Tropentag 2006
Bonn, October 11-13, 2006
"Prosperity and Poverty in a Globalised World—Challenges for Agricultural Research"

Effect of Ant on biological control of a neotropical herbivorous mite pest *Mononychellus tanajoa* (Acari: Tetranychidae) a mite pest of cassava in Africa.

B.V. Agboton1,2,3, R. Hanna1, A.T. Odjo2 and G. Goergen1

1 International Institute of Tropical Agriculture, BP 0932, Cotonou, Benin
2 Département des Sciences et Techniques de Production Végétale, Faculté des Sciences Agronomiques de l'Université National Bénin, B.P. 526 Cotonou, R. Bénin
3 Present address: University of Göttingen., Department of Crop sciences, Institute of Plant Pathology and Plant Protection. Grisebach str. 6 D- 37077 Göttingen, Germany

Abstract

The effect of ants on phytoseiid mites has been rarely studied. On cassava plants in Africa, the predatory mite, *Typhlodromalus aripo*, introduced from Brazil to Africa for the biological control of the cassava green mite, *Mononychellus tanajoa*, is frequently found sharing cassava plants and their extrafoliar exudates with several species of ants. Indeed the effect of Ant on biological control of Mononychellus tanajoa has been studied by a series of surveys in 18 farmer-managed cassava fields in southern-Benin where we determined densities of ants, *T. aripo* and *M. tanajoa* on 30 cassava plants in each field. Survey results showed that several ant species in the genus *Camponotus* were most common on cassava plants in southern-Benin. Ant abundance was highest in cassava fields bordered by forest or dense vegetation and when fields were 'weedy', while *T. aripo* was least abundant in weedy cassava fields compared with relatively well-weeded fields. Overall, increasing ant abundance in cassava fields was associated with lower *T. aripo* abundance and higher *M. tanajoa* densities.

Keywords: Ants, biological control, interaction, Mononychellus tanajoa. , Predator mite

Introduction

The cassava green mite (CGM), *Mononychellus tanajoa* (Bondar) (Acari: Tetranychidae), a native of South America was accidentally introduced into Africa where it causes serious crop losses, Yaninek and all, (1988). However Phytoseiids from South America were first imported and released in different agroecological zones of Africa since 1983, and so far *Typhlodromalus. aripo* has become successfully established (Gnanvossou, 2002). Furthermore, where establishment was successful, reductions of CGM populations by introduced phytoseiids were estimated at no more than 50% (Hanna, personal communication) due the biotic and abiotic factors. For example on cassava plants in Africa, the predatory mite, *Typhlodromalus aripo*, is frequently found sharing cassava plants and their extrafoliar exudates with several species of ants. That *T. aripo* and ants share space and food on cassava plants may result in interactions that could lead to both direct and indirect effects on their respective abundance and the biological

control of *M. tanajoa* by *T. aripo*. In this study the interactions between ants and phytoseiid mites have been rarely studied.

Material and Methods

As a first step in determining the effects of the presence of ants on the abundance of *T. aripo* and *M. tanajoa* on cassava, we conducted a series of surveys in 18 farmer-managed cassava fields in southern-Benin where we determined densities of ants, *T. aripo* and *M. tanajoa* on 30 cassava plants in each field. In addition, we conducted a factorial experiment in which we simultaneously manipulated ant and *T. aripo* densities on cassava plants and recorded ant, *T. aripo* and *M. tanajoa* densities.

Results and Discussion

Survey results showed that several ant species in the genus *Camponotus* (80.25%), were most common on cassava plants in southern-Benin (Table 1). In addition Oliveira and Brandao, (1991) showed in their research tasks that ants of the genus *Camponotus* (formicinae) are strongly attracted by the high sugar content in secretions of the plants (exudates). It this would explain the prevalence of *Camponotus* spp. on cassava plant compared to other ant species visiting the same plant. However, ant abundance was highest in cassava fields bordered by forest or dense vegetation and when fields were 'weedy', while *T. aripo* was least frequent in weedy cassava fields compared with relatively well-weeded fields (Table 2). Overall, increasing ant abundance in cassava fields was associated with lower *T. aripo* abundance and higher *M. tanajoa* densities. The predators (*T. aripo*) are importuned in their predation activities by ants which reduce their population (figure 1).

Table 1: Inventory of the different species of ants according the technique of collection

ORDER	Famille	Sub-family	Nom scientifique	Site on plant	% of Ants
Hymenoptera	Formicidae	Formicinae	***Camponotus sp***	Apex et pétiole	**80.25**
	Formicidae	Formicinae	*C.flavomarginatus (*May)	Apex et pétiole	10.35
	Formicidae	Formicinae	*Phasmomyrmex sp*	Pétiole	4.24
	Formicidae	Formicinae	*Lepisiota capensis*	Pétiole	3.41
	Formicidae	Myrmicinae		Apex et pétiole	1.75

The matrix of correlation (Figure 2) shows for the couple of variables (weeds, *T. aripo*), a coefficient of correlation which is - 0.32819 with a P=0.0154 (probability lower than 5%). Thus weeds are significantly negatively correlated to the predatory mite (*T. aripo*). Indeed in weedy cassava fields, ant densityies tend to become high and affect directly populations of the predatory mite (*T. aripo*) by a decrease thus explaining the indirect effect on Cassava Green Mite populations.

