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Some biological activities of different extracts of *Nitraria schoberi* L.

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ABSTRACT: Plants are natural products widely used for different purposes worldwide. With these properties, it is important to determine the potential of plants. In our study, some biological activities of ethanol and methanol extracts of *Nitraria schoberi* L. were determined. Ethanol and methanol extracts were obtained from the aboveground parts of the plant in the Soxhlet apparatus. Then, total antioxidant (TAS), total oxidant levels (TOS) and oxidative stress index (OSI) of the plant extracts were determined using Rel Assay kits. Antimicrobial activities of the plant extracts were determined by agar dilution method against standard bacterial and fungal strains. As a result of the analyzes, it was seen that ethanol extracts of the plant had higher TAS values. In addition, it was determined that methanol extract had higher TOS and OSI values among the plant extracts. It was observed that methanol extracts of the plant were effective against bacterial strains at concentrations between 100-400 µg/mL, while ethanol extracts of the plant were effective against bacterial strains at concentrations between 50-400 µg/mL. It was observed that both ethanol and methanol extracts were effective against fungal strains at concentrations between 100-200 µg/mL. As a result, it was observed that the plant has antioxidant and antimicrobial potentials. In this context, it is thought that it can be an important natural material in pharmacological designs.

Keywords: Antioxidant, antimicrobial, *Nitraria schoberi*, medicinal plants.

INTRODUCTION

Since ancient times, plants have been natural products used for many purposes by humans. In some cases, they have been used for different purposes such as making equipment, in some cases as food, in some cases in combating diseases, in some cases as fuel, and in some cases as shelter construction (Kına et al., 2021; El-Chaghaby et al., 2024). Plants are at the forefront of people's routine diet lists. Many plant species are preferred by people due to their nutritional properties and regulatory effects (Korkmaz et al., 2021). In addition to their nutritional properties, one of the most important functions of plants is their medicinal potential (Mohammed et al., 2020). Many studies have reported that plants have different biological activities such as antioxidant, anticancer, anti-inflammatory, antiproliferative, hepatoprotective, DNA-protective, antiallergic, antiaging, and antimicrobial (Çömlekçioğlu and Karaman, 2008; Karcioglu et al., 2011; Mohammed et al., 2019a; Pehlivan et al., 2021; Mohammed et al., 2021a; Comlekcioglu et al., 2022; Unal et al., 2022; Sevindik et al., 2023a). In this context, determining the biological activities of plants is very important for their usage potential and determining the plants to be used medically (Mohammed et al., 2022a).

In this study, some biological activities of different extracts of *Nitraria schoberi* L. were determined. *N. schoberi* (Nitrariaceae) is a flowering plant species known as nitrebush. It is widely distributed in the Irano-Turanian phytogeographic area. Its salty-sweet fruits are collected by local people due to their edible properties. The stem is 15-30 cm long, the leaves are paripinnate with 10-16 leaflets, and the flowers are scattered. It spreads in sandy areas. It is eaten fresh or canned (Temirbayeva and Zhang, 2015).

MATERIAL AND METHODS

Plant samples were collected from Konya (Turkey). The aboveground parts of the plant were dried in an environment that did not receive direct sunlight. After the drying process, 30 g of the samples were weighed and extracted with 250 mL of ethanol in a Soxhlet apparatus at 50 °C for approximately 6 hours. After the extraction process, the solvents were evaporated using a Buchi R100 Rotary Evaporator at 40 °C and crude extracts were obtained.

Antioxidant tests

Total antioxidant, total oxidant levels and oxidative stress indices of ethanol and methanol extracts of aerial parts of the plant were determined using Rel Assay kits. Trolox was used as a calibrator in the TAS test of the extracts and the values were

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expressed as mmol/L. Hydrogen peroxide was used as a calibrator in the TOS test of the extracts and the values were expressed as μmol/L (Erel, 2004; Erel, 2005). Oxidative stress index (OSI) was determined by the ratio of TOS values to TAS values (Sevindik, 2019).

