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Phytochemical analysis of the aerial parts of some selected medicinal plants growing in natural habitats

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Abstract.Demand for traditional components derived from natural resources has increased worldwide as a result of people' collective interest in traditional sources. The present study provides an investigation of some secondary compounds of the Arial partsof some selected medicinal plants (*Carduus pycnocephalus*, *Echium angustifolium*, *Anthemis cotula*, *Emex spinosa* and *Zygophyllum coccineum*) growing in natural habitats in Egypt.The presence of alkaloids, flavonoids, phenols, saponins, tannins, steroids, and flactuation of glycosides, anthraquinones, and terpenes were found in different portions of five plants, according to the findings of the analyses. On the other hand, quantitative analysis of selected plant species reveled that the highest total content of alkaloids was found in plant leaves samples (5.76 mg/g, 3.84 mg/g, 3.53 mg/g, 3.50 mg/g, and 2.45 mg/g) as following (*Carduus pycnocephalus* > *Anthemis cotula* > *Echium angustifolium* > *Emex spinosa* > *Zygophyllum coccineum*). Regarding to the plant parts following the order leaf > flower > root > stem

keywords: Wild plants; Desert; Phytochemical analysis; Medicinal plants.

1.Introduction

Egypt, like other third-world countries in dry or semi-arid regions, is confronted with three key issues: a rapid pace of population growth, limited renewable natural resources, and limited production of food, forage, and industrial raw materials. Egypt's reproductive land accounts up less than 5% of the country's total territory. The population is estimated to be around 90 million people, with a human density of more than 600 people per square Km The majority of the country is a hot, dry desert with a population density of less than 7 people per square Km. As a result, managing Egypt's renewable natural resources is critical for supplying food, fodder, and raw materials for industry and electricity[1,2].Egyptian deserts are divided into two types based on their ecological characteristics: coastal and inland deserts. The Mediterranean, Red Sea, and the two Gulfs of Sinai all have an impact on the coastal deserts. The inland deserts, which include oasis, are those that are not affected by the sea[3]. The Egyptian deserts, which are part of the study's topic region, include the desert east of the Nile, which will be referred to as the "Eastern Desert," and the Sinai Peninsula, which will be referred to as the "Western Desert."

Millions of people throughout the world rely on natural ecosystems and the wild plants that grow there, which often serve as a buffer against drought, scarcity, and hunger, as well as vital roles in sustaining livelihoods and well-being. This is especially true for those who live in many developing countries' rural areas[4,5].

Natural compounds (secondary metabolites) are crucial because they are employed in a variety of industries, including medications, cosmetics, agricultural and industrial products, and nutritional supplements [6,7]. Medicinal plants also have a high concentration of vitamins and minerals that are easily absorbed by humans[8,9].

Food, forage, and agro-industrial raw resources are in high demand around the world. Many weeds thrive in the Egyptian desert. Egyptian scientists have conducted several experiments aimed at introducing and producing some of our natural wild plants as fodder plants in Egypt [10]. Building materials, furniture, agriculture, paper, textiles, baskets, mats, and other plant products were all employed for reasons other than food Many researchers have recently investigated the primary active ingredients of many species used as forage, such as Zahran and El-Amier[1], El-Amier and Ejgholi[11], Abd-ElGawad et al. [12], El-Amier et al. [13] and Zaki et al.[14]. As a result, the goal of this study was to look at the chemical composition of select wild plants from various habitats in Egypt in order to better use these natural resources.

2. Materials and Methods

2.1. Plant material and extraction process

In March 2020, the full flowering plant of Carduuspycnocephalus, Echiumangustifolium, Anthemiscotula, EmexspinosaandZygophyllumcoccineum. was collected from Wadi Araba (Eastern Desert) and Gamasa City on the Mediterranean coast. According to [15], the plant was characterizedby Dr. Yasser A. El-Ameir, Lecturer of Plant Ecology, Botany Department, Faculty of Science, Mansoura University, Egypt. A voucher specimen was deposited at Mansoura University's Faculty of Sciences.

Before grinding, the plant sample was cleaned by hand, washed several times with distilled water, split into four pieces (root, stem, leaf, and flower), and dried in an air-forced oven for 24 hours to remove moisture. Each dried plant piece was steeped for 200 in 85 percent methanol and repeatedly shook. The dry residue was dissolved in dimethyl sulfoxide (DMSO) for later use after the extracts had been filtered and evaporated.

