African Crop Science Journal, Vol. 12. No. 3, pp. 289-293, 2004
Printed in Uganda. All rights reserved
ISSN 1021-9730/2004 $ 4.00
©2004, African Crop Science Society

EFFECT OF CASSAVA LEAF HARVEST ON A CASSAVA GREEN MITE PREDATOR IN THE DEMOCRATIC REPUBLIC OF CONGO

K. TATA-HANGY, R. HANNA[1], M. TOKO[1] and M. SOLO
Institut National pour l'Etude et la Recherche Agronomiques (INERA)
[1]International Institute of Tropical Agriculture (IITA)

ABSTRACT

Typhlodromallus aripo, a predatory phytoseiid species of the cassava green mite *Mononychellus tanajoa* was introduced to the Democratic Republic of Congo in 1998. It established easily and spread quickly to other areas from the sites of first release. But its dispersal was constrained by intense consumption and trade of young tender cassava leaves, the natural habitat of the predator. A negative and significant correlation was found between the incidence of the harvest and the plants with *T. aripo*. Harvesting at 30, 45 and 60 days interval led to population densities of *T. aripo* for the entire production period of 1.823, 1.972 and 3.675 predators units per plant, respectively. For the check where no harvest was done, population density was 7.242 per plant. Significant differences, ($P \leq 0.05$; LSD=1.277) were observed between harvests at 30 and 45 days at 60 days *T. aripo* population density remained low and reached zero in plots harvested every 30 and 45 days interval. There was no significant treatment effect on *M. tanajoa* damage on the plants, although the density of this pest was significantly higher in plots where harvesting was not done.

Key Words: *Manihot esculenta, Mononychellus tanajoa, Phytoseiid, pondu, Typhlodromallus aripo*

RÉSUMÉ

Typhlodromallus aripo, espèce prédataire phytoseiid de petites betes vertes du manioc *Mononychellus tanajoa* était introduit dans la République Démocratique du Congo en 1998. Il s'établit facilement et éparpillé rapidement dans des endroits autres que là où ils avaient été premièrement lachés. Mais sa dispersion était contrainte par l'intense consommation et vente des jeunes feuilles de manioc, l'habitat naturel du prédateur. Une corrélation significative et négative était obtenue entre l'incidence de la récolte et la plante avec *T. aripo* La récolte à 30, 45 et 60 jours d'intervalle entraina la population densité de *T. aripo* pour l'entière période de production de 1,823, 1,972 et 3,675 prédateurs par plante, respectively. Pour les check ou il y a pas eu récolte, la population était de 7,242 par plante. Des differences significatives ($P<0.05$; LSD=1.277) étaient observées concernant la densité de la population de *T. aripo* à 30, 45 et 60 jours intervalle de récolte . La population de *T. aripo* resta faible et atteint zero sur des parcelles récoltées chaque 30 et 45 jours d'intervalle. Il y a pas eu d'effet significatif du traitement sur le dommage de *M. tanajoa* sur les plantes, malgré que la densité de cette peste était plus élévée là où la récolte n'a pas été faite.

Mots Clés: Manihot esculenta, Mononychellus tanajoa, phytoseiid, pondu, Typhlodromallus aripo

INTRODUCTION

Typhlodromallus aripo, a predatory phytoseiid species of neotropical origin was introduced into the Democratic Republic of Congo in 1998, for biological control of cassava, green mite, *Mononychellus tanajoa*. It established easily and spread quickly to other areas, from the sites of initial release. Several factors seemed to be associated with ease of establishment and

dispersal, among which were cassava green mite density, cassava field frequencies, as well as cassava varieties (Unpublished data).

But in various areas, mainly along main roads leading to big cities, the dispersion of *T. aripo* was very slow. One of the reasons for the slow dispersion was suspected to be the frequent harvest of the tender cassava leaves of the shoot tip commonly called "*pondu*", for human consumption. *Pondu* is a delicious vegetable for the majority of Congolese people. It is a cheap source of proteins and vitamins for low income population, and a good source of income for poor rural farmers (Lutaladio, 1984; Ezumah, 1987). *Pondu* trade is common in DRC, especially in cities (PRONAM, 1976).

