

COMUNICAÇÃO CIENTÍFICA

MICRONUTRIENT CONTENTS IN HEALTHY AND *Crinipellis pernicioso* INFECTED TISSUES OF *Theobroma grandiflorum*¹

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ABSTRACT: Micronutrient contents in leaf and branch tissues of cupuassu plants (*Theobroma grandiflorum*) infected by *Crinipellis pernicioso*, the causal agent of witches' broom disease, were determined to support further studies on the effect of nutritional status in the disease progress. Lower contents of boron and manganese and higher content of copper were found in infected leaf tissues. There was not any statistical difference in the copper content of branch tissues, even though higher copper content was found in healthy branches than in healthy leaf tissues. No changes in contents of iron and zinc in healthy of infected tissues were detected.

INDEX TERMS: Plant Nutrition, Cupuassu, Witches' Broom.

CONCENTRAÇÃO DE MICRONUTRIENTES EM TECIDOS DE *Theobroma grandiflorum* SADIOS OU INFECTADOS POR *Crinipellis pernicioso*

RESUMO: A concentração de micronutrientes em tecidos de folhas e ramos de cupuaçuzeiro (*Theobroma grandiflorum*) infectados por *Crinipellis pernicioso* foi avaliada, visando o embasamento de estudos posteriores sobre o efeito do estado nutricional da planta no progresso da doença. As concentrações de boro e manganês foram mais baixas nos tecidos doentes. A concentração de cobre foi mais alta nos tecidos foliares doentes. Não foi detectada diferença significativa na concentração de cobre nos tecidos de ramos, apesar de a mesma ter sido mais alta nos tecidos de ramos sadios, quando comparada com a encontrada nos tecidos foliares sadios. Não foi detectada diferença significativa nas concentrações de ferro e zinco em tecidos sadios e infectados pela doença.

TERMOS PARA INDEXAÇÃO: Nutrição de Plantas, Cupuaçuzeiro, Vassoura-de-bruxa

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Witches' broom (*Crinipellis perniciosa* (Stahel) Singer) is a limiting factor to cupuassu (*Theobroma grandiflorum* (Willd ex-Spreng.) Schum.) crop expansion in the Amazon region of Brazil. Plant mineral nutrition is an environmental factor that can be easily managed and added as a complement to the cupuassu farm system in order to control diseases. However, it is necessary to understand what is mineral nutrients mechanisms to increase or reduce plant diseases through the histological and cytological properties of the host tissues, and, consequently, how they act in pathogenesis. Although there is little available information of plant nutritional status on the defense mechanism against viruses and bacteria, there are evidences of its importance against diseases caused by fungi (MARSCHNER, 1986).

Mineral nutrients are directly involved in the plant defense mechanisms as part of the cells, substrates, enzymes, metabolism activators or inhibitors, and may increase or decrease the plant resistance to diseases (MENGEL; KIRBY, 1987).

The main purpose of this research was to determine the nutrient contents in healthy and infected tissues of cupuassu plants, aiming further studies on the effect of plant nutritional status on the progress of witches' broom disease caused by *C. perniciosa*.

Leaf and branch samples were collected in April 1994 from a 10-year-old

cupuassu plantation of the Fruit Tree Experimental Field at Embrapa Eastern Amazonia, in Belém, Pará (01°28' S; 48°27' W). Soon after, the samples were oven dried (70 °C; three days), ground to powder in a Willey mill with a bolter nº 20 mesh and sent to analysis in order to determine micronutrient contents based on the method described by Malavolta, Vitti and Oliveira, (1989).

A complete randomized experimental design with four treatments (healthy leaf tissue, healthy branch tissue, infected leaf tissue, infected branch tissue) and four replicates was used. Data were analyzed by univariate analysis and the means compared by Student's t test at 5% significance level.

Micronutrient contents in the cupuassu tissues are listed in Table 1. Boron and manganese contents were higher in healthy than in infected tissues. Nakayama (1995) obtained similar results in studies about the influence of mineral nutrition on the witches' broom symptoms in cocoa (*Theobroma cacao* L.). The results of this experiment were also similar to that of Maradiaga, Rocha Neto and Viégas (1998), who reported higher levels of boron in healthy cocoa plant roots than in those infected by *C. perniciosa*. According to Huber (1981), eighteen plant pathogens were reduced by boron fertilization in different crops and only *Helminthosporium sativum* increased after the application of this element to Barley.

Table 1 – Content of five micronutrients (mg/g) in healthy and infected tissues of cupuassu by *Crinipellis pernicioso*.

Micronutrient	Healthy leaf	Infected leaf	t Test ^(a)	Healthy branch	Infected branch	t Test ^(a)
Boron (B)	30.56	14.66	6.45**	25.57	12.88	8.91**
Copper (Cu)	11.66	15.25	3.41*	19.08	17.22	0.68
Iron (Fe)	64.61	54.65	1.72	60.37	59.43	0.06
Manganese (Mn)	169.73	59.56	10.94**	152.57	81.83	2.51*
Zinc (Zn)	26.34	26.18	0.083	34.08	33.57	0.094

^(a) Significant differences by Student's t Test are indicated by *p \leq 0.05 and **p $<$ 0.01

Manganese content in plants varies according to the occurrence of the pathogen in the host plant, the cultivar and the affected part of the plant. Generally, manganese concentration is lower in susceptible tissues, even though, in the infected spots of the host its concentration increases (HUBER; WILHEM, 1988).

Andebrhan (1981) studied the physiological effect of *C. pernicioso* infection in cocoa seedlings and detected variations in some nutrient contents. Manganese in branches and leaves were significantly lower in infected seedlings. These results agree with those found in this experiment.

The copper content in healthy leaf was lower than in infected leaf tissues. No differences were observed in copper content of branches, however, its concentration. It was higher in healthy branch than in healthy leaf tissue. No statistical differences were found in the contents of iron and zinc among treatments. Andebrhan (1981) detected higher zinc content in infected cocoa

seedlings and higher copper content in healthy leaves.

According to Marschner (1986), the same principles regulate the effects of macro and micronutrients on plant resistance to diseases, as nutritional deficiency leads to the accumulation of lower molecular weight organic substances reducing plant resistance and acting on the lignification process and on the phytoalexins synthesis.

Bastos and Pereira (1994) determined total sugar, micro and macronutrients contents in healthy and infected cocoa tissues by *C. pernicioso*, discussing the effects of variation in the concentration of these elements on plant physiology and metabolism. Their results also showed no statistical differences in iron and copper contents and higher concentration of zinc and manganese in healthy cocoa tissues, in accordance with the findings of this experiment for cupuassu..

From the results obtained in this experiment it is possible to conclude that

the low concentrations of boron and manganese in leaf and branch tissues and the excess of copper in leaf tissues may predispose cupuassu plants to infection by *C. pernicioso*.

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