2.2. Qualitative phytochemical screening.

The phytochemical components were identified using standard procedures as defined by [16], Trease and Evans [17], and Harborne [18].

2.3. Quantitative determination of the chemical constituents.

Total phenolics, flavonoids, and alkaloids were determined using assays developed by [19], Stankovic [20], and Jasuja*et al*. [21]. Obadoni and Ochuko [22] identified a method for evaluating saponins content, while tannins were defined by Van Buren and Robinson [23].

3. Results and Discussion

3.1. Phytochemical constituents

The phytochemical analysis of the five plants (Carduuspycnocephalus, Echiumangustifolium, Anthemiscotula, EmexspinosaandZygophyllumcoccineum) parts (root, stem, leaves, and flowers) that have been naturally grown in the different habitats was carried out to assess their economic potential and their use as raw natural resources for various purposes. Several field trips were organized to the study area to collect samples of plants which were collected from the Deltaic Mediterranean coastal desert belt (Gamasa) and the North inland desert habitats (WadiHagul). The collected plants were dried in shade at room temperature for 21 days, grinded into a fine powder, and kept in a polyethylene container for further use.

3.2. Qualitative analysis of Some Secondary metabolites

Phytochemical screening and qualitative of the powder and crude extract of the five plants (Carduuspycnocephalus, Echiumangustifolium, Anthemiscotula, Emexspinose andZygophyllumcoccineum) parts (root, stem, leaves, and flowers) were performed and the results were recorded in Table 1. In this study, the use of different plant parts revealed different responses to the presence of phytoconstituents, and the terms of scores are used as -, +, ++, ++, according to the intensity of color or precipitates generated. As a result, the qualitative estimation of the bioactive compounds in the five plant parts were observed .

Within the different sample parts of *C. pycnocephalus* displayed substantial variance. The roots have trace amounts (+) of flavonoids, phenols, saponins, tannins, Steroids, Glycosides, Anthraquinones and Terpenes; and absence of the alkaloids have reported (Table 1). Although stems samples have reported traces amounts of flavonoids, phenols, saponins, tannins, Steroids, Glycosides and Terpenes; and absence of Anthraquinones (Table 1). The leaves were traces amounts of flavonoids, Steroids, Glycosides and Terpenes; and absence of the alkaloids, phenols, saponins, tannins and Anthraquinones have reported (Table 1). Although flowers samples have reported traces amounts of flavonoids, phenols, saponins, tannins, Steroids and Glycosides; and absence of Anthraquinones and Terpenes (Table 1).

Within the different sample parts of italic displayed substantial variance. The roots have trace amounts (+) of alkaloids, flavonoids, phenols, saponins, tannins and Steroids; and absence of Glycosides, Anthraquinones and Terpenes the have reported (Table 1). Although stems samples have reported traces amounts of alkaloids, flavonoids, phenols, Steroids and Glycosides; and absence of saponins, tannins Anthraquinones and Terpenes (Table 1). The leaves were traces amounts of alkaloids, flavonoids, phenols, saponins, tannins, Steroids, Glycosides Anthraquinones, and Terpenes (Table 1). Although flowers samples have reported traces amounts of alkaloids, flavonoids, phenols, saponins, tannins, Steroids, Glycosides Anthraquinones, and Terpenes (Table 1).

Within the different sample parts of *A. cotula* displayed substantial variance. The roots have trace amounts (+) of alkaloids, flavonoids, phenols, saponins, tannins, Steroids and Glycosides; and absence of Anthraquinones and Terpenes the have reported (Table 1). Although stems samples have reported traces amounts of flavonoids, phenols, saponins, tannins, Steroids, Glycosides and Anthraquinones; and absence of Terpenes (Table 1). The leaves were traces amounts of alkaloids, flavonoids, phenols, saponins, tannins, Steroids, Glycosides, Anthraquinones and Terpenes (Table 1). Although flowers samples have reported traces amounts of alkaloids, flavonoids, phenols, saponins, tannins, Steroids, Glycosides, Anthraquinones and Terpenes (Table 1).

Within the different sample parts of *E. spinosa* displayed substantial variance. The roots have trace amounts (+) of flavonoids, phenols, saponins, tannins, Steroids, Glycosides, Anthraquinones and Terpenes; and absence of the alkaloids have reported (Table 9). Although stems samples have reported traces amounts of flavonoids, phenols, saponins, tannins, Steroids, Glycosides and Terpenes; and absence of Anthraquinones (Table 1). The leaves were traces amounts of alkaloids, flavonoids, Anthraquinones and Terpenes; and absence of phenols, saponins, tannins, Steroids and Glycosides have reported (Table 1) .

