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Phytochemical Screening, Quantification, and Antioxidant Activity of Bio-active Compounds of Four Medicinal Plants

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Abstract Four plants (*Aerva javanica, Euphorbia retusa, Haloxylon salicornicum, and Launaea nudicaulis*) that are commonly growing in Egypt were screened for their phytochemical content and antioxidant potential. Each plant had its own methanolic extract made and tested. Quantitative analysis were utilized to estimate alkaloids, tannins, saponins, flavonoids, and phenols, while qualitative phytochemical assays were employed to determine the existence of bioactive substances. The antioxidant capacity of these extracts was measured using DPPH (diphenyl -1, 2-picryl hydrazyl). In the present results, the following is the order of phytocomponents found in the plant species that have been studied: *E. retusa* > *L. nudicaulis* > *H. salicornicum* > *A. javanica*. Regarding to antioxidant potency, IC_{50} values for the four plant samples range from 57.68 mg/ml for *Launaea nudicaulis* to 62.27 mg/ml for *Euphorbia retusa* to 71.35 mg/ml for *Haloxylon salicornicum* to 90.98 mg/ml for *Aerva javanica*. All the extracts examined had antioxidant scavenging activities, however at concentrations greater than catechol (IC_{50} = 15.23 mg/ml). Antioxidant-active phytochemicals found in these plants may give a solid rationale for their traditional medical usage.

keywords: Bioactive compound, Wild plants, Desert, DPPH.

1. Introduction

Medicinal plants contain leaves, stems, barks, or roots utilized for treatment [1] Medicinal plants now cure diabetes, malaria, and anemia [2]. Sub-Saharan African medicinal plants are more tempting as therapeutic agents than "modern" pharmaceuticals due to their availability and lower cost [3]. Various disciplines have studied medicinal plants and phytomedicine's impact on the health of a large portion of the world's population.

Many therapeutic plants include antioxidants other than vitamin C, E, and carotinoids [4]. Free radical-catalyzed oxidative reactions may be delayed or prevented by antioxidant molecules [5]. The antioxidant action is mostly attributable to phenolic components such flavonoids [6], phenolic acids, and phenolic diterpenes [7]. Cellular metabolism produces hazardous reactive oxygen species (ROS) that damage lipids, nucleic acids, and proteins, causing many chronic illnesses. Exogenous antioxidants are advised for excessive free radicals [8]. Natural antioxidants are replacing harmful and carcinogenic synthetic antioxidants like butylhydroxyanisole and butylhydroxytoluene [9].

The majority of Egypt's deserts, on the other hand, are located in the Sahara regional transition zone, with the exception of the southeast Egyptian region of Gebel Elba which constitutes a part of the Sahel regional transition zone and the western Mediterranean coastal region, which is a part of the Mediterranean-Sahara regional transition zone [10]. Wadis are a kind of environment system that is one of a kind and unmistakable. They are distinguished by the abundance, diversity, and range of natural attractions. The wadis are home to some of the most impressive wetland ecosystems, and its oases provide refuge for a variety of animals, birds, and amphibians [11, 12].

The Eastern Desert has a considerably more varied plant life than the Western Desert. Strong connections exist between the flora of the Sinai Peninsula and the northern wadis and mountains of the Eastern Desert west of the Gulf of Suez [13]. The Red Sea coastal region and the inland desert are the two main phytogeographical regions that are typically defined within the Eastern Desert. Monod [14] recognized both confined and dispersed varieties of desert vegetation. Both classifications refer to perennial vegetation that, depending on the amount of precipitation in a particular year, may also support ephemeral (or annual) plant development.

In the course of our study, we concentrated on phytochemical screening, quantification, and antioxidant activity of bio-active compounds of four medicinal plants that are found in inland desert (north sector of eastern desert).

2. Materials & Methods

2.1. Plant material

In May 2022 (flowering period), we gathered healthy samples of four different species of wild xerophytes growing in the northern sector of the Eastern Desert, Wadi Araba, Egypt (29° 4'23.59"N, 32°15'48.90"E): *Aerva javanica, Euphorbia retusa, Haloxylon salicornicum, and Launaea nudicaulis*. Plants were identified using Tackholm [15] and Boulos [16] as references. Manually cleaned, rinsed three times with distilled water to remove dust and other residues, air-dried at room temperature (25±3 °C) in a shady position for several days until completely dry, and then crushed into powder. Finally, the samples were placed in paper bags and maintained at room temperature and out of direct light until further examination was performed.