Pondu is a natural habitat for the predator. Since harvesting *pondu* involves the removal of the entire shoot with the tip, and is repeated once the new shoot is reconstituted, a negative effect on the predator is evident.

This paper evaluate the effect of the incidence and frequencies of *pondu* harvesting on the population density dynamics of *T. aripo* on cassava plants.

MATERIALS AND METHODS

During regular follows up of *T. aripo* establishment and dispersal in Bas-Congo, a number of variables were used to measure the effect of the factors which could influence *T. aripo*. Data were collected every 10 km in the release sites in cassava fields along main roads in Bas-Congo. Variables measured were: cassava field frequency on the trajectoire, and *M. tanajoa* population density and incidence, *T. aripo* presence on cassava, cassava tip size, flowering and the incidence of harvesting *pondu* in the sampled cassava field. All variables were evaluated on 50 plants. *M. tanajoa* density, incidence as well as damage on cassava, *T. aripo* incidence and *pondu* harvest are the only variables included in this paper.

M. tanajoa population was directly counted on the first fully developed leaf under a front lens, while damage caused on cassava was evaluated on the same plants using the scale 1 to 5, where 1 = no damage and 5 severe damage. The presence of *T. aripo* was assessed by checking the tip on the sampled plants. The incidence of *pondu* harvest was evaluated by assessing the de-topped plants percent of all plants in a plot. Also, a scale 1 to 3 was used, where 1 = $\leq$ 25% of de-topped plants; 2 = > 25% but $\leq$ 50% plants of de-topped plants and 3 = > 50% of de-topped plants.

A plant where *pondu* was harvested was easily recognised, even though the harvest was done in more than a month. This was so because such a plant had a new shoot of less than 30 cm high. A multiple regression analysis was performed on these variables.

Another trial was conducted at M'vuazi, INERA Research Station in Bas-Congo, to evaluate the effect of the frequencies of harvesting *pondu* on *T. aripo* population. The trial comprised four treatments arranged in a randomised complete block design with four replicates. Treatments were based on the frequencies of harvesting *pondu* and were defined as follow: T1= check, no *pondu* harvest; T2 = *pondu* harvested every 30 days; T3 = *pondu* harvested every 45 days and T4 = *pondu* harvested every 60 days. It is very important to know that the apical shoot of cassava needs at least 30 days after harvest to be picked again as *pondu*. The variety used in the trial was "Boma", the variety widely used in the area.

Data collection consisted in counting *T. aripo* population on cassava tips monthly, and *M. tanajoa* population on the first completely developed leaf from 20 plants in each plot. Since *T. aripo* lives within the tip, the tips were picked before *pondu* was harvested; and were kept in vials with 70% alcohol. The tips were processed in the laboratory under a binocular microscope for *T. aripo* count. *M. tanajoa* population was directly counted on the first fully developed leaf using a front lens. The severity of damage on cassava was evaluated on the same plants as for the population count. A complete de-topping of all the plants in each plot occurred at 3 months after planting (MAP) to make uniform the infestation. Data collection started at 4 MAP when plants were old enough to support the de-topping. *Pondu* harvest continued up to 6 months of observation for all the treatments. Data analysis involving analysis of variance, was performed using MSTAT-C software.

RESULTS

Table 1 shows the multiple regression statistics for the variables evaluated during post-release surveys of *T. aripo* in 20 cassava fields in Bas-Congo province, in the South West of DRC. It is clear that harvesting *pondu* significantly influenced ($P \leq 0.05$, LSD = 1.277) *T. aripo* density (Fig. 1). *T. aripo* density in plots where *pondu* was not harvested was (X= 7.242) two times the density found in plots where *pondu* was harvested every 60 days (X= 3.675) and almost 4 times that of the plots where *pondu* was harvested every 30 (X=1.823) and 45 days (X=1.972). Statistically significant differences in *T. aripo* density were observed between treatments where harvesting was done every 30 and 45 days with that of 60 days interval as well as that without *pondu* harvest. There was also a significant difference between plots where *pondu* was harvested every 60 days with that where no *pondu* was harvested. Harvesting at every 30 days or 45 days interval had no significant effect.

