

EFFECT OF METABOLITES OF ASPERGILLUS NIGER VAN
TIEGHAM AND SOME FUNGICIDES ON THE PHYSIOLOGY OF
PHYTOPHTHORA PALMIVORA (BUTL.) BUTL. AND ON THE
SURVIVAL OF COCOA (THEOBROMA CACAO L.) SEEDLINGS

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ABSTRACT

Culture filtrate of Aspergillus niger required for studies on the effect of the metabolites on Phytophthora palmivora was provided by culture of A. niger grown in V-8 Broth at 35°C and pH 2.3 for 4 days. The fungicides, Caocobre, Champion, Kocide and Ridomil, were prepared according to the recommendations of the manufacturers, and concentrations used varied from the recommended field application rate to $\frac{1}{10}$ ^{of} that rate.

Comparative studies on the effect of A. niger culture metabolites and the fungicides on indirect germination of sporangia of P. palmivora at $20 \pm 2^\circ\text{C}$ showed that germination by zoospores was variable depending on whether the germination medium contained fungicide or A. niger culture filtrate. Culture filtrate of A. niger at all concentrations tested (Undiluted, 1:1, 1:2, 1:5 and 1:10 v/v) was more potent and completely prevented indirect germination of sporangia of P. palmivora. The fungicides applied at the recommended field application rates completely depressed indirect germination; further dilutions permitted zoospore discharge ranging from 19 per cent (Caocobre) to 45 per cent in Champion.

The undiluted culture filtrate of A. niger and the 1:1 - 1:5 v/v dilution completely depressed direct germination by germ tube formation by sporangia of P. palmivora. All the fungicides applied at the recommended field application rates permitted direct germination of sporangia at 30°C as follows:

Ridomil (25 per cent), Champion (22 per cent), Kocide (10 per cent) and Caocobre (2 per cent). Further dilutions permitted higher percentage germination depending on the fungicide.

A. niger culture filtrate at most concentrations tested (Undiluted - 1:5 v/v) was therefore more potent than Kocide, Ridomil, Caocobre and Champion except in the 1:10 v/v dilution of *A. niger* which permitted a feeble 15 per cent germination in 6h. In all instances, direct germination of sporangia in the control (2% Yeast Extract) ranged between 90 and 100 per cent.

The germ tubes of *P. palmivora* sporangia germinating in medium containing Caocobre and Kocide were peculiarly swollen.

Oxalic acid, one of the components of the metabolites of *A. niger* applied at concentrations $1.0 \times 10^{-3}M$ - $7.0 \times 10^{-3}M$ completely inhibited zoospore discharge by sporangia of *P. palmivora* akin to what obtained when *A. niger* culture filtrate (Undiluted - 1:10 v/v dilution) was applied.

None of the sporangia in 2% yeast extract amended with varying concentrations of oxalic acid germinated directly at 30°C.

All concentrations of the fungicides prevented chlamydospore production on oatmeal agar in 6 days at 35°C as long as were the undiluted and 1:1 v/v dilutions of *A. niger* culture filtrate. Further dilution (1:2 - 1:200 v/v) permitted chlamydospores formation to different extent. The

chlamydospores were of varying sizes and thickness of the investing walls.

The chlamydospores which were formed could be delimited into two size groups; those which had thin investing wall ($0.6 - 1.8 \mu\text{m}$) and others with thick investing wall ($3.6 - 4.8 \mu\text{m}$). Diameter of the chlamydospore ranged between 16 and $48 \mu\text{m}$.

Oxalic acid of concentrations 2.0 to $7.0 \times 10^{-3} \text{M}$ completely prevented chlamydospore formation. Only oxalic acid of concentration $1.0 \times 10^{-3} \text{M}$ (0.001M) permitted chlamydospore production (12.0 ± 2.0 per H.P field) with dimensions similar to what obtained on oatmeal agar amended with 1:2 - 1:200 v/v of dilution of *A. niger* culture filtrate.

Culture filtrate of *A. niger* variably but effectively mitigated pre- and post- emergence damping-off of six varietal crosses of cocoa seedlings. On the basis of present data, susceptibility to the metabolites of *A. niger* in controlling *P. palmivora* damping-off can be arranged as follows in descending order:

T63/976xT17/524 > T85/799xSCA9 > T85/799xNA729 > T85/799xIMC47 > T85/799xAMEL > T85/799xT79/501.

The growth rate of the seedlings varied from one varietal cross to the other. However, within the same varietal cross there was no statistical difference ($P \leq 0.05$) between the control and seedlings exposed to *A. niger* filtrate of varying

dilutions (Undiluted - 1:5 v/v dilution) after 8 weeks growth. There was a delay of 1-2 weeks in the emergence of the treated seedlings depending on the varietal cross used as compared to the untreated control.