

## Ecophysiological analysis of *Zygophyllum album* plant and its allelopathy

Reham M. Mostafa and Heba S. Essawy  
Botany Dept., Sci. Fac., Benha Univ., Egypt

Corresponding: [hebsamyessawy@live.com](mailto:hebsamyessawy@live.com)

---

### ABSTRACT

*Zygophyllum* (*Z. album*) is one of the common species growing in Egypt. This species was collected from three different regions as well as texture soils (Gebel Elba, Ain Sokhna and North coast). Soils analysis under plants growing revealed variation in physicochemical characters of soil. On the other hand, they have different specific amount of the chemical constituents of trepene, flavonoids, phenolic, tannin, saponine, alkaloids and reducing sugars. The higher content of flavonoids, phenolic and antioxidants was recorded in the crude extract of *Z. album* of Gebel Elba and Ain Sokhna (5.23mg/g, 3.28mg/g & 50.84 µg/l), (1.29mg/g, 2.54mg/g & 17.2 µg/l) respectively and the lower content was recorded in *Z. album* from North Coast (0.88mg/g, 0.92mg/g & 10.6 µg/l). The methanolic extract of *Z. album* from Gebel Elba has allelopathic effect as antimicrobial agent on bacteria. The highest effect of this extract recorded inhibition zone (15mm) on *pseudomonas aeruginosa* and the lowest effect was (11mm) on *Neisseria gonorrhoeae*, but it has no effect on fungi (*Candida albicans* & *Aspergillus flavus*).

**Keywords:** *Zygophyllum album*; Phytochemistry; phenol; flavonoid and antioxidant.

## INTRODUCTION

The value of medicinal plants to the mankind is very well proven. Nature has been a source of medicinal plants for thousands of years and an impressive number of modern drugs have been isolated from natural sources. Various medicinal plants have been used for years in daily life to treat various diseases all over the world **Shanmugam et al., (2009)**. The use of plant extracts and phytochemicals, both with known antimicrobial properties, can be of great significance in therapeutic treatments. Many plants have been used because of their antimicrobial traits, which are chiefly due to synthesized during secondary metabolism of the plant **Prusti, (2008)**. Zygophyllaceae is a family of approximately 27 genera and 285 species; it consists of trees, shrubs and herbs, mostly restricted to arid and semi-arid areas in the tropics and subtropics **Beier, (2003)**. *Zygophyllum* is the largest genus of the family about 80 species. Nine species of *Zygophyllum* are recorded in Egypt **Tackholm, (1974)**. *Z. album* and *Z. simplex* are two of nine species which are widespread in the deserts and salt marshes in Egypt and Sinai Peninsula. Previous investigation of *Z. album* revealed that, the plant contains carbohydrates, tannins, amino acids, saponins, triterpene and flavonoid **Attia and Samar, (2004)** and **Hani et al., (1995)**. This plant used in traditional medicine as a remedy for rheumatism, gout, asthma and as a diuretic. The plants of this genus have been the object of several studies where they could confirm their biological activities **Hassanean et al., (1993)**. The aim of our study was to discuss the effect of variation in ecosystem and physicochemical of soil on its chemical constituents. Evaluate the antioxidant properties, phenolic and flavonoid contents of the crude extract of *Z. album*. Prove the allelopathic effect of Gebel Elba specimen as antimicrobial agent.

## MATERIALS AND METHODS

### Plant Samples

*Zygophyllum album* plants growing in xeric and hydric soils conditions were collected from three different soil habitats. These plants were taxonomically identified and authenticated by Botany Dept. Sci, Fac. Benha Univ according to **Tackholm, (1974)**. The morphological

## ۳ Ecophysiological analysis of *Zygophyllum album* plant and its allelopathy...

characters, plant height, stem diameter, leaf shape, long and breadth were determined.

### **Edaphic factor**

**Soil analysis:-** Soil samples supporting *Z.album* were collected at 0-10 cm layer from the three habitats, Gebel Elba (Shalateen away from Marsa Alam to 280 kilo), Ain Sokhna (Suez Cairo Desert Road) and North coast (a distance of about 50 kilometers from Alexandria). Soil solution was prepared by fifty grams of air-dried soil were mixed with 250 ml distilled water and shaken for one hour. The heavier particles of soil allowed settling and the supernatant liquid was decanted into a tall cylinder. After repeated filtration, clear soil extract was attained **Piper, (1947)**. Physico-chemical soil characters (soil texture, chemical reaction, Anion contents, cations contents, total nitrogen, total organic carbon and calcium carbonate) were determined by methods described in a standard book **Jackson, (1967)**.

