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Biologically Active Agents of *Salicornia europaea* L. Grown in East Kazakhstan.

Sïlybaeva B.M.[1]*, Mussabayeva B.Kh.[2], Zharykbasova K.S.[1], Kydyrmoldina A.Sh.[1], and Kaygusuz O.[3]

[1]Department of Applied biology, Kazakh Humanitarian-Law Innovative University, Semey, Kazakhstan
[2]Department of Chemistry, State University of Semey named after Shakarim, Kazakhstan
[3]Department of Biology, Faculty of Science and Arts, Pamukkale University, Denizli, Turkey

ABSTRACT

In this study the biologically active agent compositions of *Salicornia europaea* were investigated. The quantity of alkaloids and tannins at a plant have been determined by Pharmacopoeia methods. The composition of flavonoid - luteolin have been determined by high performance liquid chromatography. It was established by gas chromatography that essential oils, isolated from *Salicornia europaea* consist of 48 components.

Keywords: *Salicornia europaea*, saponins, tannins, alkaloids, flavonoids,essential oils.

Corresponding author

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INTRODUCTION

Recently, the decreasing of soil moisture and the expansion of dry lands at the territory of Kazakhstan are observed. At the same time on the arid and landscape lands of Kazakhstan the larger areas are occupied by saline soils.

Saline soils are formed by evaporation of salty underground waters and in situ desiccations of salt reservoirs (lakes). Problems of improvement of ecological situation of the saline soils and searching of opportunities of use the galophyte plants grown on these lands are very actual. For this purpose the scientific studies are required.

Galophyte plants, including *Salicorniaeuropaea*grown at the territory of East Kazakhstan were not investigated before. Chemical composition of *S. europaea* grown in Almaty region of Kazakhstan only was studied and the contents of the macro-and microelements, fatty acids, amino acids were determined, the presence of a metoxyflavonoid was qualitatively determined by the paper chromatography method [1].

The purpose of this work is to study the biological features and determination of biologically active agents in the land parts of *S. europaea.*

MATERIALS AND METHODS

Route expedition to Kalbatau's region which is in the East Kazakhstan was carried out. Plant materials for the study was collected near lakes Aktaylak and Qyzylshili in a phase of the complete fructifying in October, 2015.

The quantitative determination of saponins, tannins and alkaloids was carried out by Pharmacopoeia methods [2].

The content of separate flavonoids, luteolin and quercetin was determined on the High Performance Liquid Chromatography (HPLC) "Shimadzu LG-20 Prominence" (Japan) with photometric detecting. The relative frame phase was acetonitrile.

The extraction of flavonoids for a chromatographic analysis was carried out by 70% ethanol in the presence of concentrated hydrochloric acid [3]. Then, the test for HPLC of the analysis was filtered through a membrane filter and used for carrying out the analysis.

The luteolin and quercetin from Sigma-Aldrich were used as standards. Working reference solutions in 70% ethanol with the concentration 0.3, 0.15 and 0.075 mg/ml was prepared from luteolin and quercetin, as well as mixes with the same cooperative concentration of luteolin and quercetin.

Essential oils were isolated on Klevendzher's apparatus by the hydrodistillation method. The component composition of essential oils were determined on a Gas Chromatograph of Clarus-SQ 8 (Perkin Elmer) with the Mass-spectrometer detector. Chromatography conditions were as follows: carrier gas - He, carrier gas speed –1 ml/min, sample volume – 1.0 µl, temperature of evaporation 280ºC. Components were identified by mass spectra and retention times (RT).

RESULTS AND DISCUSSION

S.europaea is an annual succulent plant. Morphological characteristics: It has a juicy branched stalk 5-30 cm long. Counter light green or bright green stalks turn into red color. Leaves are locatedon the contrary of each other, imperceptible in the form of short vaginas. Flowers are two sexes, fruit is achene and inflorescence is spike [4]. Blossoms in the second half of summer, fructifies in October. It was revealed that *S. europaea* has a big area of distribution and densely grows on saline soils near lakes Aktaylak and Qyzylshili (Fig. 1).

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Figure 1. Common growing of the plant *S. europaea.*

In the micrograph received by the scanning electron microscopy congestions of crystals of salt on fabrics of a phloem and a xylem (Fig. 2) are clearly visible. It confirms that *S. europaea* is a unique plant, it is tolerant towards salinity to 3% concentration of NaCl and is capable to accumulate salt from soil [5].

