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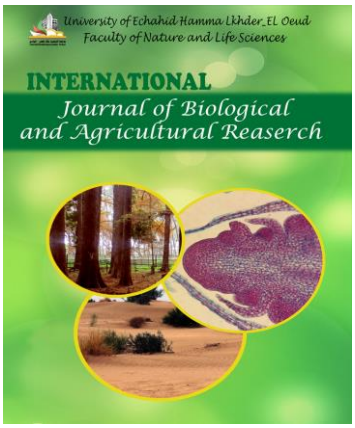

Evaluation of total phenolic contents and antioxidant potentials of ten medicinal plants from Algerian Sahara

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Abstract

In the context of discovery a new antioxidants from natural sources. We are interested in this work to study the phenolic compounds and the antioxidant activities of aerial part extracts for ten (10) medicinal plants, from Wilaya of El-Oued (South-east Algeria) : *Bassia muricata*, *Traganum nudatum*, *Haloxylon scoparium*, *Cornulaca monacantha*, *Malcolmia aegyptiaca*, *Retama raetam*, *Heliathemum lipii*, *Zygophyllum album*, *Ephedra alata*, *Moltkia ciliate* . The results obtained demonstrated that phytochemical screening of aerial part extracts for ten plants studied varies from one plant species to another. The richness of *Hiliantimum lippii* and *Retama raetam* in polyphenols whose content varies between 134.67 and 133.33 mg AGE/g Ext respectively. For other plants, the polyphenol content is between 31.02 and 58.33 mg AGE/g Ext. The antioxidant activity tests by using the DPPH method show that all the extracts of the plants studied have antioxidant properties lower than ascorbic acid (IC_{50} = 16.25 µg / ml) of which the species *Hiliantimum lippii* represents the best capacity (IC_{50}=27.79µg/ml). The low power is recorded in the species *Haloxylon scoparium* (IC_{50} = 793.29 µg / ml)

Keywords: Phenolic contents, Antioxidant activities, Medicinal plants, DPPH.

1. Introduction

The experimental studies [1] and clinical studies [2] have shown that many medicinal plants have an antioxidant effect through their active ingredient, which exists in plant organs. The use of natural products from plant origin has taken advantage of multiple interests in food, cosmetic and pharmacological activity for their high *Antioxidant activity*. Also, the use of natural antioxidants does not induce side effects, while synthetic antioxidants were found to have genotoxic effect [3-4].

The natural products are found many kinds of secondary metabolites such as flavonoids, Alcaloids, tannins…etc. The natural substances are being extensively studied *In vivo* for their capacity to protect organisms and cells from damage brought on by oxidative stress, the latter being considered a cause of ageing and degenerative diseases [5]. Additionally, recent studies have suggested that natural antioxidants in complex mixtures ingested with the diet are more efficacious than pure compounds in preventing oxidative stress-related pathologies due to particular interactions and synergisms [6].

In this study, we investigated the phenolic composition and antioxidant capacity *In vitro* of the aerial part of ten medicinal plants from Algerian sahara, Wilaya of El-Oued (South-east Algeria).

2. Materials and methods

2.1. Collection of plants material

The aerial parts of ten plants were collected in December 2017 from desert of Wilaya of El-Oued, Algeria. Each areal part was washed under running tap water to eliminate dust and other foreign particles and to cleanse the leaves thoroughly and shade dried for 22 days. The dried plant materials were then stored in air-tight containers until used. The plants selected for the present study are: *Bassia muricata*, *Traganum nudatum*, *Haloxylon scoparium*, *Cornulaca monacantha*, *Malcolmia aegyptiaca* , *Retama raetam* ,*Heliathemum lipii*, *Zygophyllum album*, *Ephedra alata* ,*Moltkia ciliate.*

2.2. Preparation of aqueous extract

10 g of powdered plant materials (aerial parts) were soaked in 100 ml of distilled water for 72 h in dark. The mixture was stirred every 24 h using a sterile glass rod. At the end the resulting extract was filtrated through Whatman N°: 1.The final filtrate obtained was concentrated under reduce pressure at 40°C in a rotavapour and stored at 4°C until further use.

