically suitable for the development of the mites. Conceivably, alternative host plants could be important in maintaining natural enemies of *M. tanajoa* in those periods, making it possible for them to reach the crop earlier and to increase their efficiency. Moraes et al. (1993) collected the 2 main predators of *M. tanajoa*, *Amblyseius idaeus* (Denmark & Muma) and *Amblyseius manihoti* Moraes, on leaves of *P. cinninnata* in northeastern Brazil. Further studies should concentrate on evaluating the importance of that plant as an alternative substrate to those predators.

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SUMMARY

The suitability of *Passiflora cinninnata*, *Manihot pseudoglaziovii*, *Manihot esculenta* (cassava) and *Phaseolus vulgaris* (common bean) were evaluated as food substrates for the mite *M. tanajoa*. The mite performed better on cassava ($r_m = 0.14$), although it also developed and reproduced on *M. pseudoglaziovii* ($r_m = 0.09$) and *P. cinninnata* ($r_m = 0.06$). Mites developed to the adult stage on common bean but did not oviposit.

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