### **Phytochemical Analysis:-**

The aerial parts of *Z. album* were collected in summer season (April) 2015 from three regions at same region of collected soil samples. The plant material were shade air dried for seven days at room temperature until the plant become well dried and dry weight were contracted. The dried tissues were grinded and transferred into air tight containers to protect them from humidity.

### **Preparation of methanolic extract:-**

The methanol extract was prepared by soaking 100 g of dry powdered plant material in 1liter of methanol at room temperature for 48h. The extract was filtrated by whatman filter paper No. 42(125mm) cotton wool. The extract was concentrated using a rotary evaporator with the water bath set at 40°C. **Reham et al., (2015)**.

**Qualitative analysis:-** Phytochemical screening (**terpenoids, flavonoids, phenolic, saponins, tannins and alkaloids**) were performed using standard Procedures according to **Sofowora, (1993)**.

**Quantitative analysis:- The total phenolic content:** TPC in the crude extract and the fractions of *Z. album* was estimated by using Folin-Ciocalteu reagent-**Gutfinger, (1981)**. Briefly; 0.1 ml of the extract sample was mixed with 0.5 ml of a (10%) Folin-Ciocalteu reagent. After 5 min, 2.0 ml of (20%) sodium carbonate were added, the mixture was shaken and reacted for 30 min at room temperature in the dark. The absorbance was measured at 760 nm by spectrophotometer (SV 1100 digital, visible spectro photometer) and the results were expressed as mg gallic acid equivalent per gram of plant dry weight (mg GAE/g).

**The total flavonoid content:-** TFC in the crude extract and the fractions of *Z. album* was estimated by using aluminum chloride colorimetric method **Meenakshi, et al., (2009)**. Briefly, 0.5 ml of 2% AlCl<sub>3</sub> ethanol solution was added to 0.5 ml of extract. After 30 min incubation at room temperature, the absorbance was measured at 430 nm and the results were expressed as mg quercetin equivalent per gram of plant dry weight (mg QE/g).

**Antioxidant Properties:-** The free radical scavenging activity of the extract was measured by using 1, 1- Diphenyl-2-Picrylhydrazyl radical (DPPH) as described by **Lee, et al., (2002)**. The extracts were prepared at 1 mg/ml concentration with DMSO solution. The mixture was made uniform and 100-500 µg/ml concentrations were made as working solutions. Further 0.004% (W/V) solution of DPPH in methanol was added to the solution. The mixture was shaken and incubated for 60 min in the dark at room temperature. The absorbance was measured at 517 nm against blank. The DPPH scavenging activity (I %) was calculated as Follows:

$$\text{DPPH}^\circ \text{ scavenging activity (\%)} = [(\text{AC}-\text{AS}) / \text{AC}] \times 100$$

Where **Ac**: is the absorbance of the DPPH solution without extract.

**As**: is the absorbance of the DPPH solution with extract.

**Biological activities of *Z.album* methanolic extract:** The filamentous fungi; yeast and bacteria (Table, 3) were obtained from micro-analytical center Cairo university and tested against *Z.album* methanolic extract from Gebel Elba by Disc diffusion method using approved standard

• **Ecophysiological analysis of *Zygophyllum album* plant and its allelopathy...**

method by the NCCLS, (2003). Filter paper discs impregnated with 10 µl of *Z. album* extract placed on potato dextrin agar plates inoculated with *A. flavus* at 25°C for 48 hs; nutrient agar glucose plates inoculated with *C. albicans*; *C. parapsilosis* and incubated at 30°C for 24-48 hs; and nutrient agar plates inoculated with, *B. subtilis*; *E. coli*, *N. gonorrhoeae*; *P. aeruginosa*; *Staph. aureus* and *Strept. faecalis* incubated at 35-37°C for 24-48 hs. The diameters of the inhibition zones were measured in millimeters Bauer *et al.*, (1966). Standard discs of Ampicillin (Antibacterial agent), Amphotericin B (Antifungal agent) served as positive controls for antimicrobial activity but filter discs impregnated with 10 µl of solvent (Ethyl alcohol) were used as a negative control.

