Musa Özcan · Nuh Boyraz

Antifungal properties of some herb decoctions

Abstract The antifungal activities of four spice decoctions (sage, wild thyme, oregano and savory) which grow wild in Turkey against six moulds (Fusarium oxysporum f. sp. phaseoli, Macrophomina phaseoli, Botrytis cinerea, Rhizoctonia solani, Alternaria solani and Aspergillus parasiticus) were tested for fungistatic and fungicidal activity in vitro. Decoctions were added at 5% and 10% levels to 250ml culture medium. The results showed that the decoctions investigated varied in their antifungal activity. Sage had weak activity, whilst wild thyme, oregano and savory were active against all moulds tested. All test fungi were completely inhibited by both of the concentrations of wild thyme and the 10% level of oregano decoctions in all the incubation periods. It was concluded that some decoctions may be useful as mould inhibitors at food additive levels.

Keywords Antifungal effect · Spice · Decoction · Mould · Inhibition

Introduction

For years, many investigations have been conducted into the antimicrobial effects of various spices and derivatives. Sage, thyme, oregano and savory are aromatic herbs consisting of the leafy part of plants belonging to the Labiatae family, and are frequently added to meat, sausage, poultry, fish and food products. They are used in foods today mainly for their flavours and aromas. Several spices and herbs have been known to possess antimicrobial activities. Oregano, thyme, sage, savory, garlic, cumin and onion have generally found to be the most inhibitive and are considered among the most active of a large number of spices and/or their essential oils which have been investigated. While it is generally accepted that certain herbs and spices have antimicrobial activities and may influence the storage stability of foods to which they have been added, they are not currently used for the primary purpose of exerting a preservative effect. The preservative activity of herbs and spices has only recently received attention in the literature where some studies have shown that mycotoxin-producing moulds may be inhibited by some herbs and spices [1–5].

Recently, some components such as phenolics, saponins, alkaloids, and sulphur compounds found in plants have been tested against plant diseases in vitro and in vivo conditions [6].

There are several chemicals that can be used as antimicrobial agents. These chemicals require cautious handling since they are corrosive and their vapours can irritate the eyes and respiratory tract. Consequently, we decided to investigate the use of herbs and their derivatives which possess antimicrobial activity but cause no health problems to the handler or consumer.

The objective of this work was to investigate the activity of decoctions of sage, thyme, oregano and savory at different concentrations on Fusarium oxysporum f. sp. phaseoli, Macrophomina phaseoli, Botrytis cinerea, Rhizoctonia solani, Alternaria solani and Aspergillus parasiticus in culture medium.

Materials and methods

Materials. Salvia fruticosa L.(sage) was collected from Muğla (Turkey) and Thymbra spicata L.(wild thymus), Origanum vulgare L.(oregano) and Satureja hortensis L.(savory) from Mersin (Büyükceelli-Gülnar, Turkey) in 1998. Plants were identified at the Department of Biology, Faculty of Science and Education, Selçuk University, and example specimens were deposited at that faculty’s herbarium.

While F. oxysporum f. sp. phaseoli, M. phaseoli, R. solani and Alternaria solani were provided from the collection of the De-
partment of Plant Protection, Selçuk university, B. cinerea and A. parasiticus were provided from the collection of the Department of Food Engineering of the same university.

Medium. Potato dextrose agar (PDA) (Merck, Darmstadt) was used as the main medium in the experiment. Plants (1/2, w/v) used in this study were boiled in water by using an apparatus for re-cooling for 1 h and were filtered, cooled and stored in a refrigerator until use. This mixture is called a decoction. Decoctions to be used in experiment were added at a level of 5% and 10% to 250 ml medium sterilized by autoclaving at 121 °C for 20 min.

Analysis of antifungal activity. The effect of decoctions at different concentrations (5% and 10%) was tested against the mycelial growth of F. oxysporum f.sp. phaseoli, M. phaseoli, B. cinerea, R. solani, Alternaria solani and A. parasiticus using PDA in vitro. Medium (20 ml) was dispensed into each petri plate and five mm discs of the test fungi, cut from the periphery of 7-days-old cultures, were inoculated upside down separately to each assay plate and incubated at 24°C. The colony diameter was measured and the percentage mycelial inhibition calculated as follows [7]. Four replicates of each treatment were run and averages were calculated. Control sets were simultaneously run without using the herb decoctions.

\[ I = \left( \frac{C - T}{C} \right) \times 100 \]

where \( I \) is inhibition (%), \( C \) is the colony diameter of the mycelium on the control petri plate (mm), and \( T \) is the colony diameter of the mycelium on the test petri plate (mm).

Mycelial parts of moulds showed growth as long as samples were inoculated into the PDA medium without using the decoctions, and were observed for a week period. Fungal growth in this period exposed the fungicidal and fungistatic activities of the decoctions, respectively.

Results and discussions

Effects of four different spice decoctions on the mycelial growth of six fungi are given in Table 1. The sage decoction had differing effects on the growth rates of the mycelial growth of the moulds. Mycelial growth of F. oxysporum f.sp. phaseoli was established to have its highest rate at 3 days of incubation. Inhibition was observed to be 26.8% at both concentrations. The antifungal effect of sage decreased with the extent of incubation. At the 7th day of incubation, sage showed no inhibition when compared with the control group. The 5% level of sage decoction exhibited a weak effect on M. phaseoli. The 10% level of sage decoction had a similar effect initially, but by the 3rd day of incubation showed no effect compared to the control group. The highest antymycotic effect of sage was at the 5% level on B. cinerea, with 75% mycelial inhibition rate, but, the inhibitory effect of sage on this fungi decreased during the incubation. The 10% level of sage decoction had a lesser effect on the mycelial growths of B. cinerea, R. solani

<table>
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<tr>
<th>Table 1</th>
<th>Inhibition effect of decoctions (% inhibition) at 5% and 10% levels in the culture medium on various fungi</th>
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