SHORT COMMUNICATION

RECORDS OF PHARMACEUTICAL AND BIOMEDICAL SCIENCES

Antimicrobial and Antifungal Activities of *Alhagi maurorum* Crude Extract and Its Fractions

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Abstract

Alhagi maurorum (family Fabaceae) crude extract and its fractions were evaluated for their antimicrobial activities against an array of pathogens including fungi, gram positive and gram-negative bacteria. The results revealed that all the tested plant samples exhibited a promising antibacterial activity against *Proteus vulgaris* except the polar fractions of *A. maurorum* (50 % DCM/MeOH and 100 % MeOH) which were inactive. Additionally, the intermediate polarity fractions of the plant (75% DCM/*n*-hexane, 100% DCM and 25% DCM/MeOH) displayed notable antifungal effect against the *Candida albicans* with inhibition zones equal 11,14 and 12 mm respectively. Therefore, *A.maurorum* crude extract and its different fractions could be considered as a promising source for effective antibacterial and antifungal agents.

Keywords: *Alhagi maurorum*; Fabaceae; antimicrobial; antifungal activity.

1. Introduction

One of the major public health issues of the twenty-first century is antimicrobial resistance, which represents a threat to the effective prevention and treatment of an expanding number of infections caused by bacteria, parasites, viruses, and fungi that are no longer susceptible to the conventional medications used to treat them **(Prestinaci et al., 2015; Mishra et al., 2020)** **).** The increasing toxicity and reduced efficacy of synthetic drugs further aggravate this problem. Therefore, scientists are exploring medicinal plants for safer, cheaper, and more effective and available antimicrobial agents **(Dzotam and Kuete, 2017; Atef et al., 2019; Vaou et al., 2021)** due to the chemical and biological diversity of phytochemicals.

Family Fabaceae comprises approximately 740 genera and 19,400 species. Several studies reported the antimicrobial potential of Fabaceae plants. Thus, they open a new pathway for further investigation to discover novel complimentary antibiotics against Gram-positive and/or negative bacteria as well as antifungal medicines. **(Obistioiu et al., 2021)**

Alhagi maurorum (Fabaceae) is used traditionally for treatment of several ailments such as constipation, piles, migraine, warts, bilharziasis and rheumatism **(Abdul-Hafeez et al., 2015).** Moreover, *A. maurorum* was proved to possess various biological activities including antibacterial action **(Abdul-Hafeez et al., 2015)**. The plant owes such pharmacological effects to a wide array of secondary metabolites. Phytochemical screening of *A.maurorum* revealed the presence of flavonoids, glycosides, alkaloids, saponins, tannins, steroids, and anthraquinone **(Ahmed, 2015; Muhammad et al., 2015).**

In this study, *A. maurorum* crude extract and its different fractions were evaluated for their antimicrobial and antifungal activities against selected microorganisms.

2. Results and discussion:

Alhagi maurorum (2Kg) was collect in May 2018 from Sinai Peninsula, Egypt. It was authenticated in the department of Botany, Faculty of science, Suez Canal University. The collected plant was dried in shade at room temperature, then powdered. 1.5 kg of the powdered plant was extracted with Ethanol (3 X 2L) to obtain a brownish sticky residue (150 g). An amount of 140 g of the crude extract was fractionated by VLC using *n*-hexane: DCM: MeOH gradients to afford the fractions: F1(100% *n*-hexane, 0.5 g), F2 (25 % DCM/ *n*-hexane, 2 g), F3 (50 % DCM/ *n*-hexane, 2.4 g), F4 (75%DCM/ *n*-hexane, 1g) F5(100 % DCM, 3.6 g), F6 (25 % DCM/MeOH, 5.3 g), F7(50 % DCM/MeOH, 7.4 g) and F8 (100 % MeOH, 9.2 g).

The dried *A. maurorum* extract and fractions were dissolved in DMSO (20 mg/mL) then screened for their antimicrobial effects using a well diffusion method described in **(Abo-Ashour, Eldehna et al. 2018, Eltamany et al., 2021)** against Gram-positive bacterial strains (*Staphylococcus aureus* and *Bacillus subtilis*), Gram negative bacteria (*Escherichia coli*, *Proteus vulgaris*), as well as the fungal strains: *Aspergillus fumigatus* (filamentous fungus) and *Candida albicans* (yeast). Gentamycin antibiotic was served as a reference broad spectrum antibacterial agent. While Ketoconazol was used as a reference antifungal medication.

The obtained results were depicted in **table 1** where the inhibition zone diameter (in mm) was applied as a criterion for the antimicrobial activity. Among the tested pathogens only *P. vulgaris* (Gram -ve bacteria) and *C. albicans* (Yeast) were susceptible to *A. maurorum* crude extract and/or its fractions. All the tested plant samples were active against *Proteus vulgaris* except the polar fractions F7 (50 % DCM/MeOH) and F8 (100 % MeOH) which were inactive. The anti *P. vulgaris* plant samples displayed inhibition zones of diameters ranging from 15-17 mm. On the other hand, among the tested plant samples, only F4, F5 and F6 (75% DCM/*n*-hexane, 100% DCM and 25% DCM/MeOH) of *A. maurorum* were active against *C. albicans* inhibition zones equal 11,14 and 12 mm respectively.

Table 1. Antimicrobial and antifungal activities of *A. maurorum* crude extract and different fractions against an array of pathogens

Tested organisms / Samples	FUNGI Control: Ketoconazole		Gram Positive Bacteria *Control: Gentamycin*		Gram Negative Bacteria *Control: Gentamycin*	
	Aspergillus fumigatus (RCMB 002008)	*Candida albicans* (ATCC 10231)	*Staphylococcus aureus* (ATCC 25923)	*Bacillus subtilis* (NRRL B-543)	*Escherichia coli* (ATCC 25922)	*Proteus vulgaris* (ATCC 13315)
Control	17	20	24	26	30	*25*
***A. maraurum* Crude Extract**	NA	NA	NA	NA	NA	15
F1	NA	NA	NA	NA	NA	15
F2	NA	NA	NA	NA	NA	16
F3	NA	NA	NA	NA	NA	17
F4	NA	11	NA	NA	NA	17
F5	NA	14	NA	NA	NA	17
F6	NA	12	NA	NA	NA	15
F7	NA	NA	NA	NA	NA	NA
F8	NA	NA	NA	NA	NA	NA

The test was done using the diffusion agar technique, well diameter: 6.0 mm, 100 µL of the sample was applied into the well, Positive control for fungi: Ketoconazole (1 mg/ml), Positive control for bacteria: Gentamycin (100 µg/mL), DMSO was served as a negative control. *NA: No activity, NT: Not tested.

3. Conclusion

In the present study, we have evaluated the antimicrobial and antifungal activities of *A. maurorum* crude extract and its different fractions. Our observations revealed that *A. maurorum* could be a promising lead for the developments of effective therapeutic agents especially 75% DCM/*n*-hexane**,** 100% DCM and 25% DCM/MeOH fractions which have both antimicrobial and antifungal activities against *P. vulgaris* and *C. albicans*. Therefore, a future bioassay guided phytochemical study is needed to isolate the bioactive compound then assess their activities as effective antibacterial and antifungal agents.

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