## RESULTS

**Soil analysis:-** Soil samples were taken from three localities, the Gebel Elba (First profile), Ain Sokhna (second profile) and North coast (third profile). The results of soil analysis were recorded in table (1).

**a- Soil texture:-** Table (1) showed the analysis of three profiles representing the habitat conditions associated with *zygophyllum album* in the three habitats. The percentage of coarse sand attain higher values in the third profile (27.6%) than the second profile (24.1 %) and the first profile (14.85) while percentage of fine sand attain higher values in the first profile (69.39) than the second profile (51.88%) and the third profile (30). Mean while the percentage of silt and clay attain higher values in the third profile (35.1 and 34.0%) than the second profile (19.09 and 17) and first profile (5.63 and 8.40%).

**b- Soil chemical reaction pH:-** The soil reaction is on the alkaline side with pH values 7.42, 7.87 and 7.96 in the first, the second and third habitat respectively.

**c- Calcium carbonate content :-**calcium carbonate content is relatively higher in the third profile (9.6%) than the first profile (7.27%) and the second profile (1.35%).

**d- Cations, Anoin content and C/N ratio:-** Cations and Anion namely Na<sup>+</sup>, K<sup>+</sup>, Mg<sup>++</sup>, Ca<sup>++</sup>, Cl<sup>-</sup>, So<sub>4</sub><sup>-</sup> -and C/N ratio were determined. The

results obtained indicate that the amount of  $\text{Na}^+$  varies greatly, being 38.5, 6.10 and 0.43 ppm in profile first, third and second respectively. The potassium content is relatively higher in the first profile (0.82 ppm) than in the second profile (0.6) and third profile (0.31). The values of manganese and calcium are higher in first profile (21.20 and 10.30) than in the second and third profile (10.37, 7.88 and 2.94, 7.11). The values of chloride and sulfur are higher in the first profile (45.5 and 23.43) than in second profile (11.31 and 9.6) and third profile (3.65 and 2.42). The C/N ratio higher in the third profile (8.5) than the second profile (3.8) and third profile (2.8).

Table (1): Variation of physicochemical and texture for three soil profiles.

Soil samples	Soil texture				pH	CaCO <sub>3</sub>	Cation contents		Anion contents				C/N ratio
	Coarse Sand	Fine Sand	silt	clay			Ca <sup>++</sup>	Mg <sup>++</sup>	Na <sup>+</sup>	K <sup>+</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>-</sup>	C/N
First profile	14.85	69.39	5.63	8.40	7.42	7.27	10.30	21.20	38.50	0.82	45.50	23.43	2.8
Second profile	24.10	51.88	19.09	17.00	7.87	1.35	7.88	10.37	0.43	0.60	10.31	9.60	3.8
Third profile	27.60	30.00	35.10	34.00	7.96	9.60	7.11	2.94	6.10	0.31	3.65	2.42	8.5

Where: Gebel Elba (First profile), Ain Sokhna (Second profile) and North coast (Third profile).

**Plant morphological characters:-** Collected *Z.album* plants from different regions at April (2015) were identified according to morphological characters of the plant height, stem diameter, leaf size and shape showed variation in morphological characters photo (1) and Table (2). Gebel Elba plant showed significant the highest variation in plant height (43.3cm); and leaf size (0.24cm<sup>2</sup>) compared with other plants; where as the plants collected from the North Coast recorded the highest value in stem diameter (4mm).

✓ Ecophysiological analysis of *Zygophyllum album* plant and its allelopathy...

**Table (2):** Variation of morphological characters of three type of *Z.album* plants collected from different regions.

Type of habitat	Morphological characters			
	Plant height mm)	Stem diameter (mm)	Leaf size (cm <sup>2</sup> )	Leaf shape
Gebel Elba	34.3	3	0.24	Cylindrical and more succulent
North Coast	23.45	4	0.045	Ovoid and less succulent
Ain-Sokhna	32.2	2	0.05	Cylindrical and less succulent



Gebel Elba



North-Coast



Ain -Sokhna

**Photogram (1):** Showing variation of morphological characters (plant height, stem diameter, leaf size and shape) of *Z.album* collected from different regions.