2.2. Extraction

Standard solvent extraction separates medicinally active plant parts [17]. Extraction separates soluble plant metabolites from insoluble cellular remains. 200 grams of each dried plant portion was soaked in 85% methanol for three days at room temperature [17]. The procedure softens and breaks plant cell walls to liberate soluble phytochemicals. The mixture is filtered after 3 days. Convection and conduction transport heat in this traditional approach, and solvents decide the molecule recovered from samples [18]. Filtered and evaporated extracts were dissolved in DMSO for usage.

2.3. Phytochemical constituents

2.3.1. Qualitative phytochemical screening

Standard procedures were followed for identification of the phytochemical components as described by Farnsworth [19], Harborne [20], Sofowora [21] and Evans [22].

2.3.2. Quantitative determination of phytochemicals

For the purpose of determining the levels of tannins, saponins, flavonoids, alkaloids, and total phenols in shoot extract of selected plants, the techniques outlined by Sadasivam and Manickam [23], Harborne [20], Bohm and Kocipai-Abyazan [24], and Obadoni and Ochuko [25] were carried out.

2.4. Antioxidant activity

The free radical scavenging activities were measured in a manner similar to that reported by Bibi et al. [26]. The final concentration of the sample solution in DMSO was 100 g/mL after adding 180 µl of DPPH solution (in methanol). After 15 minutes of incubation at 37 degrees Celsius in the dark, the absorbance of the samples was measured at 517 nanometers using a microplate reader.

3. Results and Discussion

3.1. Qualitative phytochemical screening

Local knowledge and curative plant literature helped choose the species under research. Table 1 shows that alkaloids, tannins, and terpenoids were prominent secondary metabolites in many extracts. Triterpenoids have analgesic and anticancer effects [27]. Saponins are hypocholesterolemic and antidiabetic, whereas triterpenoids are analgesic and anticancer [27]. These secondary metabolites make plants powerful in pharmaceutical sectors. Qualitative phytochemical screening of the powder and crude extract of *Aerva javanica, Euphorbia retusa, Haloxylon salicornicum and Launaea nudicaulis* whole plants are presented in Table 1. In this investigation, the presence of phytoconstituents was given a score between minus one and plus four, depending on the magnitude of the color change or the amount of

precipitate that was produced. Because of this, a qualitative assessment of the bioactive chemicals found in the wild plants (*A. javanica, E. retusa, H. salicornicum*, and *L. nudicaulis*) was able to be seen. Within the same sample and between each plant sample displayed substantial variance. The samples contained varying amounts of alkaloids, flavonoids, phenols, saponins, and tannins (Table 1). However, some samples have exhibited traces or absence of some phytoconstituents (Table 1). It has been shown that studied plant species do not contain any anthraquinones.

3.2. Quantitively analysis of Some Secondary metabolites

The overall evaluation of the analytical results for several different wild plants (*A. javanica, E. retusa, H. salicornicum,* and *L. nudicaulis*) revealed the individual specificity of each studied plant as well as the rich various spectrum of phytoconstituents that differed from one another plant sample to another; it also showed that the studied plants were a rich source of saponins, tannins, phenols, flavonoids, and alkaloids. On the other hand, the following is the order of phytocomponents found in the plant species that have been studied: *E. retusa* > *L. nudicaulis* > *H. salicornicum* > *A. javanica*. To combat various illnesses, pharmacists seek plants rich in phenolic compounds [28]. The capacity of a plant to cure inflammatory illnesses and play a role in wound healing is indicated by its phenolic content

Table 1. Qualitative phytochemical analysis of some wild plants collected from the Egyptian desert.

Screening test	Plant samples			
	Aerva javanica	***Euphorbia retusa***	***Haloxylon salicornicum***	***Launaea nudicaulis***
Alkaloids	+	+++	++	+++
Flavonoids	+	+++	++	+++
Phenols	+	++	+++	+++
Saponins	++	+	++	++
Tannins	++	+	+	++
Steroids	-	+	+	+
Glycosides	+	+	+	++
Anthraquinones	-	-	-	-
Terpenes	-	+	+	+

Table 2: Bioactive secondary compounds from selected desert plants.

