In vitro inhibition of *Xanthomonas vasicola* pv. *musacearum*, the causal agent of banana Xanthomonas Wilt, using medicinal plant extracts from North Kivu, Eastern Democratic Republic of Congo

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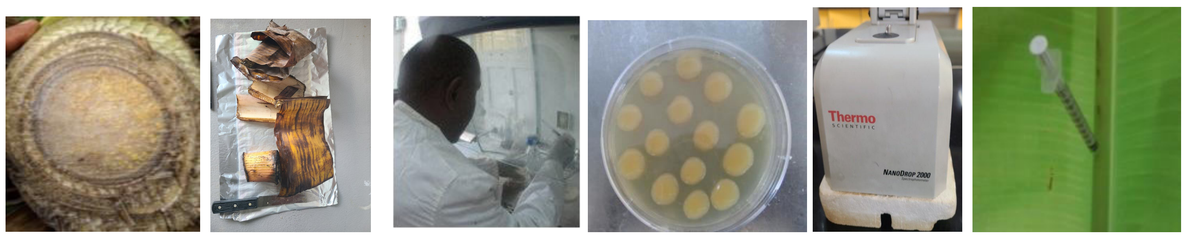
Introduction

The East African Great Lakes region accounts for more than 11% of the world's banana production. Unfortunately, banana production has decreased by 20 to 60%, due to abiotic and biotic constraints as Banana Xanthomonas wilt (BXW). Among BXW has a significant impact on banana production in the region owing to its rapid spread. At this time no chemical formula is currently available to cure the disease in the field. The ways of control are cultural practices which include sterilizing garden tools. As such, this study aimed to identify the plant species capable of inhibiting the growth of *Xanthomonas vasicola* pv. *musacearum (Xvm)* through in vitro experimentation.

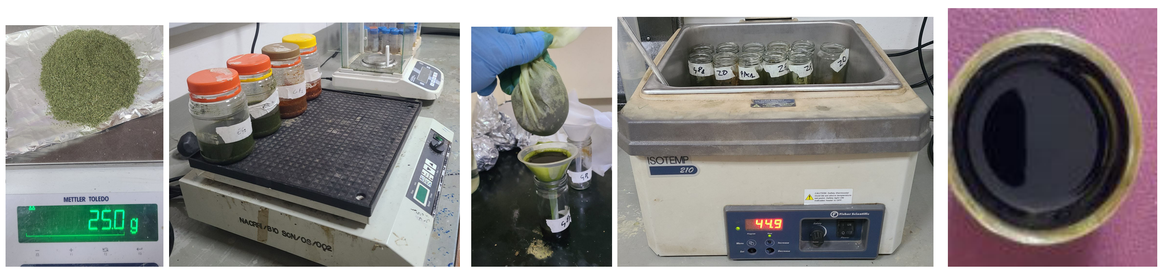
Materials and methods

Pathogenic isolation and identification



Pseudostem symptom, leaf symptom Isolation Purification Inoculum Koch test and and **PRC Test**

Plant extraction process



Weighing Maceration Filtration Evaporation

Inhibition Test

The in vitro experiment was conducted using a completely randomized design with 21 treatments, which included 19 plant extracts, 1 tetracycline (positive control) and 1 distilled water + DMSO (negative control). The treatments were replicated 3 times.

Results

The PCR results as indicated in Fig. 1, confirmed the presence of *Xvm* in diseased banana samples collected in this study, upon amplification of DNA fragment at 265 bp..

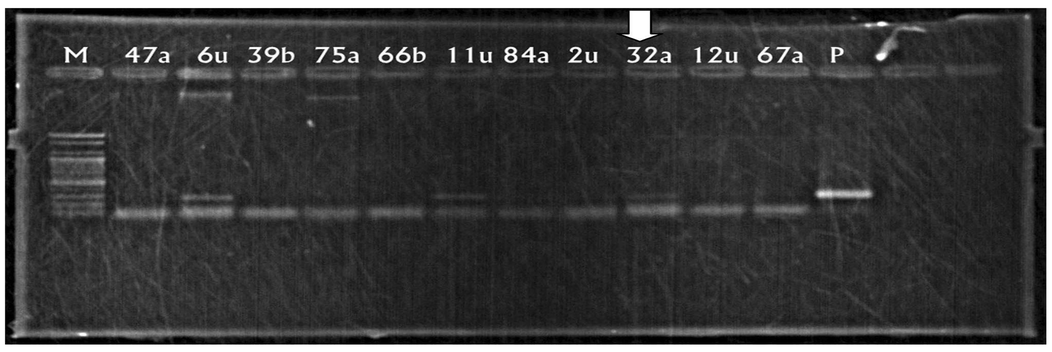


Fig. 1 PCR result on 1% Agar Gel Electrophoresis after GspDm amplification

Fig. 2 Inoculation results at IITA-Kalambo: A at 48h after inoculation; B at 10 DAI (days after inoculation); C at 25 DAI, D at 40 DAI, and E at 55 DAI

For Koch test, the first disease symptoms appeared at 7 days after inoculation (Fig.2B), while complete wilting of the plant was observed on the 47th day after inoculation (Fig. 2E)

The most effective in inhibition was the extract of Rhizome of *Z. officinale* ZO, which is locally known as Ginger. According to the Tukey test at 0.05, it was observed that extracts from the leaves of *R. communis*, *T.vogelii* and *E. heterophylla* exhibited a similar inhibition zone comparable to that of ZO (Tab. 1). *Z. officinale* is as effective as the antibiotic streptomycin in inhibiting *Xanthomonas oryzae* pv. *oryzae.* Ranjan *et a*l.2017.

Tab 1 : Inhibition zone of Xvm in mm

Treatment	Inhibition zone (mm)
Negative control	7.00 a
Conyza sumatrensis	7.00 a
Solanum aculeastrum	7.00 a
Bidens pilosa	7.33 a
Ageratum conyzoides l	7.00 a
Lantana camara	9.33 ab
Vernonia amygdalina	9.67 abc
Euphorbia hirta	10.7 abc
Lantana trifolia	12.0 bc
Citrus limon	13.00 bcd
Eucalyptus eugenoides	13.00 bcd
Psidium guajava	13.33 cd
Phyllanthus niruri	13.33 cd
Ageratum conyzoides f	16.00 de
Piper nigrum	19.00 ef
Fruit of R. communis	19.33 ef
Tephrosia vogelii	21.67 fg
Euphorbia heterophylla	21.67 fg
R. communis leaves	22.00 fg
Zingiber officinale	23.33 g
Tetracycline (+ control)	31.67

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