**Qualitative phytochemical analysis of *Z.album* extract:-** The results obtained from the preliminary phytochemical screening of crude

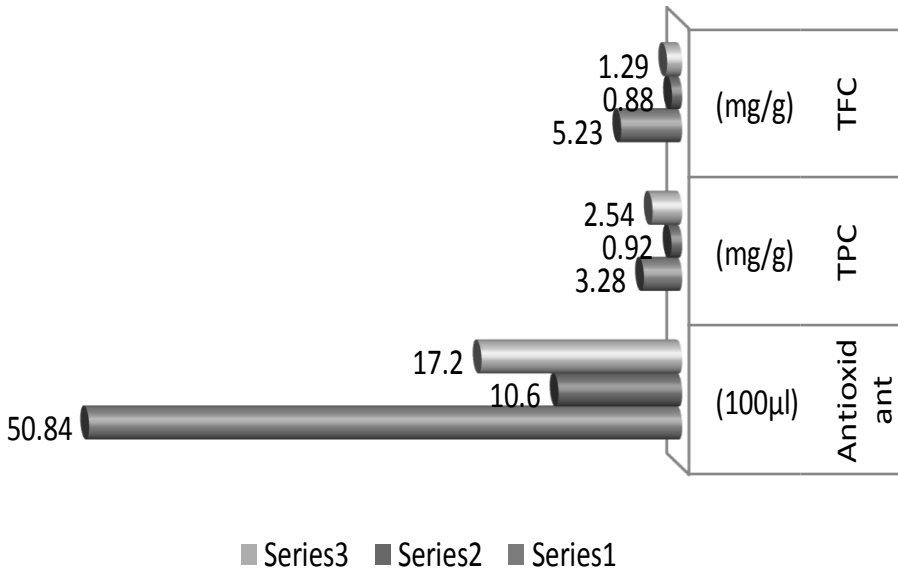
methanolic extract of *Z. album* revealed the presence of medicinally active constituents which are terpenoids, flavonoids, saponins, tannins and alkaloids in all groups of the plant.

**Quantitative analysis of bioactive compounds:-** Total phenolic (TPC) and Total Flavonoid content (TFC) of the methanolic crude extract, varied between 3.23-0.92mg/g for TPC and between 5.23-0.88 mg/g for TFC. The highest total phenolic and flavonoid contents were found in the methanolic extract of *Z. album* from Gebel Elba, while the lowest content was found in *Z. album* from North Coast (Fig. 1).

**Antioxidant activities:-** DPPH is used to evaluate the free radical scavenging activity of natural antioxidants and extracts. The method is based on the reduction of the stable free radical DPPH by donating hydrogen from the phenolic hydroxyl groups. This reduction can be monitored at 517nm by measuring the bleaching of DPPH (violet) to DPPH-H (yellow). The highest scavenging activity was observed in the Gebel Elba extract 50.84µg/l. The lowest scavenging activity was recorded in the methanolic extract of North Coast simple 10.6 µg/l (Fig. 1).

**Antimicrobial activities:-** The *Z.album* from Gebel Elba recorded the highest values of total phenolic, total flavonoid and antioxidant, so we chose this species as antimicrobial agent. The extract that was obtained from *Z.album* caused a net growth inhibition in bacterial species *B. subtilis* (13), *E.coli* (13), *N.gonorrhoeae* (11), *P.aeruginosa* (15), *Staphy. aureus* (13) and *strept.sfaecalis* (12). The level of inhibition was significantly higher in *P. aeruginosa* and the lowest value was recored with *N.gonorrhoeae*. Table (3) & Fig. (2) summarized the level of inhibition that recorded by *Z.album* extract in comparison with standard antibacterial agent (ampicillin). No significant dose – response was observed for the crude extract of *Z. album* with *A. flavus* and *C. albicans*.

