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Cinnamomum verum: A Natural Warrior Against *Aspergillus parasiticus* – Investigating the Antifungal Activity of Cinnamon Oil through Poisoned Food Technique

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Abstract

Aspergillus parasiticus, a pathogenic fungus, poses a significant threat to agriculture and human health due to its ability to contaminate foodstuffs and produce mycotoxins. The constant rise in antifungal resistance necessitates exploring alternative approaches to combat fungal infections. In this study, we investigated the potential of *Cinnamomum verum* essential oil as an antifungal agent against *Aspergillus parasiticus* using the Poisoned Food Technique. The essential oil was collected from local market and different concentrations were prepared with the help of acetone. The antifungal activity of the oil was evaluated against *Aspergillus parasiticus* in vitro using poisoned food assay. The minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC) were determined. Our findings revealed that *Cinnamomum verum* essential oil exhibited significant antifungal activity against *Aspergillus parasiticus.*

Keywords: *Cinnamomum verum*, cinnamon oil, *Aspergillus parasiticus*, antifungal activity, Poisoned Food Technique, essential oil, cinnamaldehyde, eugenol, mycotoxins, antifungal resistance.

Introduction

Aspergillus parasiticus is a fungal species known for its role as a plant pathogen, causing significant economic losses in agricultural settings. As a member of the *Aspergillus* genus, it thrives in various environments and is particularly adept at colonizing crops and stored food products. This filamentous fungus primarily affects plants during the pre- and post-harvest stages. It produces aflatoxins, potent mycotoxins that can contaminate crops such as corn, peanuts, cottonseed, and tree nuts. These toxins pose a serious health risk to both humans and animals, as they are highly carcinogenic and may lead to liver and other organ damage. *Aspergillus parasiticus* is highly opportunistic, taking advantage of weakened or stressed plants to establish infection. The fungus enters the plant through wounds or natural openings, such as stomata. Once inside, it invades and colonizes plant tissues, interfering with vital physiological processes and causing symptoms like wilting, discoloration, and lesion formation. Prevention and control of *Aspergillus parasiticus* involve a combination of good

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agricultural practices and post-harvest measures. Farmers need to implement proper crop rotation, use disease-resistant varieties, and maintain optimal irrigation and fertilization practices to minimize plant stress. Adequate storage conditions, temperature control, and moisture management are crucial in limiting fungal growth in stored crops. Regular monitoring and early detection of fungal presence are vital to prevent extensive damage. Fungicides and biocontrol agents may be used with caution, following label instructions and environmental guidelines. *Aspergillus parasiticus* is a formidable plant pathogen that poses significant challenges to agricultural industries and food safety. Proactive management strategies and vigilant monitoring are essential to mitigate its impact on crops and minimize the risk of aflatoxin contamination.[1,2,3,4]

Cinnamon oil has gained popularity as a natural antifungal agent for plants due to its potent fungicidal properties. Extracted from the leaves or bark of *Cinnamomum verum*, this essential oil contains active compounds like cinnamaldehyde, eugenol, and linalool that exhibit strong antifungal effects. When applied to plants, cinnamon oil forms a protective barrier that hinders fungal growth and development. It is particularly effective against common plant fungal pathogens such as powdery mildew, leaf spot, and damping-off diseases. The oil's ability to disrupt fungal cell membranes and inhibit enzyme activity contributes to its antifungal action. Application methods for cinnamon oil vary, with most gardeners using a diluted solution to avoid potential plant damage. Additionally, adding cinnamon oil to the soil can protect against soil-borne fungal infections. One significant advantage of cinnamon oil as an antifungal agent is its eco-friendliness, as it poses minimal risks to humans, animals, and beneficial insects. Its natural origin also makes it a preferred choice for organic gardening and sustainable agricultural practices. However, it's essential to exercise caution when using cinnamon oil on plants, as excessive concentrations may lead to phytotoxicity or harm beneficial microbial populations in the soil. Cinnamon oil's natural antifungal properties make it a promising alternative to synthetic fungicides for plant protection. When used responsibly, it can contribute to healthier plants and a more environmentally friendly approach to gardening and agriculture.[5,6,7,8,9]

Materials and Methods

- Sample collection

Seed Sample

Untreated okra seeds were collected from Indian Institute of Horticultural Research, Bengaluru, Karnataka

Fungal strain

Aspergillus parasiticus was isolated from okra seeds by agar plate method.

Essential oil

Cinnamon oil was collected from local market, Bengaluru.