2.3. Determination of extraction yield of aqueous extracts

Percentage yield from all dried aerial parts extracts was calculated by the formula given below:

$$\text{Yield of the extract (\%)} = Wx / W_y \times 100$$

Where Wx = Plant material weight after extraction process.
WY= Plant material weight taken for extraction [7].

2.4. Phytochemical Screening

Different phytochemicals tests for the screening and identification of bioactive compounds constituents in aerial part of ten medicinal plants under study such as Flavonoids, Alkaloids, Terpenes and Sterols, Saponins, Anthocyanins, Leuco-anthocyans, Catechic tannins and Gallic tannins were carried out in extracts as well as powder specimens using the standard procedures as described by Anokwuru and *al*; Paris and Moyse [8-9].

2.5. Determination of total phenolic content

Total phenolic content were determined according to Singleton method [10]. Briefly, 200 µl of the diluted sample was added to 1 ml of Folin–Ciocalteu reagent. After 4 min, 800 µl of saturated sodium carbonate solution (about 20%) was added. After 2 h of incubation at room temperature, the absorbance of the reaction mixture was measured at 765 nm. The same procedure was repeated to all standard gallic acid solutions (0 - 500 µg/ml) and standard curve was obtained.

2.6. DPPH Free Radical Scavenging Assay

The radical scavenging assay was conducted as described by Mansouri and *al* [11]. The DPPH solution was prepared by dissolving 2.4 mg DPPH in 100 ml of methanol. 25 µl of aqueous extract or standard antioxidant (Ascorbic acid) were added to 975 µl of DPPH solution. The mixture was shaken vigorously and incubated for 30 min in the dark at room temperature and the decreases in the absorbance values were measured at 515 nm. The percentage of DPPH scavenging activity was calculated using the following equation.

$$\%\text{DPPH scavenging activity} = (A_{control} - A_{Sample}/A_{control})\ 100$$

Where $A_{control}$ is the absorbance of the control reaction mixture without the test compounds, and A_{sample} is the absorbance of the test compounds. IC_{50} values, which represented the concentration of the aqueous extract that caused 50% neutralization of DPPH radicals, were calculated from the plot of inhibition percentages against concentration of the samples [12].

3. Results

3.1. Percentage yield of the aqueous extract

The results for percentage yield of the aerial parts extracts for ten plants shown in Figure 1

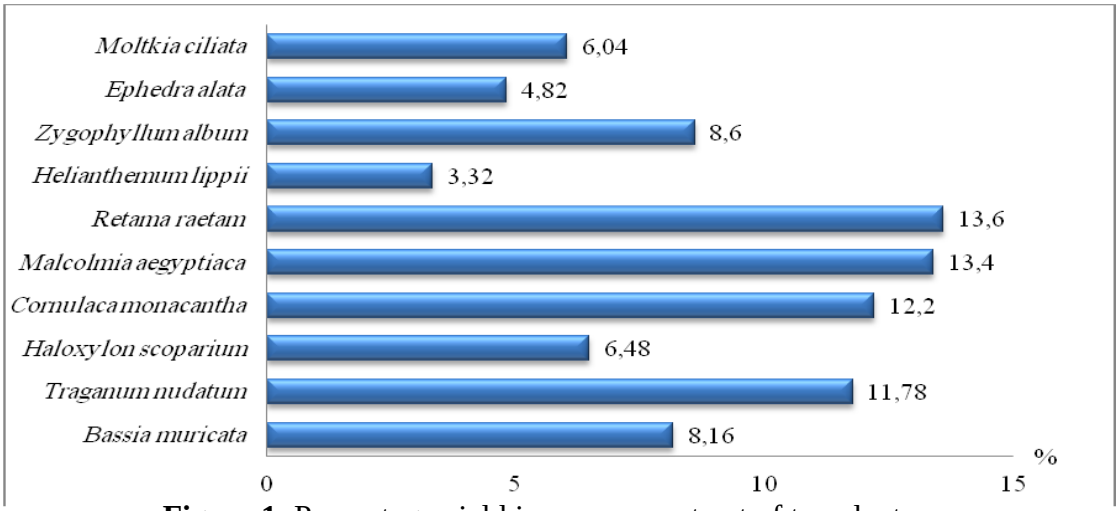

Figure 1: Percentage yield in aqueous extract of ten plants.

