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Total Antioxidant and Oxidant Status and DPPH Free Radical Activity of *Euphorbia eriophora*

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ABSTRACT

Plants have been used for many purposes in different communities. Plants used in alternative medicine since ancient times have been the main material in the treatment of many diseases. In this context, it is very important to determine the biological potential of plants. In our study, total antioxidant status, total oxidant status, oxidative stress index and DPPH free radical scavenging activity of *Euphorbia eriophora* Boiss. were determined. The aerial parts of the plant were extracted with ethanol in a Soxhlet device. TAS, TOS and OSI values of the plant extract were determined using Rel Assay kits. In addition, the free radical scavenging activity of the plant extract was measured by the DPPH method. As a result of the studies, the TAS value of the plant extract was 5.390±0.227, the TOS value was 20.971±0.348, and the OSI value was 0.390±0.014. The DPPH activity of the plant extract was determined to have an inhibition value of 68.721±1.694% at 2 mg/mL concentration. As a result, in our study, it was determined that *E. eriophora* has antioxidant potential and can be used as a natural antioxidant agent in this context.

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Introduction

Complementary medicine is widely used in the treatment of diseases in many societies. Many natural materials are used in complementary medicine in different parts of the world (Popović et al., 2016). Plants, fungi and animals are natural materials that are widely used, especially in developing countries (Dorai et al., 2012). In particular, plants contain active ingredients used in the production of many drugs (Chang and Lu, 2009; Diaz et al., 2012). Thanks to these active substances produced by plants, they have anticancer, antimicrobial, DNA protective activity, antioxidant, antiproliferative and anti-inflammatory activities (Trouillas et al., 2003; Dai and Mumper, 2010; Talib and Mahasneh, 2010; Mohammed et al., 2018; Sevindik, 2018; Salehi et al., 2019; Salehi et al., 2019). For this reason, the discovery of plants with biological activity is very important in terms of complementary medicine.

Compounds with antioxidant properties are found in many plants. These plants play an important role in reducing the effects of harmful levels of oxidant compounds (Bobrovskikh et al., 2020; Ivanišová et al., 2021). In this context, it is important to investigate plants with antioxidant effects. In this study, *E. eriophora* (Euphorbiaceae) was used as the material. Euphorbiaceae is a family represented by 300 genera and 5000 species worldwide. Different *Euphorbia* species are used in the treatment of skin diseases, gonorrhea, migraine, intestinal parasites in many different parts of the world. *Euphorbia* members spread cosmopolitanly in many parts of the world. These species contain many phytochemical compounds (Yener et al., 2018). In our study, total antioxidant, total oxidant status and DPPH free radical scavenging activity of aerial parts of *E. eriophora* plant were determined.

Table 1. TAS, TOS and OSI values of *Euphorbia eriophora* extract

Sample	TAS (mmol/L)	TOS (μmol/L)	OSI
E. eriophora	5.390±0.227	20.971±0.348	0.390±0.014

Values are presented as mean ± S.D

Table 2. DPPH free radical activity of *Euphorbia eriophora* extract

Concentration (mg/mL)	Ascorbic acid (%)	EtOH
0.25	68.500±1.724	28.311±1.554
0.5	92.718±1.544	45.683±1.413
1	94.424±0.537	57.355±2.076
2	96.388±0.670	68.721±1.694

Materials and Methods

Plant samples were collected from Gaziantep (Turkey) and their identifications were made using Flora of Turkey Volume 7 (page: 595). The aerial parts of the plant were dried under suitable conditions. After drying, the samples were ground into powder. 30 g of the samples were weighed and placed in cartridges and extracted with ethanol at 50 ^{0}C for about 6 hours in a Soxhlet device. Then, solvents were removed from the obtained extracts.