Within the different sample parts of *Z. coccineum*displayed substantial variance. The shoot samples have reported traces amounts (+) of alkaloids, flavonoids, phenols, saponins, tannins, Steroids, Glycosides and Terpenes; and absence of Anthraquinones the have reported (Table 1).

The extraction of bioactive chemicals from natural flora is influenced by a number of factors, including extraction method, raw materials, extraction solvent, plant species and age, and soil type [53,54].

3.3. Quantitative analysis of Some Secondary metabolites

The general assessment of the analytical results for different parts of the five plants (Carduuspycnocephalus, Echiumangustifolium, Anthemiscotula, EmexspinosaandZygophyllumcoccineum) parts (root, stem, leaves, and flowers) showed individual specificity of each studied part and the rich diverse spectrum of secondary metabolites differing from one another in both plant samples; and revealed that the leaves and flower parts of each sample were a rich source of saponins, tannins, phenols, flavonoids, and alkaloids than the other parts as following (leaf > flower > root > stem).

The highest total content of alkaloids was found in plant leaves samples (5.76 mg/g, 3.84 mg/g, 3.53 mg/g, 3.50 mg/g, and 2.45 mg/g) as following (Carduuspycnocephalus>Anthemiscotula>Echiumangustifolium>Emexspinosa>Zygophyllumcoccineum) as showed in Table 2 and Figure 1.

The highest total content of flavonoids was found in plant leaves samples except *Anthemiscotula* the highest content of flavonoids was found in stems (6.11 mg/g,

5.92 mg/4.38 mg/g, 3.58 mg/g and 3.32 mg/g) as following (Carduuspycnocephalus>Anthemiscotula>Emexspinosa>Echiumangustifolium>Zygophyllumcoccineum) as showed in Table 2 and Figure 1. The highest total content of phenols was found in plant leaves samples except *Anthemiscotula* the highest content of flavonoids was found in stems (11.06 mg/g, 10.2 mg/g, 9.66 mg/g, 9.03 mg/g and 8.94 mg/g) as following (Carduuspycnocephalus>Anthemiscotula>Eme x spinosa>Echiumangustifolium>Zygophyllumcoccineum) as showed in Table 2 and Figure 1 The highest total content of saponins was found in plant roots, leaves samples except *Zygophyllumcoccineum* the highest content of flavonoids was found in shoots (23.88 mg/g, 18.97 mg/g, 18.91 mg/g, 18.71 mg/g and 17.06 mg/g) as following (Zygophyllumcoccineum>Anthemiscotula>Carduuspycnocephalus>Echiumangustifolium>Emexspinosa) as showed in Table 2 and Figure 1. The highest total content of tannins was found in plant stem samples except Carduuspycnocephalus the highest content of flavonoids was found in leaves and *Echiumangustifolium* flowers (37.56 mg/g, 24.04 mg/g, 23.07 mg/g, 19.40 mg/g and 14.69 mg/g) as following (Anthemiscotula>Carduuspycnocephalus>Echiumangustifolium>Zygophyllumcoccineum>Emexspinosa) as showed in Table 2 and Figure 1.

By comparing these results with those in other plant species of the Egyptian flora, the proximate values of selected wild species agreed with those mentioned by [24], Abdullah [25] andHafazet al.[26]. But, it was lower than those reported by AbdElGawad[27] and El-Amier[28]. By comparing these results with those in other plant species, the secondary metabolites in selected wild species were lower than those reported by Wojdylo et al. [29] in Silybum and Yin et al. [30] in Cirsiumjaponicu

Table 1. Qualitative phytochemical analysis of five selected plant species collected from the Egyptian desert.