3.2. Phytochemical Screening

Results of phytochemical analysis showed the existence of secondary metabolites such as: Flavonoids, Alkaloids, Terpenes and Sterols, Saponins and Anthocyanins in all aerial part of ten medicinal plants under study. The results are shown in Table 1.

Table.1: Phytochemical screening in aqueous extract of ten plants.

	Flavonoids	Alkaloids	Terpenes and Sterols	Saponins	Anthocyanins	Leuco-anthocyans	Catechic tannins	Gallic tannins
Bassia muricata	+	+	+	+	+	-	-	+
Traganum nudatum	+	+	+	+	+	-	-	-
Haloxylon scoparium	+	+	+	+	+	-	+	-
Cornulaca monacantha	+	+	+	+	+	-	+	-
Malcolmia aegyptiaca	+	+	+	+	+	+	-	+
Retama raetam	+	+	+	+	+	-	+	-
Helianthemum lippii	+	+	+	+	+	+	+	-
Zygophyllum album	+	+	+	+	+	-	+	-
Ephedra alata	+	+	+	+	+	+	-	+
Moltkia ciliata	+	+	+	+	+	-	-	+

3.3. Total phenol content

The content of phenolic compounds in extract of plants under stady determined using regression equation of calibration curve ($y = 0.0037x + 0.0195$ $R^2 = 0.9879$), and expressed in gallic acid equivalents per g of the sample. The concentrations of phenolics in the extract are shown in Figure 2.

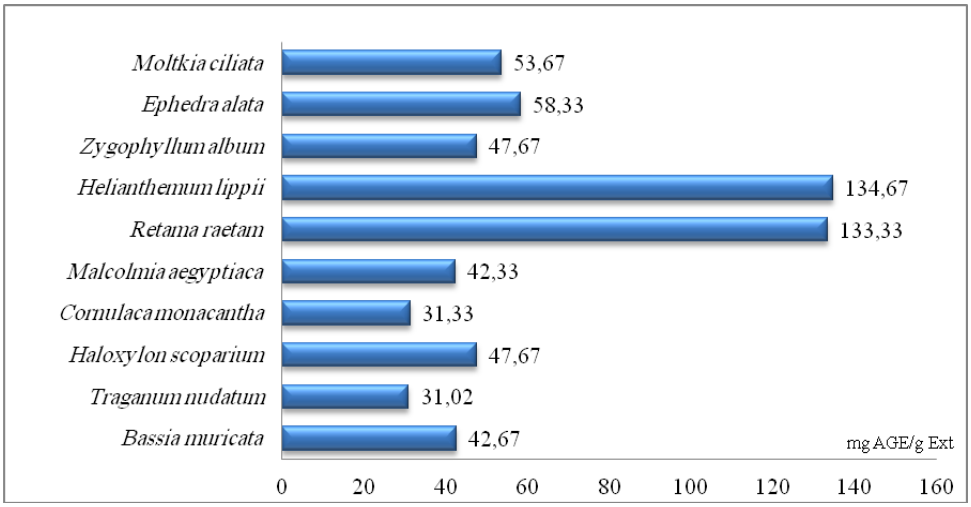

Figure 2: Content of phenolic compounds in aqueous extract of ten plants.

3.4. DPPH Free Radical Scavenging Assay

The DPPH radical scavenging activities of selected medicinal plants was screened in both aqueous extracts and presented in Table 2. All data of antioxidant activity were represented by the Inhibitory Concentration (IC_{50}) values (µg/ml). The antioxidant activitys of aqueous extracts for ten plants were compared with standard compound (Ascorbic acid).

Table.2: Antioxidant capacity of aqueous extracts for ten plants and standard.

