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Study of the Effect of Camphor Oil on *Macrophomina phaseolina*: An Exploration of Potential Antifungal Properties

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Abstract:

The present study aims to investigates the impact of Camphor Oil on the pathogenic fungus *Macrophomina phaseolina* using the Poisoned Food Technique. *Macrophomina phaseolina* is a destructive phytopathogen responsible for causing various crop diseases, leading to significant agricultural losses. Camphor Oil, derived from the camphor tree, possesses potential antifungal properties and has been explored as a natural alternative to chemical fungicides. The study aimed to assess the inhibitory effects of Camphor Oil on the growth and development of *Macrophomina phaseolina* in a laboratory setting. The Poisoned Food Technique was employed to evaluate the antifungal activity of different concentrations of camphor oil viz., 20%, 40%, 60%, 80% and 100% on *Macrophomina phaseolina* isolated from watermelon (*Citrullus lanatus*) seeds. The results revealed that Camphor oil is not effective against *Macrophomina phaseolina* leading to the conclusion that *Macrophomina phaseolina* is a strong devastating plant pathogen which is resistant to natural products such as camphor oil. Further studies should be carried out to investigate the effect of other natural products against *Macrophomina phaseolina.*

Keywords: Camphor Oil, *Macrophomina phaseolina*, Poisoned Food Technique, Antifungal activity, Phytopathogen, *Citrullus lanatus*

Introduction:

Macrophomina phaseolina, commonly known as charcoal rot fungus, is a devastating plant pathogen with a wide host range that includes over 500 plant species. It poses a significant threat to various crops, including soybeans, sorghum, sunflowers, maize, and many others. The fungus thrives in warm and dry conditions, making it particularly problematic in arid and semi-arid regions. This pathogen infects plants through their roots and spreads rapidly, leading to root rot, stem cankers, and ultimately plant death. The disease manifests as black, charcoal-like lesions, hence its name. Infected plants often exhibit wilting, stunting, and premature senescence. Control measures for *M. phaseolina* are challenging due to its resilient survival structures called sclerotia, which can persist in the soil for extended periods. Crop rotation, use of resistant cultivars, and cultural practices like proper irrigation management are some strategies employed to minimize its impact. Fungicides may provide limited control,

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but integrated management practices are essential for effective disease management. Researchers continually study the biology and genetics of this pathogen to develop more sustainable and efficient control methods, as its potential to cause significant yield losses remains a persistent concern for agriculture globally.[1,2,3,4]

Camphor oil, derived from the camphor tree (*Cinnamomum camphora*), has been recognized for its potential antifungal properties. The oil contains active compounds like camphor, which have shown inhibitory effects against various fungal strains. As an antifungal agent, camphor oil works by disrupting the cell membrane of fungi, impairing their growth and reproduction. This leads to the death or suppression of fungal activity. Its effectiveness has been observed in treating fungal infections of the skin, such as athlete's foot and nail fungus. One of the advantages of using camphor oil is its natural origin, which may appeal to those seeking alternative remedies. Camphor oil possesses antifungal properties that may offer a natural alternative for managing fungal infections, but further research is needed to establish its efficacy and safety fully. This research paper aims to investigate the potential antifungal efficacy of camphor oil against *M. phaseolina* and explore its applicability as a natural fungicide.[5,6,7,8]

Materials and Methods:

- Sample collection

Seed Sample

Untreated seeds of watermelon were collected from Indian Institute of Horticultural Research, Bengaluru, Karnataka, India.

Fungal strain

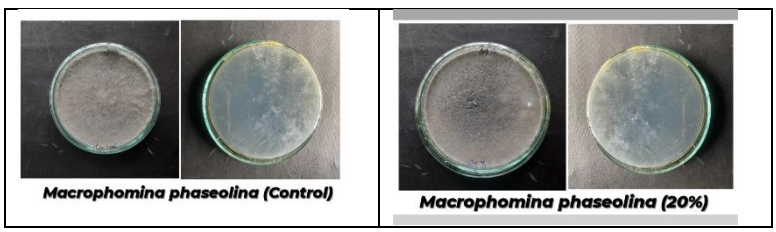
Macrophomina phaseolina was isolated from watermelon seeds by agar plate method.