Plant species	Active organic compounds				
	Phenolics	**Alkaloids**	**Flavonoids**	**Saponins**	**Tannins**
Aerva javanica	7.86	14.33	13.67	5.62	3.41
Euphorbia retusa	20.13	32.01	20.11	12.99	9.06
Haloxylon salicornicum	14.42	21.66	17.90	3.41	4.99
Launaea nudicaulis	16.26	28.39	19.25	3.90	6.83

2.4. Antioxidant activity

Methanolic extracts of the plants *Aerva javanica, Euphorbia retusa, Haloxylon salicornicum, and Launaea nudicaulis* were tested for their antioxidant activity against 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radicals by determining the concentration of an antioxidant required to reduce the initial DPPH concentration by 50% (IC_{50}). When it comes to antioxidant strength, a lower IC_{50} value indicates better performance. In this analysis, catechol was used as a reference chemical.

Plant methanol extracts showed antioxidant activity that increased with concentration and was on par with that of the conventional antioxidant catechol. The scavenging activity of 1000 mg/ml extracts of *Aerva javanica, Euphorbia retusa, Haloxylon salicornicum, and Launaea nudicaulis* ranged from 56.72 percent to 71.95 percent. However, as can be shown in Figure 2, the antioxidant activity is lowest at the lowest concentration (100 mg/ml).

Figure 2 shows that the IC_{50} values for the four plant samples range from 57.68 mg/ml for *Launaea nudicaulis* to 62.27 mg/ml for *Euphorbia retusa* to 71.35 mg/ml for *Haloxylon salicornicum* to 90.98 mg/ml for *Aerva javanica*. Figure 2 shows that all the extracts examined had antioxidant scavenging

capabilities, however at concentrations greater than catechol (IC_{50} = 15.23 mg/ml).

It would seem, based on the distribution of antioxidant activities, that the majority of the plant extracts had mild DPPH values. This might be either as a result of a low concentration of the antioxidants or as a result of the antagonistic behavior of the active chemicals, which would then block the antioxidant effects. This confirms what Surveswaran et al. [29] discovered in their research on 133 Indian medicinal herbs and is consistent with their findings from the past.

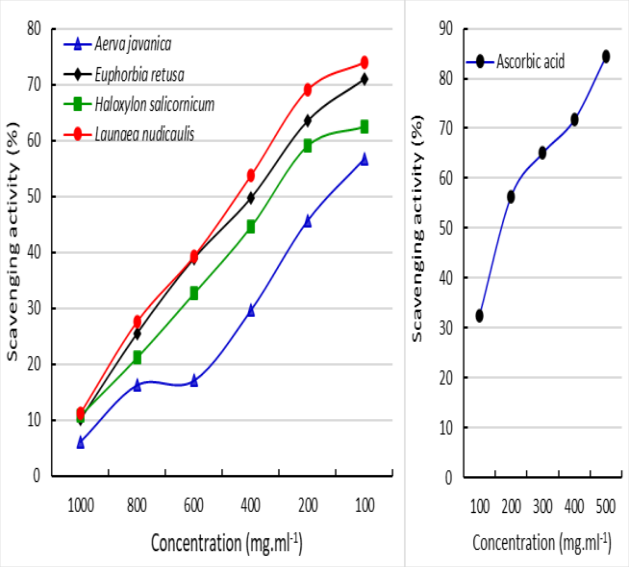

Figure 1. Scavenging activity percentage of DPPH by MeOH extract of wild plants collected from the Egyptian desert and ascorbic acid as standard.

4. Conclusion

The findings given here lend credence to the utilization of some plant extracts. The type of the plant, the isolation system, and the evaluation procedure all influence the qualities of the medicinal compounds found in plants. There was a strong correlation between antioxidant capabilities and bioactive chemicals, suggesting that the latter are the primary reason why these plants are so powerfully antioxidant. These findings open the way for further research into the medicinal potential of various plants and the selection of an appropriate solvent for extraction in order to separate molecules with economically viable bioactive qualities.

4. References

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