Antioxidant Activity

Total antioxidant (TAS), total oxidant status (TOS) and oxidative stress index of EtOH extract of the plant were measured using Rel Assay TAS, TOS kits (Erel, 2004; Erel 2005). Trolox was used as the calibrator in the TAS kits and the results were expressed as mmol Trolox equiv./L. Hydrogen peroxide was used as calibrator in TOS kits and the results were expressed as μmol H_2O_2 equiv./L. Oxidative stress index (OSI) was determined by dividing the unit of TOS value to the unit of TAS value (Sevindik, 2019).

Stock solutions were prepared from plant extracts using DMSO (Dimethyl sulfoxide) at 0.25, 0.5, 1 and 2 mg/mL concentrations. 50 μL of the stock solutions were added to 160 μL of 0.039% DPPH and incubated for 30 minutes. After incubation, absorbance was determined at 517 nm. These processes were repeated at all concentrations of the plant extracts (Shimada et al., 1992). Ascorbic acid (AA) was used as the reference antioxidant.

Result and Discussion

In recent years, the discovery of plants with antioxidant properties has increased. Antioxidant compounds play a role in reducing the effect of oxidative stress (Hoseinifar et al., 2020; Islek et al., 2021). There is an increase in the levels of oxidant compounds produced as a result of environmental and structural effects and metabolic activities of the organism. In this case, the antioxidant defense system comes into play in reducing the effect of oxidant compounds (Korkmaz et al., 2018; Forman and Zhang, 2021). When the antioxidant defense system is insufficient, oxidative stress occurs. As a result of oxidative stress, many diseases such as Parkinson's, Alzheimer's, cardiological disorders and cancer can occur in humans. Supplemental antioxidants are very important in reducing the effects of oxidative stress (Dubois-Deruy et al., 2020; Sevindik et al., 2020; Sarıdogan et al., 2021). In this context, it is very important to investigate the antioxidant properties of plants. In this study, TAS, TOS and OSI values of *E. eriophora* were determined. The obtained results are shown in Table 1. In addition, DPPH free radical scavenging activities of plant extracts are shown in Table 2.

In this study, TAS, TOS and OSI values of EtOH extract of *E. eriophora* were determined using Rel Assay kits. In addition, the DPPH free radical scavenging activity of the plant extracts was determined. No study has been found to determine the TAS, TOS and OSI values of *E. eriophora* before. In a previous study, the antioxidant activity of methanol extracts of *E. eriophora* was investigated by β-Carotene-linoleic acid test system, DPPH free radical and ABTS cation radical scavenging and cupric reducing antioxidant capacity (CUPRAC) methods. As a result of the study, it was reported to have high antioxidant activities (Yener et al., 2018). In our study, EtOH extract of the plant was used and its effects were investigated at 0.25, 0.5, 1 and 2 mg/mL concentrations. As a result of the study, it was observed that DPPH activity increased as the concentration of plant extracts increased. The highest activity was measured as 68.721±1.694 at 2 mg/mL from the test concentrations. The percent inhibition concentration of Ascorbic acid, the standard used, was measured as 96.388±0.670 at 2 mg/mL. It is seen that the DPPH activity of the plant extract at the same concentration is lower than the standard used. However, it was determined that the plant has DPPH activity. In this context, Yener et al., (2018) concluded that the findings we obtained are similar to their study, and that there is DPPH activity. As a result, it was determined that *E. eriophora* has antioxidant potential.

