

EFFICIENCY OF *Beauveria bassiana* FOR *Acromyrmex* spp. CONTROL (HYMENOPTERA: FORMICIDAE)

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ABSTRACT

Efficiency of *Beauveria bassiana* for *Acromyrmex* spp. Control
(Hymenoptera: Formicidae)

The leaf-cutting ants of the genus *Acromyrmex* are responsible for considerable damage to vegetable cultures, and their control has been done mainly by chemical products. We studied the efficiency, in the field, of a strain of *Beauveria bassiana* (Bals.) Vuill. in the control of the population density of *Acromyrmex* spp. Two experiments were carried out, one in 47 nests situated in a mixed culture area and another in 148 nests in an *Eucalyptus saligna* area. In both experiments, *B. bassiana* showed high efficiency up to the 35th day, causing 87,2% and 83,1% mortality, respectively.

KEY WORDS: Insecta, biological control, leaf-cutting ants, entomopathogenic fungi.

RESUMO

As formigas cortadeiras do gênero *Acromyrmex* são responsáveis por consideráveis danos às culturas vegetais e o seu combate tem sido feito principalmente por produtos químicos. Este trabalho objetivou determinar a eficiência, em campo, de uma linhagem de *Beauveria bassiana* (Bals.) Vuill. para controle da densidade populacional de *Acromyrmex* spp.. Para tanto foram conduzidos dois experimentos, um em 47 ninhos localizados em área de cultura mista e outro em 148 ninhos em área de

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Eucalyptus saligna. Em ambos experimentos *B. bassiana* mostrou alta eficiência, causando respectivamente 87,2 e 83,1% de mortalidade até o 35º dia.

PALAVRAS-CHAVE: Insecta, controle biológico, formigas cortadeiras, fungos entomopatogênicos.

INTRODUCTION

In the American tropical and sub-tropical regions, the leaf-cutting ants of the genus *Atta* and *Acromyrmex* are considered the major pests of agriculture, pastures and reforestation areas. Up to now, many chemical products and application techniques have been developed to control these ants (Cameron 1990). However, they are either little efficient or highly toxic and/or responsible for the selection of resistant populations.

The entomopathogenic fungi are some of the agents which naturally control the size of insect populations and, therefore, potentially, they could be employed in biological control programs (Krebs 1986). In natural conditions, both *Metarhizium anisopliae* (Metsch.) and *Beauveria bassiana* (Bals.) Vuill. have already been isolated out of queens and workers of the genus *Atta* (Alves & Sosa Gómez 1983, Diehl-Fleig et al. 1992). Similarly to the control of other pests, the search for specific strains, conditions and techniques of adequate application may favour the success of programs of biological control of leaf-cutting ants. Silva & Diehl-Fleig (1988) obtained promising results, in the laboratory and in the field, with *B. bassiana* and *M. anisopliae* in the control of *Atta sexdens piriventris* Santschi. However, the degree of effectiveness has varied according to the strain, quantity of infective units and size of the colony treated. In this work we tested a strain of *B. bassiana* in the field for the control of leaf-cutting ants of the *Acromyrmex* genus.

MATERIAL AND METHODS

In two experiments the Bsa strain of *B. bassiana* was used, isolated from *A. S. piriventris* naturally infected. The formulation consisted of the fungus in the rice middle itself (10^9 conidia/0.1g). For application, the dry straw covering of nests, typical of various species of *Acromyrmex*, was removed and *B. bassiana* was inoculated directly on the symbiotic fungus. The first experiment was conducted in a mixed cultivation area of vegetable and fruit trees of Gravataí county, RS, Brazil. From March to May 1989 nests of previously marked *Acromyrmex crassispinus* (Forel) and *A. heyeri* (Forel) were individually inoculated with 40g of the *B. bassiana* formulation, in 47 nests. As control, 13 uninoculated nests were evaluated. In this experiment, daily behavioural records were

made during the first week. On the 14th, 21st and 35th days, evaluations of activity and mortality were made.

The second experiment was carried out in an area with *Eucalyptus saligna* trees belonging to Florestal Guaíba, RIOCELL, Eldorado do Sul county, RS, Brazil. The most frequent species were *A. aspersus* (F. Smith), *A. subterraneus bruneus* (Forel), *A. crassispinus* e *A. lundi* (Guerin). On November 27th, 1991, 94 nests were treated and on December 11th, 1991, 54 additional nests of *Acromyrmex* spp. were inoculated with 80g of the *B. bassiana* formulation. As control, 44 untreated nests were evaluated. The activity of the colonies and mortality evaluations were made on the 7th, 14th, 21st and 35th days after the inoculation.

RESULTS AND DISCUSSION

In the first experiment, on the days following the application, the return of rice grains with fungus was observed, followed by great disarray on the tracks and reduction of external activity. The removal of foreign bodies, was also observed after the application of chemical insecticides, as well as the returning of baits (Jurueña 1980) which can be interpreted as a defense reaction (Machado *et al.* 1988). In the first test 8 of the 47 treated nests were reinoculated on the 7th day and of these 3 were reinoculated again on the 4th day once they showed no signs of activity reduction (Table 1).

Table 1. Results of field tests with the use of *Beauveria bassiana* in *Acromyrmex* spp.

Experiment	Nests (n)	Inactive nests/day				Mortality (%)
		7 ^º	14 ^º	21 ^º	35 ^º	
I	47	10 ¹	32 ²	38	41	87.2
Control	13	0	0	0	0	0.0
II	148	22	66 ³	93	123	83.1
Control	44	0	0	0	0	0.0

¹Reinoculation of 8 nests.

²Reinoculation of 3 nests.

³Reinoculation of 28 nests.

In the second experiment, 28 nests were reinoculated on the 14th day. In both experiments *B. bassiana* showed high efficiency in the control of *Acromyrmex* spp.. Similar results were obtained by Stimac *et al.* (1989) with the application of *B. bassiana* to nests of *Solenopsis* spp. Kermarrec *et al.* (1986) with *A. octospinosus*, Lucchese (1987) with *A. s. piriventris* and Diehl-Fleig & Lucchese (1991) with *A. striatus* (Roger.) have described behaviours of cleaning and isolation of contaminated areas and withdrawal of sick individuals which could possibly prevent a

pathogen to provoke an epizooty in the colony. The secretions from the metapleural glands of the ants are also thought of as having an antimicrobial effect (Beattie *et al.* 1986). Nevertheless, it seems to us that these defenses can have effect only when the pathogen is in low density; the defense reactions emitted by the workers in the presence of insecticides, however, are not sufficient to avoid massive death.

The results obtained in the two experiments indicated that the *B. bassiana* entomopathogen, strain Bsa, can be employed in programs of biological control of *Acromyrmex* spp. It is suggested that the active nests be reinoculated on the 7th day after the application of *B. bassiana* and the first application be made with greater amount of infective units. Additional studies to improve the techniques of application in the field should be conducted.

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