- Preparation of different concentrations of cinnamon oil

1. 100% - Concentrated oil was use

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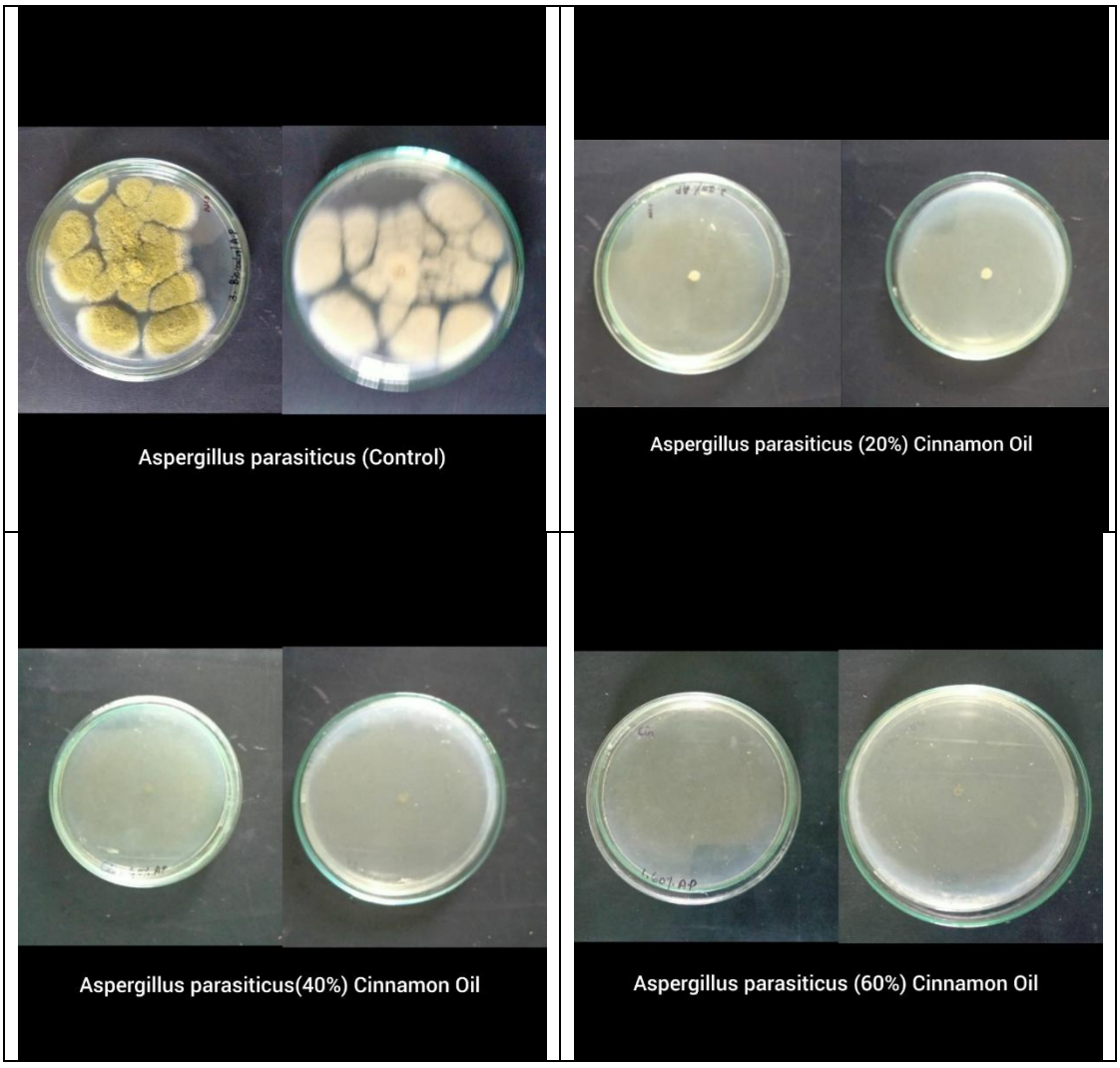
2. 80% - 4ml oil in 1 ml acetone
3. 60% - 3 ml oil in 2 ml acetone
4. 40% - 2 ml oil in 3 ml acetone
5. 20% - 1 ml oil in 4 ml acetone
6. 0% or Control – Untreated plates

- Antifungal Assay

Poisoned Food Techniquewas used to test the antifungal property of Cinnamon Oil against *Aspergillus parasiticus*. Different concentrations of cinnamon oil viz., 20%, 40%, 60%, 80% and 100% were incorporated in potato dextrose agar media at 1000 ppm. Control plates without cinnamon oil were also prepared. After inoculation, the plates were incubated at 28°C for seven days. After seven days zone of inhibition was calculated and recorded.