9 Ecophysiological analysis of *Zygophyllum album* plant and its allelopathy...



**Fig (1):** Histogram showing the Variety in bioactive quantitative compounds between three *Z. album* plants.

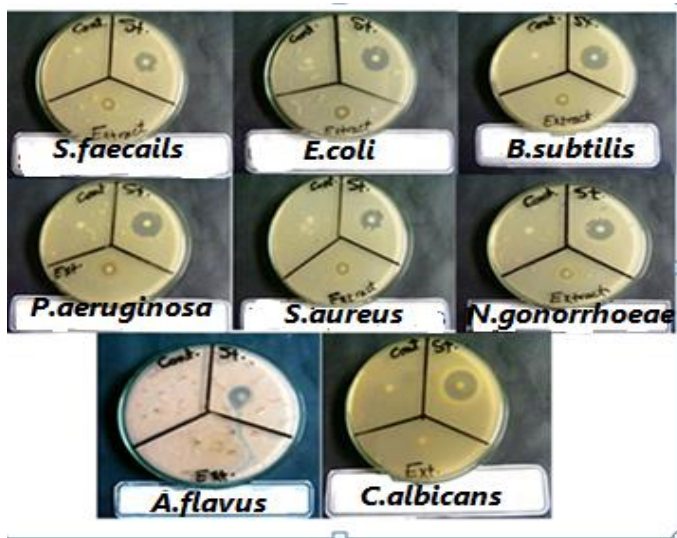
**Table (3):** The diameter of inhibition zone formed by the methanolic extract of *Z. album* from Gebel Elba against microorganisms.

Microorganisms	Gram reaction	Inhibition zone diameter (mm / Sample)		
		Standard (Antibiotics)		Extract
		*Ampicillin	**Amphotericin B	
<i>Bacillus subtilis</i> ATCC (6051)	G <sup>+ve</sup>	21	ND	13
<i>Escherichia coli</i> ATCC (11775)	G <sup>-ve</sup>	21	ND	13
<i>Neisseria gonorrhoeae</i> ATCC(19424)	G <sup>-ve</sup>	20	ND	11

<i>Pseudomonas aeruginosa</i> ATCC(10145)	G <sup>-ve</sup>	23	ND	15
<i>Staphylococcus aureus</i> ATCC(12600)	G <sup>+ve</sup>	18	ND	13
<i>Streptococcus faecalis</i> ATCC(19433)	G <sup>+ve</sup>	17	ND	12
<i>Candida albicans</i> ATCC(7102)	Fungus	ND	17	0.0
<i>Aspergillus flavus</i> ATCC(9643)	Fungus	ND	17	0.0

\* Antibacterial agent

\*\*Antifungal agent ND: no. detected

G<sup>+ve</sup>: gram positiveG<sup>-ve</sup>:gram negative

**Fig. (2):** Agar plate illustrated the effect of methanolic extract on different bacteria and fungi.

**St:** antibiotic standard    **Ex:** methanolic extract    **Cont:** without standard and extract

## DISCUSSION

The climatic conditions are the most essential factors that affect the morphological characterises and chemical constituents of plant. The climatic factors are of greatest importance in controlling the distribution of plants. These are light, temperature, rainfall, wind, and humidity. All of which are essential and vary in amount from part of biosphere to another. In a particular habitat the interaction and combination of these factors with other permit the presence of certain plants or exclude others **Tivy, (1971)**. **Ahmed, (1989)** carried out an anatomical study on *Z. album* in Egypt and reported the effect of the different ecological factors on the stem growth.

The results of climatic conditions reflect some variations between the three studied habitats with respect to the soil supporting *Z. album*. The first habitat; Gebel Elba Mountain lies in the extreme south east corner of Egypt in the Sudanese Government Administration Area (SGAA), also known as the Hala'ib Triangle **Henderson, (1965)**. The climate of the Gebel Elba seems to occupy an intermediate position between those of the regions of the tropical rains and those of the dry Egyptian rocky deserts **Fahmy, (1936)**. According to **Ayyad and Ghabbour, (1986)**, Gebel Elba lies in the arid climatic. The prevailing wind in Gebel Elba come from south east from the direction of the sea was mist so the clouds soak the mountain, giving Gebel Elba a higher biodiversity than any other region of Egypt. The amount of average rainfall is high at 50mm in comparison to the other areas from the same latitude. The annual temperatures ranging from 43°C in the sun and 36°C in the shade **Moldovan et al., (2010)**. The second habitat; Ain Sokhna, lying on the western shore of the Red Sea's Gulf of Suez. It is situated 55 km south of Suez and approximately 120 km east of Cairo. Ein Sokhna is close enough to the desert to be affected by heat and dryness. Yet its location on the coast balances the extremes of desert temperatures throughout the year. The area is known for its mild climate all year round. Temperatures range is between 36°C and 30°C. The average rate of humidity is 50 percent. Rainfall occurs largely in winter months, wind mainly blows from the north and the northwest **Abd El-Raziq, (1999)**. The third

habitat; North coast its climate is characterized by warm summer and no dry season. Mean annual temperature. 8-20°C. Prevailing wind from the Mediterranean sea greatly moderate the temperatures of the northern coastal line, making the summers moderately hot and humid, while the winter moderately wet and mild. Temperatures are more moderated along the northern coast. Plant of Gebel Elba are good indicators for harsh desert environmental conditions and that clear in the morphological characteristics and the analysis of phytochemical constituents in the tissue of this habitat. The results of soil analysis reflect some variations between the three studied habitats. The soil texture showed relatively wide range of variations. The sum of sandy fractions was higher in Gebel Elba habitat. On contrast, the higher percentage of fine particles was attained in North Coast habitat so the texture of this soil is clay loam.

