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REGULAR ARTICLE

ANTIFUNGAL ACTIVITY OF GARLIC (*ALLIUM SATIVUM*) EXTRACT ON SOME SELECTED FUNGI

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ABSTRACT

The study was aimed to determine the antifungal activity of garlic on some selected fungi. Garlic samples were purchased from Dutsinma central market, Katsina state. The samples were washed, separated and peeled to obtain the edible portion. The fungi were isolated using the culture method and identified based on morphological characteristics. The extract was prepared using two solvents (aqueous and ethanol) by soaking method. The antifungal activity of aqueous and ethanolic garlic extract was determined on some selected fungi namely, Fusarium spp and Rhizopus spp. From the results it is clear that, ethanol extract showed more activity when compare to aqueous extract. The diameter of zones of inhibition for the ethanolic extract ranged between 4.1-14.3 mm, while that of aqueous extract ranged between 2.4-10.4 mm. The MIC for the ethanolic extract was 2.5 mg/ml and 5.0 mg/ml for Fusarium spp and Rhizopus spp respectively. While for aqueous extract there was no effect on both tested organisms. It can be concluded from this study that garlic extract showed antifungal activity against the test organism. Moreover, the ethanolic extract showed inhibitory activity among the tested fungi.

Keywords: *Allium sativum,* Antifungal Activity, Extract, Fungi

INTRODUCTION

The medicinal and antimicrobial activities of extracts from plants are gaining attention of researchers worldwide. The modern medicine has its own advantages and side effects, so the plant based products are getting more popularity, as they are safe to use, and comparatively easily available and cheap. Many extracts possess antifungal activity [1]. Plant extracts and essential oils are effective in plant pathogens [2]. Apart from the use of plant based products in medicine, the usage of these extracts in plant protection also now becoming popular throughout the world [3, 4].

Garlic is one among the important earliest known medicinal plants [5, 6]. Its usage worldwide has a long history [6]. Being an important food spice plant, it has significant role in disease prevention and control, many of the diseases can be cured with garlic [7]. It has been used since long time against human pathogens. But studies are less regarding the usage of garlic against plant pathogens. Some earlier works [8-12] deals with the action of garlic against pathogens.

The aim of this research work was to determine antifungal activity of aqueous and ethanolic garlic extract on some selected fungi at different concentrations and to determine the minimum inhibitory concentration (MIC) of aqueous and ethanolic extract of garlic.

MATERIALS AND METHODS

Collection and preparation of sample

Fresh bulbs of garlic were purchased from Dutsin-ma central market. The cloves were separated, peeled and washed to obtain the edible portion.

Isolation and identification of fungi

The fungi were isolated as described earlier [13].

Preparation of water extract of garlic and ethanol extract preparation were done by following standard method [14]

Media preparation

The media was prepared according to the manufacturer's specifications. About 19.5grams of sabouraud dextrose agar (SDA) was weighed using a weighing balance and dissolved into a conical flask containing 300 ml of sterile

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distilled water. It was then shaken to mix up and dissolved in a hot plate. It was further sterilized by autoclaving at 121 °C for 15 min and allowed to cool down. The media was dispensed into sterile Petri dishes and allowed to solidify.

Determination of antifungal activity of the extracts

The antifungal screening of the aqueous and ethanolic extracts was carried out using the agar well diffusion method as described by [15].

Determination of minimum inhibitory concentration (MIC) of extract

The Minimum Inhibitory Concentration (MIC) was determined using modified methods of [16].

RESULTS AND DISCUSSION

The results of antifungal activity obtained showed that the ethanolic plant extracts has no effect on all the test organisms at 1.5 mg/ml. However, at 2.5 mg/ml, 5.0 mg/ml, 10.0 mg/ml and 20.0 mg/ml, the plant extracts showed inhibition zones of 5.2, 6.4, 9.1 and 12.2 mm for *Rhizopus spp*. While at 2.5 mg/ml, 5.0 mg/ml, 10.0 mg/ml and 20.0 mg/ml, the plant extracts showed inhibition zones of 4.1, 6.2, 10.1 and 14.3 respectively for *Fusarium spp*. in which 20 mg/ml showed the highest zones of inhibition with inhibition of 14.3 mm for *Fusarium spp* and 12.2 mm for *Rhizopus spp*., for the control, there was no effect as presented in table 1.