T. aripo population dynamics where *pondu* was

TABLE 1. Multiple regression statistics for the effect of harvesting *pondu* on *T. aripo* incidence and *M. tanajoa* incidence, density and damage during surveys in Bas-Congo

Variables	Corellation coefficient	Regression coefficient	T-value
Dependant variable			
Pondu harvest incidence			
Independant variables			
% of plants with T. aripo	-0.58*	-8.32	3.82*
M. tanajoa incidence	0.17	4.21	0.26
M. tanajoa density	-0.39*	-2.46	3.05*
M. tanajoa damage	0.18	1.11	0.51

R (square) = 0.49; * = Significant at 5%

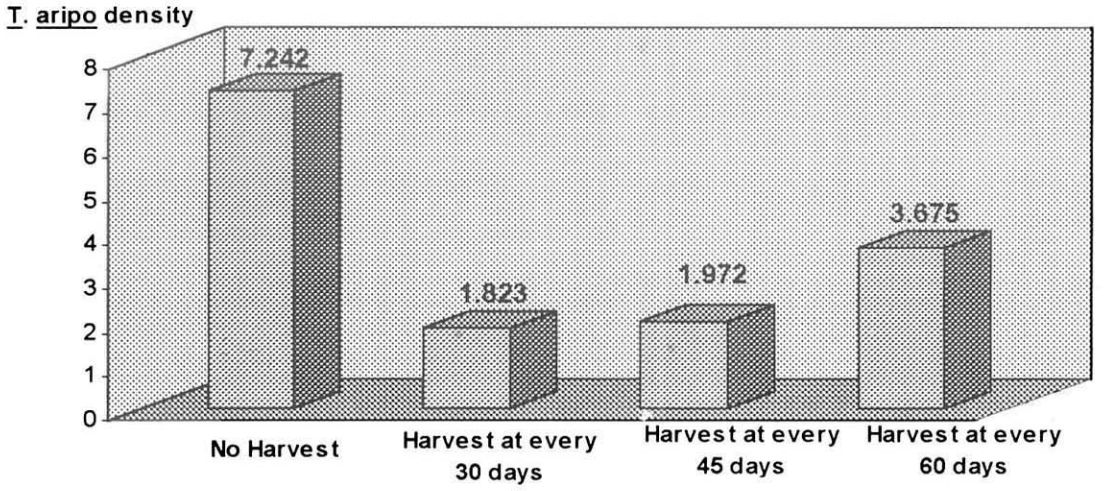

Figure 1. Population density of *T. aripo* on cassava plant under different frequencies of *pondu* harvest M'vuazi, in Bas-Congo.

harvested and where harvesting was not done are presented in Figure 2. Cassava in plots where *pondu* was not picked harboured large numbers of predators throughout the trial. *T. aripo* density was low in plots where *pondu* was harvested every 30 and 45 days. This density approached nil in the latter plots, indicating that there were moments when *T. aripo* disappeared from the plots. These results indicate that harvesting *pondu* every 30 days and 45 days interval suppresses *T. aripo* population development on cassava. Plots where *pondu* was harvested every 60 days had constantly almost 2 times more *T. aripo* than plots of 30 and 45 days interval. Although the overall mean population density of *M. tanajoa* was higher in plots where *pondu* was not harvested (17.1), its damage on cassava was not significant (Table 2). Root and leaf yields were not evaluated.

DISCUSSION

T. aripo is for the moment the only exotic natural enemy of the cassava green mite which succeeded to establish in DRC. Different predators and its population dynamics studies conducted in different sites show a real impact of the predator on the pest (unpublished data). Cassava green mite was reportedly introduced into DRC in the 1970s and no control strategy was effective (Tata-Hangy, 1995). Several introductions of neotropical predator species were even repeatedly introduced over years, but none of them succeeded to established successfully (Yaninek *et al.*, 1993). Since *T. aripo* is now well established and controls the pest, there is need for particular attention for its management in cassava fields.