pH value in the soil was found to be slightly alkaline habitat. The higher calcium carbonate content in profile (3) than in profile (1 and 2) is attributed to the fine texture in the latter profile. From the results it is clear that an increase in silt and clay percent, which is also followed by decrease in sandy percentage, is associated with an increase in CaCO<sub>3</sub> content.

This investigation was in agreement with previous that the alcoholic extract of *Z.album* contains various flavonoids substance, carbohydrates and tannins **Hassanean et al., (1993)** and **Hussein et al., (2011)**. All these compounds are known as secondary plant metabolites and have biological properties such as antioxidant activity, antimicrobial effect, stimulation of the immune system, decrease of platelet aggregation and anticancer property **Narasinga, (2003)**.

Phenolic compounds (phenols, flavonoids and proanthocyanidins) received considerable attention because of their potential anti-oxidant activity **Suhartono et al., (2012)**; **Pavithra and Vadivukkarasi, (2015)**; **Khelif et al., (2015)**; **John and Shahidi, (2010)**. These compounds are known for their ability of scavenging free radicals and active oxygen species such as single oxygen **Lahlou et al., (2014)**. The total phenolic contents of *Z.album* extracts by different solvents ranged from 78.0 to

403.4 mg gallic acid/g extract; the total flavonoids varied from 21.8 to 120.2 mg/ g extract and the total antioxidant capacity of various extracts ranged from 0.3 to 0.4µg/l. Flavonoids and triterpene glycosides, tannins and saponins were the major compounds found and isolated from *Z.album*. These families of compounds are known as great antioxidant and widely used in industrial fields according to **Ksouri et al., (2013)** and **Mahdi et al., (2015)** found that the crude extract, butanol and water fractions of *Z.album* contain more TPC than the same fractions of *Z.cornutum*. Whereas, chloroform and ethyl acetate fractions of *Z.cornutum* are richer than those of *Z. album*; TFC found in crude extract and butanol fraction of *Z. cornutum* are less than those of *Z.album*. The previous investigation on the oil of *Z. album* shows that the oils were a complex mixture of monoterpenes and sesquiterpenes with the large fraction of miscellaneous compounds **Tigrine et al., (2010)**. This sesquiterpene is a common constituent of essential oils that showed anti-inflammatory activity in several animal models **Bhatia et al., (2008)**.

## CONCLUSION:

The crude extract from *Z. album* (Gebel Elba) exhibited a powerful antioxidant activity, which can be ascribed to their total phenolic and flavonoid content. It has a great effect as antimicrobial agent especially on bacteria (*Pseudomonas aeruginosa*).

## REFERENCES

- Abd El-Raziq M. (1999)**. *New inscriptions at El-Ein El- Sukhna*.  
*Memnonia* 10: 125 –31.
- Ahmed K.A. (1989)**. Anatomical Studies on the Desert plant *Zygophyllum album* L. Desert Inst, Bull., A.R.E., 39 (suppl), 433-448p.
- Attia H.A. and M. M. Samar, (2004)**. Antidiarrhoeal activity of some Egyptian medicinal plant extracts J. Ethnopharmacol., 92:303-309.
- Ayyad, M.A. and S. Ghabbour, (1986)**. Hot deserts of Egypt and the Sudan. In Evenari Metal. (eds.) Ecosystems of the world 128 and arid shrublands, pp.149-202.