Screening test	**Plant species**							
	Carduuspycnocephalus				***Echiumangustifolium***			
	Root	Stem	Leaves	Flower	Root	Stem	Leaves	Flower
Alkaloids	-	+	-	+	+	+	+	+
Flavonoids	+	+	+	+	+	+	+	+
Phenols	+	+	-	+	+	+	+	+
Saponins	+	+	-	+	+	-	+	+
Tannins	+	+	-	+	+	-	+	+
Steroids	+	+	+	+	+	+	+	+
Glycosides	+	+	+	+	-	+	+	+
Anthraquinones	+	-	-	-	-	-	+	+
Terpenes	+	+	+	-	-	-	+	+
Screening test	***Anthemiscotula***				***Emexspinosa***			***Zygophyllumcoccineum***
	Root	Stem	Leaves	Flower	Root	Stem	Leaves	Shoot
Alkaloids	+	+	+	+	-	+	+	+
Flavonoids	+	+	+	+	+	+	+	+
Phenols	+	+	+	+	+	+	-	+
Saponins	+	+	+	+	+	+	-	+
Tannins	+	+	+	+	-	+	-	+
Steroids	+	+	+	+	+	+	-	+
Glycosides	+	+	+	+	+	+	-	+
Anthraquinones	-	+	+	+	+	-	+	-
Terpenes	-	-	+	+	+	+	+	+

4. Conclusion

Finally, the wild species chosen are important deletethat have been employed in traditional medicine to cure a variety of ailments. Five plants were shown to provide a sustainable supply of agro-industrial and therapeutic goods in this study. Furthermore, phytochemicals from specific plant species can be used as a raw material for the development of less expensive medications and a variety of other marketable public-use items. Regarding, the leaves and flowers of plants showed that the highest concentrations of natural compounds

Table 2: Secondary compounds (mg g^{-1} dry wt) in different parts of selected taxa collected from the Egyptian desert.

Plant species	Secondary metabolites				
	Alkaloids	**Flavonoids**	**Phenols**	**Saponins**	**Tannins**
Carduuspycnocephalus					
Root	3.52±0.20	4.32±0.24	7.75±0.43	18.91±1.05	20.73±1.15
Stem	4.43±0.25	3.95±0.21	9.21±0.51	14.04±0.78	19.26±1.07
Leaves	5.76±0.32	6.11±0.34	11.06±0.61	13.78±0.77	24.04±1.34
Flower	4.05±0.23	5.2±0.29	10.24±0.56	13.54±0.75	20.70±1.15
Echiumangustifolium					
Root	3.01±0.17	2.81±0.16	6.97±0.39	12.92±0.72	29.69±1.65
Stem	2.9±0.16	2.57±0.14	7.286±0.40	11.00±0.61	14.62±0.81
Leaves	3.52±0.20	3.58±0.20	9.026±0.50	18.71±1.04	19.26±1.07
Flower	3.32±0.18	3.35±0.19	7.69±0.43	15.54±0.86	23.07±1.28
Anthemiscotula					
Root	3.16±0.18	3.02±0.17	6.713±0.37	18.97±1.05	28.57±1.58
Stem	2.64±0.15	2.00±0.11	7.94±0.44	13.80±0.77	37.56±2.09
Leaves	3.84±0.21	5.92±0.33	10.2±0.56	16.15±0.90	21.00±1.17
Flower	2.19±0.12	2.25±0.13	6.36±0.35	13.39±0.74	13.94±0.77
Emexspinosa					
Root	3.18±0.18	2.20±0.12	7.016±0.39	9.87±0.55	11.42±0.63
Stem	2.30±0.13	4.38±0.24	9.66±0.54	10.52±0.58	14.69±0.82
Leaves	3.50±0.19	2.80±0.16	8.24±0.46	17.06±0.95	13.96±0.78
Zygophyllumcoccineum					
Shoot	2.45±0.14	3.32±0.18	8.94±0.50	23.88±1.33	19.40±1.08

Values are mean of triplicates ± standard error.

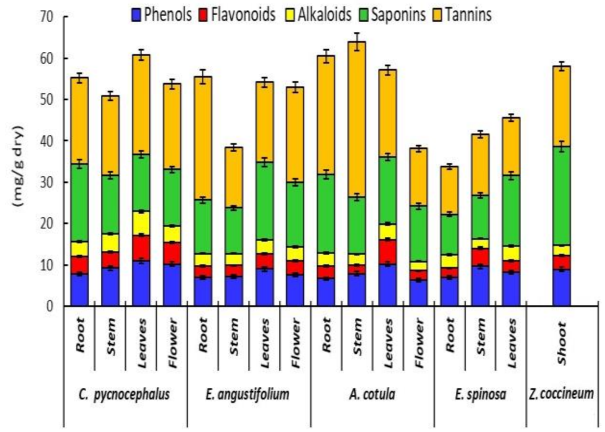

Figure 1. Secondary compounds (mg g^{-1} dry wt) of selected taxa collected from the Egyptian desert.

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