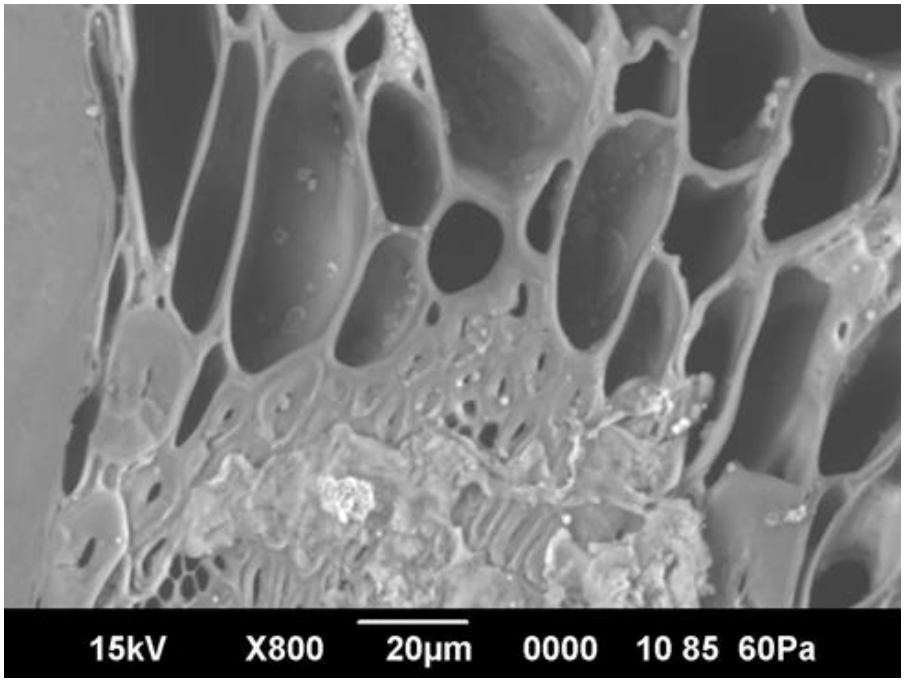

Figure 2. Accumulation of salt in *S. europaea.*

S. europaea extract was prepared in vitro. For this purpose weighed a shot of the air-dried plant crushed and pounded to homogeneous mass, and 90% ethanol in the ratio 1:5 was added. The prepared mixture was mixed in a shaker within 3 h at a temperature of 25ºC with a speed of 175 rpm. Then solution was dried 12-15 h separated from a deposit filtering. The filtrate was heated to 80ºC before solidification. The solid extract was dried up in a desiccator within 2 days. The prepared extract was analyzed on content of flavonoids.

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In Table 1 the composition of flavonoids in the extract and in the dried plant is given.

Table 1. Content of flavonoids in the extract and in the dried plant

Test	Content of flavonoids in the extract, %		Content of flavonoids in the dried plant, %	
	quercetin	luteolin	quercetin	luteolin
S. europaea	-	0.45	-	0.022

As shown in Table 1, in the extract and in the dried plant quercetin is not found, and the composition of a luteolin were 0.45% and 0.022%, respectively.

Results of the quantitative determination of saponins, tannins and alkaloids are given in Table 2. According to Table 2 in land part of the plant the presence of saponins was not determined, total composition of tannins and alkaloids were 0.33±0.01% and 2.83±0.23%, respectively.

Table 2. Content of saponins, tannins and alkaloids in the dried plant

Sample	Total sponins, %	Total tannins, %	Total alkaloids, %
S. europaea	-	0.33±0.01	2.83±0.23

Content of essential oils in the dried plant was determined. Total quantity of isolated essential oils was 0.22%. The component composition of essential oils received by gas chromatography is given in Figure 3 and Table 3.