- Bauer A.W., W.M. Kirby, C. Sherris, M. Turck, 1966**, Antibiotic susceptibility testing by a standardized single disk method, American Journal of Clinical Pathology, 45, 493-496.
- Beier B.A., (2003)**.Acta Universitatis Upsaliensis, Uppsala, p.2.
- Bhatia S.P.; C.S. Letizia and A.M. Api (2008)**.Fragrance material on alpha-terpinol, food Chem. Toxicol 46:595-601.
- Fahmy, IR. (1936)**.Report on Gebel Elba. pub. Fac. Medicine Cairo 7:58 PP.
- Gutfinger, T. (1981)**. Polyphenols in olive oils. Journal of the American Oil Chemists Society; 58: 966-968.
- Hani M.; A. Elgamal; H. Kamel; Shaker; K. Pollmann and K. Seifert, (1995.)**. Triterpenoid saponins from *Zygophyllum* species. Phytochemistry, 40:1233-1236.
- Hassanean H.H.; E.K. Desoky and M.M.A. El-Hamouly, (1993)**. Quinovic acid glycosides from *Zygophyllum album*, *Phytochemistry*, vol.33, no. 3, pp.663-666.
- Henderson, K.D.D. (1965)**. Sudan Republic (W/W) Book. Praeger, New York, USA
- Hussein S. R.; M.M. Marzouk; I. F. Ibrahim; S.A. Kawashty and N.A.M. Saleh, (2011)**. Flavonoids of *Zygophyllum album* L.f. and *Zygophyllum simplex* L., (*Zygophyllaceae*), Biochemical Systematics and Ecology, vol. 39, no. 4-6, pp. 778-780.
- Jackson, M.L. (1967)**: Soil chemical analysis Book Co. Ltd. London.
- John J. A. and F. Shahidi, (2010)** Phenolic compounds and anti-oxidant activity of Brazil nut (*Bertholletia excelsa*). J func Foods. 2: 196-209.
- Khelif I.; K. Jellali; T. Michel; M. Halabalaki; Skaltsounis, A.L. and N. Allouche, (2015)**.Characteristics, phytochemical analysis and biological activities of extracts from Tunisian Chetoui Oleaeuropaea Variety. Hind Pub Corp J Chem. in press.
- Ksouri W.M.; F. Medini; K. Mkadmini; J. Legault; C. Magne; C. Abdelly and R. Ksouri. (2013)**. Identification of bioactive secondary metabolites involved in the antioxidant, anti-

1 • Ecophysiological analysis of *Zygophyllum album* plant and its allelopathy...

- inflammatory and anticancer activities of the edible halophyte *Zygophyllum album* desf., Food Chemistry, 139(1-4), 1073-1080.
- Lahlou F.A.; F. Hmimid; M. Loutfi and N. Bourhim, (2014).** Antioxidant activity phenolics flavonoids and proanthocyanidins content of *Senecioanteuphorbium*. Inter J. Biochem Res. Rev. 6: 550-58.
- Lee, J.C.; H.R. Kim; J. Kim and Y.S. Jang, (2002).** Antioxidant property of an ethanol extract of the stem of *Opuntia fiunsindica* var. Saboten. J. Agric. and Food Chem., 50:6490-6496.
- Mahdi B.; H. Dendougui; Z. kendour;B. Assia; B. Cheyma and M.Hadjadj (2015).** Antioxidant activities, phenolic, flavonoid and tannin contents of endemic *Zygophyllum Cornutum* Coss From Algerian Sahara. Der Pharma Chemica, 7(11):312-317.
- Meenakshi, S.; D.M. Gnanambigai, S.T. Mozhi; M. Arumugam; and T. Balasubramanian, (2009).** Total flavonoid in vitro antioxidant activity of two seaweeds of rameshwaram coast. Global Journal of Pharmacology; 3(2):59-62.
- Moldovan I.; J. Burrell; D. Hoek; D. Mauras; M. Megalli and Bernhard (2010).** Gebel Elba Ornithological Survey 3- 10. J. Indian Bot. Society
- Reham.M. Mostafa; A.A. Aly; M.M Hazaa and Heba S. Essawy (2015).** Quatitative screening of bioactive phytochemicals in wastes on banana plants. J. Biol. Chem. Environ. Sci., Vol. 10 (4):325-338.
- Narasinga R. (2003).** Bioactive phytochemicals in Indian foods and their potential in health promotion and disease prevention. Asia Pacific Journal of Clinical Nutrition: 12 (1): 9-2210.
- National Committee for Clinical Laboratory Standards. (NCCLS) (2003).** Method for Antifungal Disk Diffusion Susceptibility Testing of Yeast: Proposed Guideline M44-P., Wayne, PA, USA.
- Pavithra K. and S. Vadivukkarasi, (2015).** Evaluation of free radical scavenging activity of various extracts of leaves from

