Antioxidant activity of Thymus Kotschyanus Boiss. & Hohen. extracts and essential oil

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Abstract

Medicinal plants are rich in therapeutically important secondary metabolites. In this paper, we are representing the phenolic content and the antioxidant properties of *Thymus kotschyanus* Boiss. & Hohen. decoction, ethanolic extract and different dilutions of essential oil. Based on the results we obtained from this study we concluded that decoction and 0.5% essential oil solution of *T. kotschyanus* have remarkable activity and can serve as a strong natural antioxidant.

Keywords: *Thymus kotschyanus*, essential oil, antioxidant activity, phenols.

Introduction. Medicinal plants are rich in therapeutically important secondary metabolites. The key advantages claimed for the therapeutic use of medicinal plants in various diseases are their economics, efficacy, and their safety, in addition to their availability. Because of these advantages, medicinal plants have been traditionally widely used in medicine. Among the various plants, *Thymus kotschyanus* Boiss. & Hohen. is traditionally used in Armenia by the vast majority of the population to treat numerous illnesses, however, it is not an officinal plant. The thyme has expectorant, antiseptic, antispasmodic and antifungal effects.

The contents and types of secondary metabolites differ depending on the locations of the plant. In general, essential oil (EO) of *T. kotschyanus* contains phenolic compounds such as thymol, carvacrol, linalool, α-terpineol, and geraniol (Tohidi et al., 2018). Many *in vitro* pharmacological experiments conducted over the last decade have shown clear pharmacological activity in both thyme EO and

plant extracts (Baharfar et al., 2015; Zakaryan et al., 2018; Ghasemi et al., 2020; Golkar et al., 2020).

In Armenia, traditionally fresh or dried thyme is used to flavour tea, cheese, curd, bean and meat dishes, sausages, sauces, salads, pickles, bread, spirits, etc. Thyme is an excellent honey plant, producing abundant nectar. The essential oil is used in the confectionery and canning industry, as well as in perfumery. The branches and roots have tanning properties. In dry hay, in the form of a partial mixture, thyme has a beneficial effect on the digestion of cattle. The plant is ornamental, it is widely used to make flower carpets and rock gardens (Nanagulyan et al., 2020).

The aim of the research is the screening of antioxidant activities of the *T. kotschyanus* plant aerial part extracts and EO and the determination of its extracts' total phenolic contents by spectrophotometry method.

Materials and Methods.

Plant Material. The species was collected from Vayots Dzor province of Armenia. Specimens were dried under natural conditions. Voucher specimens were deposited in the Herbarium of Yerevan State University (ERCB).

Decoction. Air-dried and powdered plant samples were heated with distilled water for 15 min in the water bath. The ratio of solvent to raw material is usually 20:1. After the incubation, the decoction was cooled for no less than 45 minutes at room temperature, filtered and added distilled water until the previous volume.

Obtaining of Extracts. Air dried samples (5.0g) were placed for 24 hours on magnetic stirrer with water-ethanol mixture (3:7(v/v), 50mL) for alcoholic extract preparation. After the incubation, extracts were filtered and used.

Hydrodistillation. Essential oils from aerial parts of *T. kotschyanus* were obtained by hydrodistillation using a Clevenger-type apparatus. The air-dried plant material (200.0 g) was placed in around-bottomed flask and was subjected to hydrodistillation for 3 h with 600 mL distilled water according to the European

Pharmacopoeia. The obtained oils were dried over anhydrous sodium sulfate and stored at 4°C before the analysis.

Determination of Total Phenolic Content. The content of total phenols was determined by spectrophotometry, with some changes, using gallic acid as standard (Vamanu, Nita, 2012; Gevorgyan et al., 2017).

Determination of Antioxidant Activity. The antioxidant activity (AOA) was determined by potentiometric measurements of change of ORP of $[Fe(CN)_6]^{3-}/[Fe(CN)_6]^{4-}$ mediatory system caused by antioxidants in extracts (Braynina et al., 2004; Gevorgyan et al., 2016).

Results and Discussions. EO was obtained by hydrodistillation using a Clevenger-type apparatus. The yield of EO of aerial parts in *T. kotschyanus* was 0.82% (w/w).

The total phenolic contents of the *T. kotschyanus* decoction and ethanolic extract were estimated through the Folin-Ciocalteu method. Gallic acid was used as standard for the calibration curve (Fig. 1). Total phenol content was expressed as milligrams Gallic Acid Equivalent (GAE) per mL of extract.

Total phenols of extracts ranged between 3.31±0.72 and 5.75±2.02 mg GAE/mL and decreased in the order of water>ethanol.

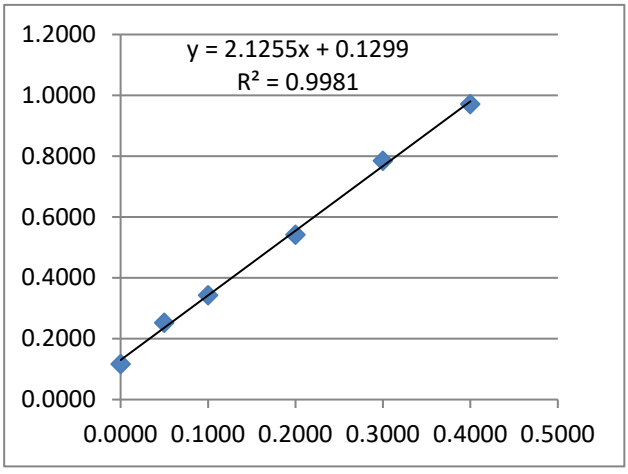

Fig. 1. Gallic acid calibration curve.

The AOA of *T. kotschyanus* was investigated for decoction and ethanolic extract and different dilutions of EO by potentiometric method of a change in Oxidation Reduction Potential (ORP) of $[Fe(CN)_6]^{3-}$ /$[Fe(CN)_6]^{4-}$ mediatory system. Results in Table 1 show the ORP and vitamin C equivalent values of *T. kotschyanus* decoction, ethanolic extracts and EO in different dilutions. Extracts show AOA as follows: 0.1 % essential oil > ethanolic extract > 0.25% essential oil > 0.5% essential oil > decoction.

Table 1.

Thymus kotschyanus essential oil and extracts redox potential and antioxidant activities equivalent in Vitamin C

Simple	***Redox potential mV***	***Vit. C x 10^{-4}g/l***
Ethanolic extract	234 ± 2.36	9
Decoction	225 ± 1.75	112
0.1 % essential oil	264.5 ± 4.95	-20
0.25% essential oil	215.5 ±16.26	26
0.5% essential oil	191.5 ± 2.12	79
Buffer	271	

The antioxidant agent is considered to be active against free radicals if the Vitamin C equivalent is $50x10^{-4}$g/l and more. So we can say that the ethanolic extract and 0.25% essential oil ethanolic solution have weak antioxidant activity and the 0.1% essential oil hasn't activity. The results indicate that *T. kotschyanus* 0.5% EO solution and decoction have higher activity and can serve as a strong natural antioxidant.

Conclusion. The yield of EO of aerial parts in *T. kotschyanus* was 0.82% (w/w). Our data showed that ethanolic extract of *T. kotschyanus* exhibited the highest amount of total phenols with values of *5.75±4.02* of GAE/mL. Based on the results of the determination of the AOA *T. kotschyanus* we concluded that decoction and 0.5% essential oil solution have remarkable activity and can serve as a strong natural antioxidant.

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