Control of Powdery Mildew in Roses by Applying Lixiviated Plantain Rachis Compost

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INTRODUCTION

Powdery mildew (*Sphaerotheca pannosa* var. *rosae*) is an economically significant disease found in all rose-producing countries of the world. To control or prevent the disease, expensive and toxic chemical fungicides are currently being used.

To take advantage of an agroindustrial by-product obtained after harvest, several plantain plantations in Colombia are rustically producing lixivium from decomposed plantain (*Musa* AAB) **(Figure 1)**.

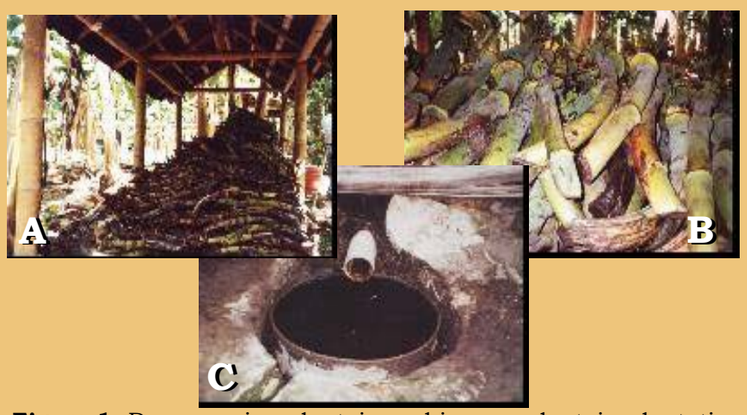


Figure 1. Decomposing plantain rachis on a plantain plantation in Colombia. **(A)** Collecting plantain rachis. **(B)** Decomposition the rachis. **(C)** Collecting the lixivium generated during decomposition.

Our research aimed to (1) evaluate the effect of the lixivium on the disease and on the rose plant, and (2) observe the effect of the lixivium on the pathogen using a scanning electron microscope.

MATERIALS AND METHODS

Plant material and test conditions. A total of 175 young, diseased rose plants of the variety Livia were used. The three trials were carried out under glasshouse conditions at CIAT in Colombia.

(Bio)fungicides. Six treatments of lixivium were applied at different concentrations. The positive checks (Trial 1) received, alternately, applications of dodemorph acetate (2.5 mL/L), and fenarimol (0.6 mL/L). In Trial 2, dodemorph acetate and kresoxim-methyl were applied at 0.25 mL/L.

Four applications of each treatment were manually sprayed on leaf undersides at 4-day intervals.

Treatment effectiveness. To assess the effectiveness of the treatments, only the first three or six true leaves of each stem were evaluated (the youngest leaves and those with the greatest disease incidence).

The evaluations took into account the degree of sporulation per leaf foliole and the area infected per foliole, using a visual scale of 0 to 3.

Scanning electron microscopy. We used two sets of leaflets: (1) one from infected plants that had received applications of lixivium 6 hours before inoculation; and (2) one from infected plants without any treatment. Samples were fixed in phosphate buffer, followed by post-fixation in osmium tetroxide and gold filling.

RESULTS

The treatment that best controlled powdery mildew in the three trials was lixivium concentrated at 5% because it reduced fungal sporulation and the area of lesions **(Figures 2 to 4)**. Satisfactory control was also obtained with the other concentrations of lixivium, although lixivium at 50% proved toxic to the plants.

Because inoculum pressure was high, untreated plants showed increased sporulation of *S. pannosa* and increased the leaf area infected by the fungus.

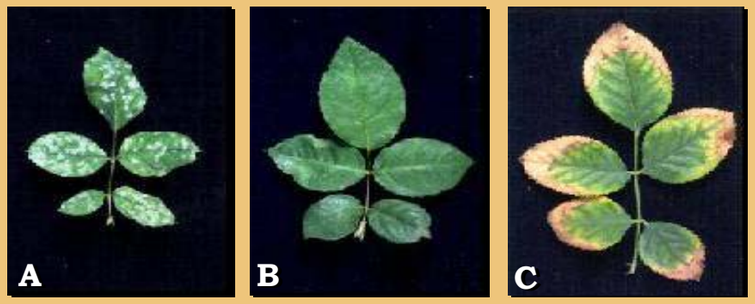
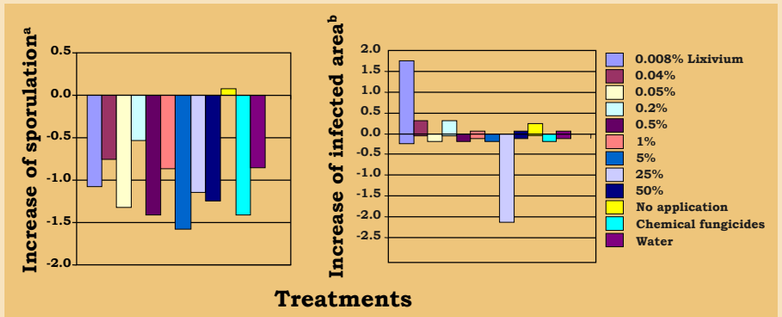


Figure 2. (A) Untreated leaf. **(B)** Disease control by lixivium. **(C)** Phytotoxicity caused by lixivium at 50%.



Figures 3 and 4. Effect of different lixivium concentrations of plantain rachis and other treatments on powdery mildew of roses (averages of three trials).

Negative values indicate reduction in the disease.
[a]Scale 0 to 3: 0 = absence of disease and 3 = abundant sporulation.
[b]Scale 0 to 3: 0 = 0% lesions and 3 = lesions occupying more than 25% of leaf area.

A drastic effect can be observed on the mycelia of *S. pannosa* in samples receiving an application of lixivium 6 hours before inoculation **(Figure 5)**.

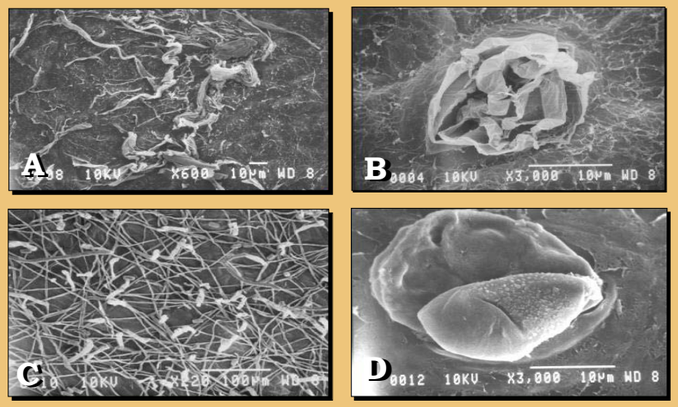


Figure 5. A scanning electron microscope shows the effect of plantain lixivium on *Sphaerotheca pannosa*. Mycelia **(A)** and conidium **(B)** destroyed in tissue receiving lixivium 6 hours before inoculation. Mycelia **(C)** and conidium **(D)** in tissue that had not received lixivium.

DISCUSSION

The study demonstrated that plantain lixivium can control powdery mildew of roses at a level equal, and sometimes superior, to that achieved with conventional chemical products. Lixivium's disease control potential will prove to be highly significant, in economic terms, for Colombian rose producers.

Adding ethanol and submitting lixivium to high temperatures did not significantly reduce its disease control capacity (data not presented). This finding suggests that the effect of lixivium is due to a chemical agent it contains rather than to the microorganisms it may carry.

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