- Kedrostisfoetidissima (Jacq.) Cogn. Food Sci Human Wellness. 4: 42-46.
- Piper, C.S. (1947):** "Soil and plant analysis" (university of Adelaide) Inter sciencepublisher, Inc. New York.
- Prusti A.; S.R. Mishra; S. Sahoo and S.K. Mishra, (2008).** Antibacterial Activity of some indian Medicinal plants Department of botany, P.N. College, Khurda-752057. Orissa University Department of Pharmaceutical Sciences. Utkal University, Bhubaneswar Orissa. 751004.
- Shanmugam S.; K.Manikandan and K. Rajendran, (2009).** Ethnomedicinal survey of medicinal plants used for the treatment of diabetes and jaundice among the villagers of sivagangai district, Tamil Nadu. Ethnobotanical leaflets, 13:186-193.
- Sofowora, A. (1993).** Medicinal Plants and traditional Medicine In Africa. Spectrum Books Ltd., Ibadan, Nigeria; 191-289.
- Suhartono E.; E. Vianib; M.A. Rahmadhan; I. S.Gultom; M.F. Rakhman and D. Indrawardhanac, (2012).** Total flavonoid and anti-oxidant activity of some selected medicinal plants in South Kalimantan of Indonesian.APCBEE Procedia. 4: 235-39.
- Tackholm, V., (1974).** Students Flora of Egypt, Seconded ed. Cairo University Press. Cairo, pp.300.
- Tigrine K.N.; B.Y. Meklati and F. Chmat(2010).** Analysis by gas, chromatography-mass of essential oil of *Zygophyllum album L.* an aromatic and medicinal plant growing in Algeria, the International Journal Of Aromatherapy 16:187-191.
- Tivy, J. (1971):** A study of plants in the ecosphere oliver and Boyed corythorn House, Edinburgh. Geographical Review vol.63, No.4 (Oct., 1973), pp.595-597.

١٧ Ecophysiological analysis of *Zygophyllum album* plant and its allelopathy...

*Egypt J. Bot. (2016)*

ريهام مصطفى، هبة عيسوي  
قسم النبات، كلية العلوم، جامعة بنها، مصر

## الملخص العربي

يعتبر نبات الزيجوفيللم. ألبم من أكثر الأنواع النباتية شيوعاً في مصر. وقد تم جمع النبات والتربة الخاصة به من ثلاث مناطق مختلفة وهي جبل عليه، العين السخنة والساحل الشمالي. وتحليل التربة وجد اختلاف في الخصائص الفيزيوكيميائية لها. ومن ناحية أخرى وجد أيضاً اختلاف في كمية المحتوى الكيميائي للمجموعات الفعالة (التريينات، الفلافينويدات، الفينولات، التانينات، الصابونين، القلويدات والسكريات المختزلة) للعينات النباتية الثلاثة. وسجلت عينه جبل عليه أعلى محتوى كيميائي من المجموعتين الفعالتين (الفلافينويدات ٥.٢٣ ملي جرام/جرام والفينولات ٣.٢٨ ملي جرام/جرام) وبالتالي أعلى محتوى من مضادات الاكسدة (٥٠.٨٤ ميكروجرام/لتر) وتليها عينة العين السخنة، حيث سجلت ١.٢٩ ملي جرام/جرام و ٢.٥٤ ملي جرام/جرام. ١٧.٢ ميكروجرام /لتر. بينما سجلت عينه الساحل الشمالي أقل محتوى كيميائي (٠.٨٨ ملي جرام /جرام و ٠.٩٢ ملي جرام /جرام، ١٠.٦ ميكروجرام/لتر) على التوالي. وتم اختيار عينة جبل عليه لمعرفة التأثير الاليلويائي لها كمضاد فعال للميكروبات علي ستة أنواع من البكتريا (٣ موجبة جرام-٣ سالبة جرام) ونوعين من الفطريات. ووجد أن أكثر الأنواع البكتيرية تأثراً بهذا المستخلص هي *pseudomonas aeruginosa* وأقلها تأثراً كانت *Neisseria gonorrhoeae* ولم يكن للمستخلص أي تأثير على الفطريات المستخدمة في الدراسة

(*Candida albicans* & *Aspergillus flavus*)