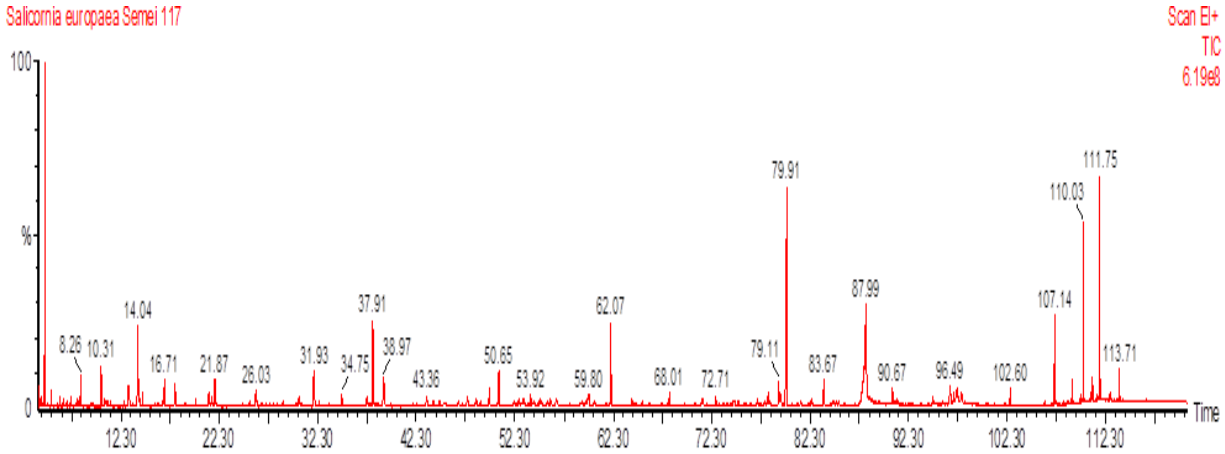

Figure 3. Chromatogram of essential oils of *S. europaea.*

Table 3. Components of essential oils of the plant *S. europaea.*

№	Retention time, sec.	Compound	Content, %
1	4,601	Hexanal	4,7
2	8,259	Heptanal	0,7
3	10,31	Phenol, 3,5-dimethyl-	0,9
4	13,083	5-Hepten-2-one, 6-methyl-	0,9
5	14,041	Furan, 2-pentyl-	2,3
6	14,544	trans-2-(2-Pentenyl)furan	0,4
7	16,708	1-Hexanol, 2-ethyl-	0,9
8	17,809	2,6-Dodecadien-1-al	1,0
9	21,276	Cyclopentane, 2-ethylidene-1,1-dimethyl-	0,5
10	21,551	α-Thujone	0,3

11	21,874	Nonanal	0,9
12	26,03	2-Nonenal, (E)-	0,6
13	31,933	2-Isobutyl-6,6-dimethylbicyclo [3.1.1] heptan-3-one	1,4
14	34,747	Unknown 1	0,5
15	37,304	2,4-Decadienal, (E,E)-	0,5
16	37,91	Thymol	3,2
17	38,97	2,4-Decadienal	1,2
18	43,365	2-Undecenal	0,5
19	47,485	2-Undecanone, 6,10-dimethyl-	0,4
20	49,723	6-Methyl-6-(5-methylfurane-2-yl) heptanes-2-one	0,7
21	50,655	5,9-Undecadien-2-one, 6,10-dimethyl-, (Z)-	1,3
22	53,16	Methyleugenol	0,5
23	53,92	Dodecane, 2,6,10-trimethyl-	0,4
24	54,855	α-Citrilidene-ethanole	0,5
25	56,565	Cadina-1(10)4-diene	0,5
26	59,801	Caryophylleneoxide	0,8
27	62,068	2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	3,3
28	68,015	Octadecane, 1-(ethenyloxy)-	0,7
29	71,364	Nonadecane	0,5
30	72,711	1-Dodecanol, 3,7,11-trimethyl-	0,6
31	74,967	2-Octyl benzoate	0,4
32	78,027	Benzoic acid, hept-2-yl ester	0,7
33	79,105	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	1,2
34	79,344	Benzoicacid, tridecylester	0,5
35	79,913	Perhydrofarnezyl acetone	9,8
36	83,666	Farnezyl acetone	1,1
37	87,991	n-Hexadecanoicacid	11,0
38	88,428	Oleic Acid	1,0
39	90,669	Octa decanal	0,7
40	94,767	1-Eicosanol	0,4
41	96,491	Phytol	0,9
42	96,906	Eicosane	0,4
43	97,188	9,12-Octadecadienoic acid (Z,Z)-	1,0
44	97,687	trans-Octa decanoic acid	0,5
45	102,596	Unknown 2	0,7
46	107,138	Heneicosane	1,8
47	110,033	Triacontane	2,0
48	111,75	Hentriacontane	2,8
Total			68,8

Overall, 48 components in essential oils were determined. The main components were n-Hexadecanoic acid (11.0%), Perhydrofarnezylacetone (9.8%) and Hexanal (4.7%). Content of other components was less than 4%.

Salicornia is used for various purposes. It is used as a source of salt [6] in food, for receiving drinks and vinegar [7], the land green part is used as salad [5]. Medicinal properties of *Salicornia* are of special interest, these plants possess anticancer [8], antidiabetic [9], hepatoprotective [10], lipid lowering [11] and other medicinal properties. Medicinal properties of these plants are depend on contents of biologically active agents in them. As a part of *Salicornia* the biologically active agents, such as flavonoids, saponins, alkaloids, tannins and sterols are found. Besides, in some types of *Salicornia*, for example, in *S. brachiate,* presence of the important microelement selenium is determined [12].

S. europeae is utilized long in the Kazakh traditional medicine against disease scurvy and as a diuretic. As a result of our researches it is shown that *S. europea* grown in East Kazakhstan consist of such biologically active agents as flavonoids, tannins, alkaloids and essential oils.

Earlier it has been shown that the flavonoids, luteolin and quercetin found as a part of a plant possess powerful antioxidant, anti-inflammatory and anticancer properties [13]. It is known that medicinal properties of tannins and alkaloids are extremely diverse. Antioxidant properties of essential oils are known as well [14].

CONCLUSIONS

S. europaea is the plant which dominates in the saline soils of East Kazakhstan. Contents of biologically active agents, such as, flavonoids, tannins, alkaloids, essential oils in the land parts of *S. europaea* allow to use this plant in pharmacology. It was determined that in this region population of this plant is sufficient for its use as raw materials for preparing medicinal substances and other purposes. Further researches for determination of medicinal properties, in particularly, anticancer activity of this plant are required.

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