Results

Results revealed that cinnamon oil possessed significant antifungal activity against *Aspergillus parasiticus*.



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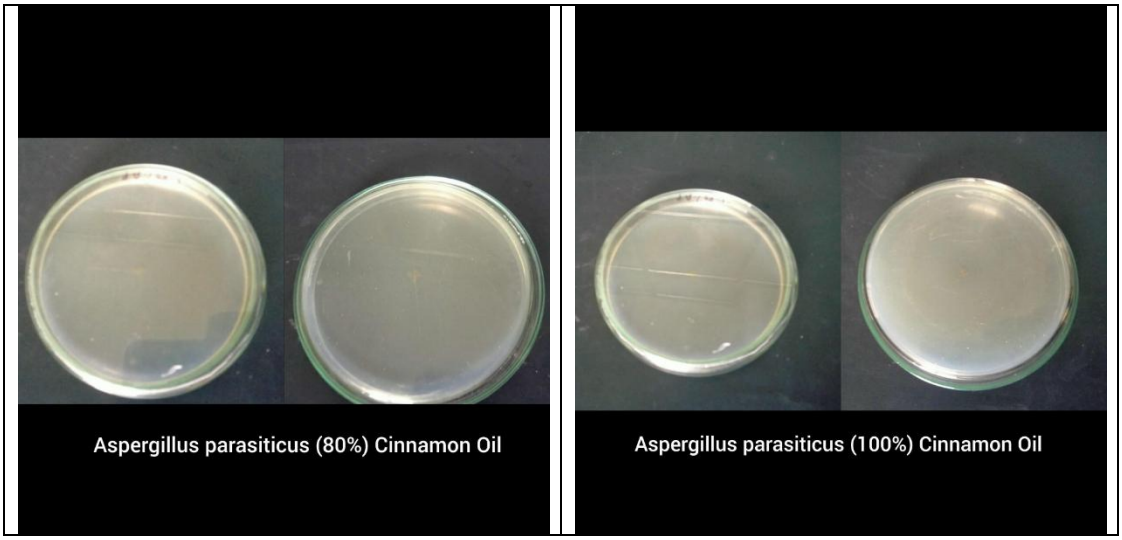

Fig 1: Antifungal activity of cinnamon oil against *Aspergillus parasiticus*

Table 1: Antifungal activity of cinnamon oil against *Aspergillus parasiticus*

Essential oil	Concentration	Mean colony diameter(mm)	Percent of inhibition (%)
Cinnamon oil	Control	81.66	-
Cinnamon oil	20%	4	96.29
Cinnamon oil	40%	00	100
Cinnamon oil	60%	00	100
Cinnamon oil	80%	00	100
Cinnamon oil	100%	00	100

Discussion

Cinnamon oil has been found to exhibit antifungal properties against various fungi, including *Aspergillus* species like *Aspergillus parasiticus*. Studies have shown that cinnamon oil contains active compounds, such as cinnamaldehyde, eugenol, and trans-cinnamic acid, which contribute to its antifungal activity. When tested against *Aspergillus parasiticus*, cinnamon oil has been observed to inhibit the growth and development of the fungus. The mechanism of action involves disruption of the fungal cell membrane, interference with cellular functions, and inhibition of fungal enzyme activity. These antifungal properties make cinnamon oil a promising natural alternative for controlling fungal infections caused by *Aspergillus parasiticus*. However, further research is needed to understand its efficacy, safety, and potential applications in medical or agricultural settings.[10,11,12,13,14]

Conclusion

In conclusion, this research paper demonstrates the significant antifungal potential of cinnamon oil against *Aspergillus parasiticus*. The active compounds present in cinnamon oil, particularly cinnamaldehyde, offer promising prospects for developing a natural alternative to combat fungal infections. Cinnamon oil's efficacy, safety, and low likelihood of developing drug resistance make it a valuable candidate for future antifungal drug development and

treatment strategies against *Aspergillus parasiticus*. However, further research is warranted to fully harness its therapeutic potential and eventually translate it into clinical applications.