Antibacterial and antifungal activity tests

Stock solutions were prepared from ethanol and methanol extracts of the plant separately by dilution method at concentrations of 800-12.5 μg/mL. Then, these stock solutions were tested for their activities against test microorganisms. Bacterial strains were pre-cultured in Muller Hinton Broth medium. Fungal strains were pre-cultured in RPMI 1640 Broth medium.

Test bacteria: *Staphylococcus aureus* ATCC 29213, *S. aureus* MRSA ATCC 43300, *Enterococcus faecalis* ATCC 29212, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853 and *Acinetobacter baumannii* ATCC 19606

Test fungi: *Candida albicans* ATCC 10231, *C. krusei* ATCC 34135 and *C. glabrata* ATCC 90030.

In our study, the lowest extract concentrations that inhibited the growth of microorganisms were determined (Bauer et al., 1966; Hindler et al., 1992; Matuschek et al., 2014; Baba et al., 2020).

RESULTS AND DISCUSSION

Antioxidant and Oxidant Status

Oxidizing compounds are free radicals released during metabolite processes in living organisms (Sevindik, 2018). While these free radicals do not have harmful effects at low levels, they can cause serious damage as levels increase. The antioxidant defense system suppresses the harmful effects of oxidizing compounds (Mushtaq et al., 2020). However, in some cases, the balance between oxidizing compounds and the antioxidant defense system is disrupted and oxidative stress occurs (Bal et al., 2023). As a result of oxidative stress, serious diseases such as cancer, lung and kidney diseases, cardiovascular diseases, and neurodegenerative disorders can be seen in humans (Pehlivan et al., 2018; Uysal et al., 2021). Supplemental antioxidant sources can be used to reduce or suppress the effects of oxidative stress (Mohammed et al., 2019b). Plants are important antioxidant sources thanks to the bioactive compounds they produce in their bodies. In this context, it is very important to determine the antioxidant potential of plants (Mohammed et al., 2021b). In our study, the total antioxidant level, total oxidant level, and oxidative stress index of *Nitraria schoberi* were determined. The findings are shown in Table 1.

Table 1. *TAS, TOS and OSI values of Nitraria schoberi*

Extracts	TAS (mmol/L)	TOS (μmol/L)	OSI (TOS/(TAS*10))
Ethanol	4.317±0.025	10.339±0.113	0.239±0.003
Methanol	5.333±0.158	8.001±0.069	0.150±0.003

Values are presented as mean±SD

The antioxidant potential of Nitraria schoberi has been reported using different methods in the literature (Khajeddini et al., 2012; Sharifi Rad et al., 2014; Sharifi Rad et al., 2015; Dall'Acqua et al., 2024). In our study, TAS, TOS and OSI values were determined for the first time using Rel Assay kits. TAS, TOS and OSI values of different plant species have been reported previously. In these studies, TAS values of *Arum dioscoridis, Glaucium alakirensis, Mentha longifolia, Viola odorata*, *Campanula strigosa* and *Sideritis libanotica* subsp. *kurdica* were reported as 6.486, 3.469, 2.860, 6.752, 4.974 and 7.934 mmol/L, respectively. TOS values were reported as 13.578, 2.204, 14.858, 7.886, 12.437 and 10.626 μmol/L, respectively. OSI values were reported as 0.209, 0.063, 0.522, 0.117, 0.251 and 0.134, respectively (Doğan et al., 2023; Mohammed et al., 2023; Mohammed et al., 2024; Özcandır et al., 2024; Seğmenoğlu and Sevindik, 2024). The TAS value of the ethanol extract of *N. schoberi* used in our study was determined to be lower than *A. dioscoridis, V. odorata, C. strigosa* and *S. libanotica* subsp. *kurdica*, and lower than *G. alakirensis* and *M. longifolia*. The TAS value of the methanol extract of *N. schoberi* was determined to be lower than *A. dioscoridis, V. odorata* and *S. libanotica* subsp. *kurdica*, and higher than *G. alakirensis, M. longifolia* and *C. strigosa*. The TAS value is an indicator of the whole antioxidant compounds produced in natural products (Mohammed et al., 2022b). It was determined that both ethanol and methanol extracts of *N. schoberi* used in our study had antioxidant potential. The TOS values of both ethanol and methanol extracts of *N. schoberi* were measured to be lower than *A. dioscoridis, M. longifolia, C. strigosa* and *S. libanotica* subsp. *kurdica*, and higher than *G. alakirensis* and *V. odorata*. The TOS value is an indicator of the whole oxidant compounds produced in natural products (Mohammed et al., 2022b). The oxidant values of *N. schoberi* used in our study were found to be at normal levels. The OSI value of the ethanol extract of *N.*