Plants	DPPH IC_{50} (µg/ml)
Bassia muricata	543.26 ± 39.62
Traganum nudatum	508.63±78,74
Haloxylon scoparium	793.29 ± 96.63
Cornulaca monacantha	297.53 ± 76.38
Malcolmia aegyptiaca	391.42 ± 11.46
Retama raetam	91.05 ± 6.13
Helianthemum lippii	27.79±6.50
Zygophyllum album	664.14 ± 12.61
Ephedra alata	124.10 ± 8.59
Moltkia ciliata	189.35±8.44
Ascorbic acid	16.25 ± 1.36

Results were given as means ± SD.

4. Discussion

The investigations of biological activity and chemical composition of medicinal plants as a potential source of natural antioxidants are numerous. In this work, the percentage yield of the aqueous extracts was found in the order as *Retama raetam* > *Malcolmia aegyptiaca* > *Cornulaca monacantha* > *Traganum nudatum* > *Zygophyllum album* > *Bassia muricata* > *Haloxylon scoparium* > *Moltkia ciliata* > *Ephedra alata* > *Helianthemum lippii*. The extraction methods and solvents used are responsible for dissolving the chemical compounds of the plants [13]. Moreover, in nature; chemical compounds exist in plants can be polar or non-polar and are more soluble in polar organic solvents (presence of a hydroxyl group), for this reason the water was selected as the extracting solvent [14].

Phenolic class is the major chemical compounds of plant metabolites, and play an important role in the defense of plants [15]. They are involved in different physiological and biochemical mechanisms such as antioxidant activities. According to the results obtained in the present study, there is a variation in the content of phenolic compounds in aqueous extracts from ten plants. The highest total phenolic content was found in extract of *Helianthemum lippii* (134,67 mg EAG/g Ext), followed by *Retama raetam* (133,33 mg EAG/g Ext). whereas *Traganum nudatum* and *Cornulaca monacantha* extracts had the lowest content with 31.02 and 31.33 mg GAE/g Ext, respectively.

The phenolics compounds especially Polyphenols are an important group of secondary metabolites produced exclusively by plants. The quantity of phenolics compounds depends probably due to several factors as the ecological conditions under which the plants were collected (geographical area, drought, soil, etc.) [16], collection timing [17].

Many disorders in human organism may be the result by excessive generation of reactive oxygen species including superoxide free radicals (O_{2}-), hydrogen peroxide (H_2O_2), singlet oxygen and other chemical entities such as nitric oxide (NO) and peroxynitrite [18]. The free radicals (Pro-oxidants) originate from normal metabolism or are induced by different pollutants. Harmful effects of disturbed antioxidant-prooxidant balance can be largely prevented by intake of antioxidant substances [19-20].

The results indicated that the plants extracts had different antioxidant capacities and showed concentration dependent increases in radical scavenging capacity. The greatest DPPH radical scavenging capacity of a minimum IC_{50} value was recorded for *Helianthemum lippii* (27.79 µg/ml), followed by *Retama raetam* (91.05 µg/ml), *Ephedra alata* (124.10 µg/ml), *Moltkia ciliate* (189.35µg/ml), *Cornulaca monacantha* (297.53 µg/ml), *Malcolmia aegyptiaca* (391.42 µg/ml), *Traganum nudatum* (508.63 µg/ml), *Bassia muricata* (543.26 µg/ml), *Haloxylon scoparium* (793.29 µg/ml). Several studies have reported the relation between the total antioxidant potential and the chemical compounds content, which are considered the most representative among the bioactive substances with this activity [21]. However, The antioxidant potential of the aqueous extracts are influenced by various factors and largely depends on both the composition of the extract and the analytical test system [22].

5. Conclusion

In this study, result of total phenolic contents and antioxidant potentials of ten medicinal plants selected from Algerian Sahara were evaluated. In summary, the high contents of phenolic compounds exist in *Helianthemum lippii* and *Retama raetam.* These results suggest also that some plants under study such as *Helianthemum lippii* can be useful as a source of chemicals compounds with strong antioxidant activity.

6. Acknowledgement

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