The results of antifungal activity obtained showed that the aqueous extract has no effect on all the test organisms at 1.5 mg/ml and 2.5 mg/ml, respectively. At 5.0 mg/ml, 10.0 mg/ml and 20.0 mg/ml, the plant extracts showed inhibition zones of 4.3, 5.2 and 10.4 mm for *Rhizopus spp*. While at 5.0 mg/ml, 10.0 mg/ml and 20.0 mg/ml, the plant extracts showed inhibition zones of 2.4, 4.2, and 9.5 mm respectively for *Fusarium spp*. in which 20 mg/ml showed the highest zones of inhibition with inhibition of 9.5 mm for *Fusarium spp* and 10.4 mm for *Rhizopus spp*., for the control, there was no effect as presented in table 2.

Table 1: Antifungal activity of ethanolic extract on the growth of *Fusarium* and *Rhizopus spp*

Concentration (mg/ml)	Diameter of zones of inhibition against the test organism (mm)	
	Fusarium spp	***Rhizopus spp***
1.5	-	-
2.5	4.1	5.2
5.0	6.2	6.4
10.0	10.1	9.1
20.0	14.3	12.2
Control	-	-

Key; -means growth

Table 2: Antifungal activity of aqueous extract on the growth of *Fusarium* and *Rhizopus spp*

Concentration (mg/ml)	Diameter of zone of inhibitions against the test organisms (mm)	
	Fusarium spp	***Rhizopus spp***
1.5	-	-
2.5	-	-
5	2.4	4.3
10	4.2	5.2
20	9.5	10.4
Control	-	-

Key: -means no activity, The result showed minimum inhibitory concentration (MIC) of ethanol garlic extract. The MIC was found to be 2.5 mg/ml for *Fusarium spp* and 5.0 mg/ml for *Rhizopus spp* as presented in table 3.

Table 3: Minimum inhibitory concentration of ethanolic extract of garlic

Test organism	Concentration of extracts (mg/ml)					
	1.5	**2.5**	**5**	**10**	**20**	**MIC**
Fusarium spp	+	-	-	-	-	2.5
Rhizopus spp	+	+	-	-	-	5

Key: +means growth,-means no growth.

The result showed minimum inhibitory concentration (MIC) of aqueous extract of garlic. The MIC of aqueous extract has no effect on both the tested organisms as presented in table 4.

Table 4: Minimum inhibitory concentration of aqueous extract of garlic

Test organism	Concentration of extracts (mg/ml)				
	1.5	**2.5**	**5**	**10**	**20**
Fusarium spp	+	+	+	+	+
Rhizopus spp	+	+	+	+	+

Key: +means no growth.

Garlic (*Allium sativum*) is a spice with global recognition. In the present study, it has been shown to inhibit the growth of fungi when tested. The antifungal action of garlic is due to the compound allicin. It has strong antimicrobial and antifungal activities. Thus, inhibition of fungi observed in this study may be related to allicin or ajoene which curbs the performance of some enzymes that are important to fungi. Our results clearly indicate that the garlic ethanol extract showed higher inhibitory activity. Likewise, the aqueous extracts of garlic show less antifungal activity than the ethanolic extract against the test organisms, which is in agreement with earlier reports [17,18]. Moreover, all the extracts of garlic in higher concentrations showed that the antifungal effect increase when the concentration is also increased.

Inhibition in growth of Fusarium spp and Rhizopus spp observed in this study was similar to previous findings of [19,20] who demonstrated antifungal potency of garlic where inhibition of Trichophyton and Microsporum species using fresh garlic juice was shown due to stronger activity of ajoene. It is also in conformity with the previous works [21-23].

CONCLUSION

It can be concluded from this study that garlic extracts showed antifungal activity against the test organisms. Moreover, the ethanolic extract showed inhibitory activity among the tested fungi namely *Fusarium spp and Rhizopus spp*, where *Rhizopus spp* is more susceptible to aqueous extract and *Fusarium spp* more susceptible to the ethanolic garlic extract.

AUTHORS CONTRIBUTIONS

Abdulaziz Bashir Kutawa (Bashir, K. A.) planned and carried out all the experiments in this study. Musa Daniel Danladi (Musa, D. D.) helped in writing and paraphrasing the work, and Haruna Aisha (Haruna, A.) also played an important role in proofreading and editing the work.

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