

Potential Use of EM for Controlling Witches'-Broom Disease in Cocoa

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Background

About 20 percent of the world's cocoa supply comes from Brazil and is valued at US \$500 million annually. Approximately 85 percent of the Brazilian crop is produced in the State of Bahia in northeast Brazil where 700,000 hectares are grown. Recently, the cocoa crop has been seriously threatened by a disease called Witches'-Broom in English, Vassoura de Bruxa in Portuguese, and Escoba de Bruja in Spanish. It is caused by a basidiomycetous fungus known scientifically as *Crinipelis perniciosa*. The fungus infects the main meristematic tissue in the flower of the cocoa plant causing a rapid proliferation of side shoots which later become necrotic and die, leaving a broom-like structure laden with basidiocarp mushrooms for reproducing the fungus. The disease is endemic in wild cocoa in the Amazon Basin, and epidemic in commercial plantations in South America, the Caribbean Islands and Central America.

The main cocoa-producing areas of Brazil were kept free of the disease until 1989 when several outbreaks occurred. At first, we attempted to contain and eradicate the disease by establishing buffer strips, 350 meters wide with cocoa plants and all other vegetation completely removed. Unfortunately, we found that the disease had already spread. Only 28 farms were found to be infected with the disease in 1989, but two years later more than 1000 farms were infected. The disease has become a serious threat to the economy of the cocoa-growing region which involves some 25,000 producers and employs three million people in the production, processing and marketing of cocoa.

Today, we are trying to control the disease by keeping inoculum levels low in order to slow the rate at which it spreads. This is done by removing infected tissues including branches, pods, fruits, and flowers. We have also established a research program to study the biology of the fungus, epidemiology of the disease, and integrated control measures, along with a search for resistance in new germplasm.

Control of Witches'-Broom with EM: Laboratory Results

The laboratory results which I will discuss here briefly were obtained only a month ago. I received a sample of EM which had no label as to which EM it was or what particular microorganisms it contained. It now appears that the sample was EM 4 since that is the only EM product that is produced in Brazil. With selective media we observed high bacterial counts in the product.

We then conducted dose/response experiments to determine whether the EM mixed culture might be effective in inhibiting or controlling the growth of the witches'-broom fungus, *Crinipelis perniciosa*. We used potato dextrose agar (PDA) as a growth medium containing EM at concentrations of 1, 2.5, and 5 percent (v/v). After implanting a standard size plug of the fungal pathogen in the center of the petri dish, we measured the resulting growth diameter after 9 days. At first, we observed no microbial growth from the EM inoculant on the petri dishes. However, when we used growth media containing higher levels of carbon and inorganic nutrients, bacteria and yeast colonies developed from the EM culture.

We were pleased to find that as the concentration of EM increased, fungal growth progressively decreased. Also, the highest EM concentration (5 percent) completely inhibited the growth of the

fungus. I would caution that these results are indeed preliminary and must be repeated in greater detail to determine (a) the degree of reproducibility of EM for inhibiting/controlling the fungus, (b) what mechanisms of inhibition are involved, and (c) whether greenhouse and field tests are warranted.