Ezumah (1987), reported that harvesting cassava leaves had a negative effect on cassava root yield. On the other hand, this work demonstrates also a negative effect of harvesting *pondu* on *T. aripo* density and incidence. This work shows that harvesting *pondu* numerically reduced *M. tanajoa* density on cassava. This was due to manual removal of the pest on the plants through frequent de-topping. Nevertheless, damage inflicted to the crop remained statistically equal with that of the

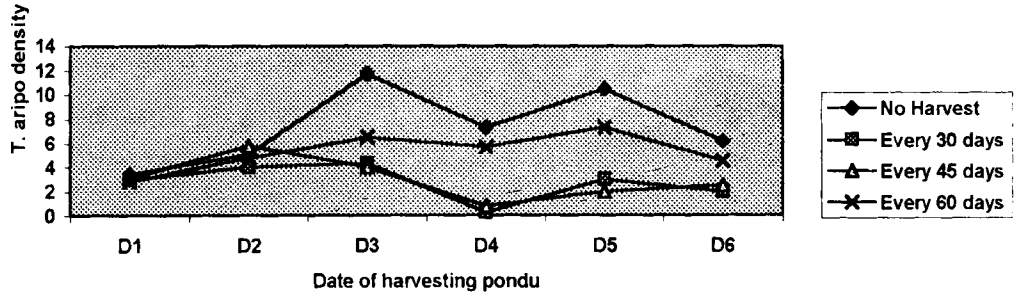

Figure 2. Population development of *T. aripo* on cassava plant under different frequencies of *pondu* harvest.

TABLE 2. *M. tanajoa* density and damage on cassava plants under different frequencies of harvesting *pondu* at M'vuazi, in Bas-Congo

Treatments	*M. tanajoa* density	*M. tanajoa* damage
T1 (No pondu harvest)	17.1	2.4
T2 (Harvest at 30 days interval)	4.8	1.9
T3 (Harvest at 45 days interval)	7.6	1.8
T4 (Harvest at 60 days interval)	11.3	2.1
LSD (0.05)	7.5	0.7

plants in plots where *pondu* was not picked. We assume then that the loss in root yield would be higher in plots where *pondu* was frequently picked because of the double negative effects of *pondu* harvest on both cassava yield and cassava green mite damage. Green mite damage on cassava was maintained low in all the plots thus, preventing more loss on root yield, which would occur if no natural enemy was present.

From this study, we recommend that harvesting *pondu* should be delayed at least for 60 days to maintain *T. aripo* density sufficient enough in cassava field for a permanent biological control of cassava against its pest the cassava green mite.

ACKNOWLEDGEMENTS

This work is a product of a collaboration between the International Institute of Tropical Agriculture (IITA) and the Institut National pour l'Etude et la Rechrche Agronomiques (INERA) through the Green Mite Project. We thank our collaborator, Mrs Marie Tuwizana Sefu, Research Technician, for her contribution during data collection.

REFRENCES

Ezumah, H. C. 1987. The effect of harvesting leaves on cassava yield in Zaire. *Agric. Intl* 39:5.

Lutaladio, N. B. 1984. Evaluation of cassava clones for leaf production in Zaire. In: *Tropical Root Crops: Production and Uses in Africa.* IDRC, Ottawa, Canada. Terry, E. R., Doku, E. V., Arene, O. B. and Mahungu, N. M. (Eds.), pp. 41-44.

PRONAM, 1976. Rapport Annuel 1976. Programme National Manioc. Département de l'Agriculture. République du Zaire; INERA-M'vuazi; Bas-Zaire, Democratic Republic of Congo.

Tata-Hangy, K. 1995. Lutte biologique de la cochenille farineuse et de l'acarien vert du manioc au Zaire. Tropicutura 13:

Yaninek, J.S., Onzo, A. and Ojo, J.B. 1993. Continent-wide releases of neotropical phytoseiids against the exotic cassava green mite in Africa. *Exp. Appl. Acarol.* 17:145-160.

Yaninek, J.S. and Hanna, R. 2003. Cassava greenmite in Africa: a unique example of successful classical biological control of a mite pest on a continental scale. In: Neuenschwandu, P., Borgemeister, C. and Langewold, J. (Eds.), pp. 61 - 75. Biolgical Control in IPM Systems in Africa, CABI.