schoberi was determined to be higher than *A. dioscoridis*, *G. alakirensis*, *V. odorata*, *S. libanotica* subsp. *kurdica*, and lower than *M. longifolia* and *C. strigosa*. The OSI value of the methanol extract of *Nitraria schoberi* was determined to be lower than *G. alakirensis, Viola odorata, C. strigosa* and *S. libanotica* subsp. *kurdica*, and higher than *A. dioscoridis*, *M. longifolia*. The OSI value shows the percentage of suppression of oxidant compounds by antioxidant compounds (Mohammed et al., 2022b). It was observed that *N. schoberi* used in our study has a significant potential in suppressing oxidant compounds.

Antimicrobial activity

Today, microorganisms are at the root of many diseases. Scientists' greatest trump card against microorganisms is antimicrobial drugs (Eraslan et al., 2021). However, today, due to the unconscious use of antimicrobial drugs, the number of resistant microorganisms is increasing (Islek et al., 2021). In this context, researchers have turned to the discovery of new antimicrobial drugs (Sevindik et al., 2023b). Due to the possible side effects of synthetic drugs, researchers aimed to determine the antimicrobial potential of natural products such as plants (Saridogan et al., 2021). In our study, the antimicrobial activities of *N. schoberi* were determined. The findings are shown in Table 2.

Table 2. *Antibacterial and antifungal activities of Nitraria schoberi*

	S. aureus	*S. aureus* MRSA	*E. faecalis*	*E. coli*	*P. aeruginosa*	*A. baumannii*	*C. glabrata*	*C. albicans*	*C. krusei*
Ethanol	50	50	200	400	200	200	100	200	100
Methanol	100	100	400	400	200	400	100	200	100

Extract concentrations that inhibit the growth of microorganisms are 50, 100, 200 and 400 µg/mL.

In the literature, it has been reported that methanol extract of *Nitraria schoberi* fruit is effective against *Acinetobacter lwoffii*, *Enterobacter aerogenes*, *Klebsiella pneumoniae*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* (Sharifi Rad et al., 2015). In our study, the effects of ethanol and methanol extracts of the aerial parts of *Nitraria schoberi* against standard bacterial and fungal strains were investigated. It was determined that ethanol extract showed higher activity in general. It was determined that ethanol extract of the plant exhibited the highest effect against *S. aureus* and *S. aureus* MRSA at a concentration of 50 µg/mL. In addition, ethanol extract of the plant was effective against *C. glabrata* and *C. krusei* at a concentration of 100 µg/mL. The ethanol extract of the plant was effective against *E. faecalis*, *P. aeruginosa*, *A. baumannii* and *C. albicans* at a concentration of 200 µg/mL. The ethanol extract of the plant was effective against *E. coli* at a concentration of 400 µg/mL. It was determined that the methanol extract of the plant exhibited the highest activity against *S. aureus*, *S. aureus* MRSA, *C. glabrata* and *C. krusei* at a concentration of 100 µg/mL. The methanol extract of the plant exhibited against *P. aeruginosa* and *C. albicans* at a concentration of 200 µg/mL. The methanol extract of the plant was effective against *E. faecalis*, *E. coli* and *A. baumannii* at a concentration of 400 µg/mL. As a result, it was determined that *Nitraria schoberi* has antimicrobial potential.

CONCLUSION

In this study, antioxidant and antimicrobial activities of *Nitraria schoberi* were determined. In this context, ethanol and methanol extracts of the plant were tested. According to the findings, it was seen that the plant has antioxidant and antimicrobial potential. As a result, it was determined that *Nitraria schoberi* can be used as a natural agent in pharmacological designs.

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CONFLICT OF INTEREST

The authors have not declared any conflict of interest

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