References

1. https://en.wikipedia.org/wiki/Aspergillus_parasiticus
2. Perrone G, Susca A, Cozzi G, Ehrlich K, Varga J, Frisvad JC, Meijer M, Noonim P, Mahakarnchanakul W, Samson RA. Biodiversity of Aspergillus species in some important agricultural products. Stud Mycol. 2007;59:53-66. Doi: 10.3114/sim.2007.59.07. PMID: 18490950; PMCID: PMC2275197.
3. https://www.britannica.com/science/Aspergillus-parasiticus
4. Nikolić M, Savić I, Nikolić A, Jauković M, Kandić V, Stevanović M, Stanković S. Toxigenic Species Aspergillus parasiticus Originating from Maize Kernels Grown in Serbia. Toxins (Basel). 2021 Nov 26;13(12):847. Doi: 10.3390/toxins13120847. PMID: 34941685; PMCID: PMC8704542.
5. Gupta P, Arora A, Gupta M, Singh R, Rudramurthy SM, Kaur H. First case of endophthalmitis by Corynesporacassiicola. J Mycol Med. 2022 Nov;32(4):101298. Doi: 10.1016/j.mycmed.2022.101298. Epub 2022 May 22. PMID: 35640523.
6. Stevens N, Allred K. Antidiabetic Potential of Volatile Cinnamon Oil: A Review and Exploration of Mechanisms Using In Silico Molecular Docking Simulations. Molecules. 2022 Jan 27;27(3):853. Doi: 10.3390/molecules27030853. PMID: 35164117; PMCID: PMC8840343.
7. El Atki Y, Aouam I, El Kamari F, Taroq A, Nayme K, Timinouni M, Lyoussi B, Abdellaoui A. Antibacterial activity of cinnamon essential oils and their synergistic potential with antibiotics. J Adv Pharm Technol Res. 2019 Apr-Jun;10(2):63-67. Doi: 10.4103/japtr.JAPTR_366_18. PMID: 31041184; PMCID: PMC6474160.
8. Ganić T, Vuletić S, Nikolić B, Stevanović M, Kuzmanović M, Kekić D, Đurović S, Cvetković S, Mitić-Ćulafić D. Cinnamon essential oil and its emulsion as efficient antibiofilm agents to combat Acinetobacter baumannii. Front Microbiol. 2022 Oct 10;13:989667. Doi: 10.3389/fmicb.2022.989667. PMID: 36299724; PMCID: PMC9589355.
9. Kallel I, Hadrich B, Gargouri B, Chaabane A, Lassoued S, Gdoura R, Bayoudh A, Ben Messaoud E. Optimization of Cinnamon (Cinnamomum zeylanicum Blume) Essential Oil Extraction: Evaluation of Antioxidant and Antiproliferative Effects. Evid Based Complement Alternat Med. 2019 Dec 24;2019:6498347. Doi: 10.1155/2019/6498347. PMID: 31929818; PMCID: PMC6942840.
10. Santra HK, Banerjee D. Natural Products as Fungicide and Their Role in Crop Protection. Natural Bioactive Products in Sustainable Agriculture. 2020 May 12:131–219. Doi: 10.1007/978-981-15-3024-1_9. PMCID: PMC7212785.
11. https://homework.study.com/explanation/summarize-the-advantages-and-disadvantages-of-using-synthetic-pesticides.html
12. Pedro, Ivo & Leandro, Victor & Antonia, Alice & Heder, Braun & Odair, dos & Altamiro, Souza & Maria, Rosangela. (2016). Alternative control of Corynesporacassiicola in papaya seedlings and fruits by Cinnamomum zeylanicum essential oil. African Journal of Agricultural Research. 11. 1862-1871. 10.5897/AJAR2015.10754.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper© 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 12, Iss 1, 2023

13. Valentini, Renan & Bonome, Lisandro & Moura, Gabriela & Siqueira, Diogo &Tomazi, Yasmin &Franzener, Gilmar & von Hertwig Bittencourt, Henrique. (2019). Essential oils of Tahiti lemon and cinnamon bark in control of storage fungi and the physiological and sanitary quality of beans. Arquivos do Instituto Biológico. 86. 10.1590/1808-1657000172019.
14. Hong, Z., Talib, K.M., Mujtaba, K.G. et al. Antifungal potential of cinnamon essential oils against Phytophthora colocasiae causing taro leaf blight. Chem. Biol. Technol. Agric. 8, 39 (2021). https://doi.org/10.1186/s40538-021-00238-3