- Antifungal assay

Effect of camphor oil on *Macrophomina phaseolina* was studied by Poisoned Food Technique. Different concentrations of camphor oil viz., 20%, 40%, 60%, 80% and 100% were incorporated in potato dextrose agar media at 1000 ppm. Control plates without camphor oil were also prepared. After inoculation the plates were kept at 28°C for seven days. After seven days plates were observed for the effect of camphor oil on *Macrophomina phaseolina*.

Results:

Results revealed that camphor oil didn't possesed any effect against *Macrophomina phaseolina*.



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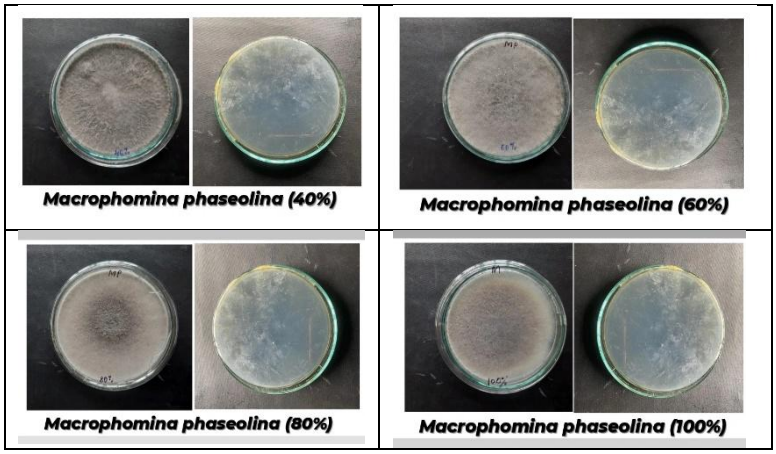

Fig 1: Resistance of *Macrophomina phaseolina* against camphor oil

Discussion:

Camphor oil has been gaining attention as a potential biopesticide to combat plant pathogens. Camphor oil is derived from the leaves of the camphor tree (*Cinnamomum camphora*) and is known for its antimicrobial properties. Studies have shown that camphor oil exhibits potent antifungal activity, making it a promising candidate for controlling plant diseases caused by fungi like *M. phaseolina*. The mechanism of action behind camphor oil's antifungal activity lies in its ability to disrupt the fungal cell membranes, inhibit essential enzyme activity, and interfere with fungal growth and reproduction. These properties help to weaken the pathogen's defense mechanisms and hinder its ability to infect and spread within the plant tissues. [9,10,11,12] Research conducted on camphor oil's effect against *M. phaseolina* has revealed that different concentrations of camphor oil viz., 20%, 40%, 60%, 80% and 100% didn't exhibit any effect against *Macrophomina phaseolina*.

Macrophomina phaseolina is a devastating plant pathogen that affects a wide range of crops. The emergence of resistance against certain fungicides poses a significant challenge for crop protection. One such natural fungicide is camphor oil, which has been used as a potential alternative to synthetic chemicals due to its natural origin and low toxicity. Studies showed promising results in controlling different fungi with camphor oil. So, in the present study camphor oil was used against *Macrophomina phaseolina*. However, over time, the fungus has developed resistance mechanisms against this natural fungicide. This resistance is likely due to the fungus evolving to detoxify or modify the active compounds in camphor oil or altering its cell structure to reduce penetration. To address this issue, an integrated approach that combines multiple control strategies, including rotating different fungicides, adopting cultural practices, and using resistant plant varieties, could be beneficial in mitigating the resistance problem.[13,14,15,16]

Conclusion

The study revealed that camphor oil didn't exhibit any effect against *Macrophomina phaseolina*. These findings open avenues for further research and development of eco-friendly alternatives to combat fungal diseases in crops.

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