TAS values show all of the antioxidant compounds in the plant (Mohammed et al., 2019). In our study, TAS values of *E. eriophora* were determined for the first time. In previous TAS studies on different plants, *Mentha longifolia* subsp. *longifolia* (TAS: 3.628), *Marrubium globosum* (TAS: 7.677), *Datura stramonium* (TAS: 7.559), *Thymbra spicata* (TAS: 8.399), *Rosa canina* (TAS: 4.602), *Scorzonera papposa* (TAS: 5.314), *Salvia absconditiflora* (TAS: 6.979), *Salvia multicaulis* (TAS: 6.434), *Rumex crispus* (TAS: 6.758) and *Gundellia tournefortii* (TAS: 6.831) have been reported (Sevindik et al., 2017; Pehlivan and Sevindik, 2018; Pehlivan et al., 2018; Daştan et al., 2019; Saraç et al., 2019; Akgül et al., 2020; Mohammed et al., 2020a; Mohammed et al., 2020b; Mohammed et al. ., 2021; Pehlivan et al., 2021). Compared to these studies, the TAS value of *E. eriophora* was higher than *M. longifolia* subsp. *longifolia*, *R. canina* and *S. papposa*, and lower than *M. globosum*, *D. stramonium*, *T. spicata*, *S. absconditiflora*, *S. multicaulis*, *R. crispus* and *G. tournefortii*. As seen in our study, it was determined that *E. eriophora* has antioxidant potential. It is thought that the antioxidant effective compounds in the body of *E. eriophora* can be determined and used as an antioxidant source with future studies.

TOS value shows the whole of the oxidant compounds produced by the plant as a result of environmental and structural effects and metabolic activities (Mohammed et al., 2019). In previous TOS studies on different plants, *M.*

longifolia subsp. *longifolia* (TOS: 4.046), *M. globosum* (TOS: 12.387), *D. stramonium* (TOS: 10.711), *T. spicata* (TOS: 6.530), *R. canina* (TOS: 6.294), *S. papposa* (TOS: 24.199), *S. absconditiflora* (TOS: 5.681), *S. multicaulis* (TAS: 22.441), *R. crispus* (TOS: 5.802) and *G. tournefortii* (TOS: 3.712) have been reported (Sevindik et al., 2017; Pehlivan and Sevindik, 2018; Pehlivan et al., 2018; Daştan et al., 2019; Saraç et al., 2019; Akgül et al., 2020; Mohammed et al., 2020a; Mohammed et al., 2020b; Mohammed et al., 2021; Pehlivan et al., 2021). Compared to these studies, the TOS value of *E. eriophora* was lower than *S. multicaulis* and *S. papposa*, and higher than *M. longifolia* subsp. *longifolia, M. globosum, D. stramonium, T. spicata, R. canina, S. absconditiflora, R. crispus* and *G. tournefortii*. In this context, it has been determined that *E. eriophora* has high oxidant values by taking the plants mentioned in the literature as standard.

The OSI value shows how much the plant suppresses the oxidant compounds produced in the plant with endogenous antioxidants. High OSI value indicates that the plant's defense system is insufficient against oxidant compounds (Mohammed et al., 2019). In previous OSI studies on different plants, *M. longifolia* subsp. *longifolia* (OSI: 0.112), *M. globosum* (OSI: 0.162), *D. stramonium* (OSI: 0.142), *T. spicata* (OSI: 0.078), *R. canina* (OSI: 0.138), *S. papposa* (OSI: 0.456), *S. absconditiflora* (OSI: 0.081), *S. multicaulis* (TAS: 0.349), *R. crispus* (OSI: 0.086), and *G. tournefortii* (OSI: 0.054) have been reported (Sevindik et al., 2017; Pehlivan and Sevindik, 2018; Pehlivan et al., 2018; Daştan et al., 2019; Saraç et al., 2019; Akgül et al., 2020; Mohammed et al., 2020a; Mohammed et al., 2020b; Mohammed et al., 2021; Pehlivan et al., 2021). Compared to these studies, the OSI value of *E. eriophora* was lower than *S. papposa* and higher than *M. longifolia* subsp. *longifolia, M. globosum, D. stramonium, T. spicata, R. canina, S. absconditiflora, S. multicaulis, R. crispus, G. tournefortii*. In this context, it is seen that the oxidant compounds produced by *E. eriophora* are insufficient in suppressing with the antioxidant defense system.

Conclusion

In this study, the antioxidant potential of *E. eriophora*, one of the plants used in alternative medicine, was determined for the first time with Rel Assay kits. In addition, the DPPH free radical scavenging activity of the plant was determined. As a result of the studies, it was determined that *E. eriophora* has antioxidant potential.

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