In the on-station manipulative experiment, ant exclusion had no effect on *T. aripo* and *M. tanajoa* abundance, probably due to low density of the same *Camponotus* spp. during the period of the experiment. The failure to show an effect of ant exclusion on *T. aripo* and *M. tanajoa* abundance, not withstanding the two studies, underscore the complexity of trophic interactions in the cassava food web and suggest the need for greater understanding of the interactions between ants and *T. aripo* and the effect of these interactions on biological control of cassava green mite.

Table2: Average density of various variables by type of the fields

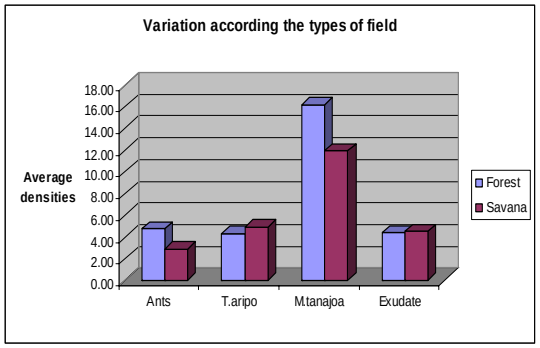
Variables	Type of Field		
	Forest	Savane	Probability
Ants	4.72 ± 0.45 **a**	2.90 ± 0.40 **b**	**0.0040**
M.tanajoa	16.19 ± 3.54 a	11.92 ± 2.69 a	0.3413
T.aripo	4.35 ± 0.38 a	4.92 ± 0.47 a	0.3561
Exudates	4.40 ± 0.29 a	4.50 ± 0.27 a	0.7991

Figure 2: Various possibilities of correlation between Ants, *T.aripo* and *M. tanajoa*.

(the results are obtained starting from the analysis in principal components carried out with software SAS, by using procedures PRINCOMP and Factor)

	T.aripo	*M.tanajoa*	Ants	Weeds	Exudat
T.aripo	1.00000 0.0	0.00340 0.9805	0.08165 0.5572	**-0.32819** **0.0154**	0.01495 0.9146
M.tanajoa	0.00340 0.9805	1.00000 0.0	-0.05449 0.6956	0.01620 0.9074	- 0.41922 0.0016
Ants	0.08165 0.5572	-0.05449 0.6956	1.00000 0.0	-0.35113 0.0092	-0.03021 0.8283
Weeds	**-0.32819** **0.0154**	0.01620 0.9074	-0.35113 0.0092	1.00000 0.0	0.03735 0.7886
Exudat	0.01495 0.9146	-0.41922 0.0016	-0.03021 0.8283	0.03735 0.7886	1.00000 0.0

Figure1: Effect of presence of ants on the *T. aripo* density according the different cassava fields



Conclusions

. AGRIC is one of the cassava varieties that produce lot of exudates, and that is mostly colonized by ants, especially those of the genus *Camponotus*

. Ants of the genus *Camponotus*, are the most commonly species found on cassava plants when fields are in vicinity of relatively dense vegetation.

. When cassava fields are weedy, densities of both *T. aripo* and ants decrease, leading to an increase in *M. tanajoa* densities (especially because of the reduction of predator density) and consequently cassava yield is considerably reduced.

. Nevertheless the presence of ants leads to a decrease of predator densities which affect their impact on *M. tanajoa* population.

. The present work shows the complexity of trophic interactions in the cassava food web and suggest the need for greater understanding of the interactions between ants and *T aripo* and the effect of these interactions on biological control of cassava green mite. This study gives also guidelines for future work about the impact of ants on biocontrol of pests.

References

Bakker, F.M. and M.E. Klein, (1992). Transtrophic interaction in cassava Exp. Appl. Acarol. 14: 293-311.

Bakker, F.M. and M.E. Klein, (1993). Host plant mediated coexistence on predatory mites: the role of extrafloral nectar and extrafoliar domiata on cassava.

Beattie, A.J. (1985). The evolutionary ecology ant-plant mutualisms. Cambridge University Press, Cambridge.

Cudjoe, A.R., Neuenschwander, P. and M.J.W. Copland, (1993). Interference by ants in biological control of the cassava mealybug, *Phenacoccus manihoti* (Hemiptera: Pseudococidae) in Ghana. Bulletin of Entomological Research 83, 15-22.

Gnanvossou, D. (2002) Infochemical use by predatory mites of the cassava green mite in a multitrophic context. Ph.D. dissertation, Wageningen, The Netherlands. 152 p.

Hanna, R. Ojo, D., Yaninek, J. S., Toko, M., Gnanvossou, D. and A. Onzo, (2000). Effects of cassava cultivar on abundance of exotic Phytoseiid mites in Africa. Abstracts of the XXI International Congress of Entomology, 20th – 26th August 2000, Brazil.

Oliveira, P.S. and C.R.F., Brandao, (1991). The ant community associated with extrafloral nectaries in Brazilian cerrados. Ant-plant interaction (eds D.F. Cutler & C.R. Huxley), Oxford University Press, Oxford, pp. 192-212.

Onzo, A.,(2003) Population dynamics of cassava green mite and its predator Typhlodromalus aripo in Benin, West Africa. Ph.D. dissertation, Amsterdam, The Netherlands. 146 p.

Yaninek, J.S. and Herren, H.R. (1988). Introduction and spread of the cassava green mite, *Mononychellus tanajoa* (Bondar) (Acari: Tetranychidae), an exotic pest in Africa and the search of appropriate control methods: a review. *Bull. Ent. Res.* 78: pp. 1-13.