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ECONOMIC POTENTIALITIES OF SOME PLANTS GROWING NATURALLY IN THE NILE DELTA REGION, EGYPT

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Flora of Egypt appeared promising as raw materials for various uses e.g. industrial, grazing, pharmaceutical, etc. The species growing naturally in the Nile Delta region namely: *Bidens pilosa, Digitaria sanguinalis, Echinochloa crus-galli, Lactuca serriola, Lepidium sativum, Lolium perenne, Malva parviflora, Paspalidium geminatum, Portulaca oleracea* and *Saccharum spontaneum* had been investigated. The preliminary phytochemical screening revealed the presence of carbohydrates, sterols, alkaloids, flavonoids, saponins, chlorides and sulphates in shoot system of all the studied plants. Moisture, ash, water soluble ash, acid insoluble ash, total nitrogen, total proteins, total lipids, crude fibre, glucose, sucrose, total soluble sugars and polysaccharides together with some elements were estimated. The highest values of total proteins and lipids were estimated in *Saccharum spontaneum,* while the highest total carbohydrates were measured in *Lactuca serriola.* The elementary analysis of the studied plants indicate that potassium, sodium, and calcium were the main cations. Quantitative and qualitative analysis of the protein amino acids revealed the presence of seventeen amino acids with high values of aspartic acid, glutamic acid and proline. These results indicate that these selected plants may be used as highly potential natural plants.

Keywords: weed flora, carbohydrates, amino acids, fatty acids, elements.

There are an excessive global demands for food, forage and agro-industrial raw materials. The Nile Delta region flourished by many weeds. Among the common wild flora of Damietta region, the authors chose ten species to evaluate their chemical constituents. The genera of these plants have attracted the attention of workers in many countries. In genus *Bidens*, polyacetylene, flavonoids, methoxylated flavone glucosides and chalcone ester glucosides were reported (Alez, *et al.* 1996; Wang, *et al.* 1997;

Brandao *et al.*, 1998 and De Tommasis *et al.*, 1998). Forage yield, crude protein, minerals, starch, ash, protein and lipids were studied in genus *Digitaria* (Shy *et al.*, 1995; Santana and Mc Dowell, 1996 and Shatters and West, 1996). Takatsuto and Kawashima (1998); Turrner, *et al.* (1998) and Watanabe (1999) studied polysterols, cystathionine B-layse, antioxidative phenolic compounds in genus *Echinochloa* respectively. In genus *Lactuca*, nitrate, vitamin C, B-carotene, lutein, reducing sugars, chlorophyll, minerals, flavonoids and germacolide glucoside were investigated by Drews and Krumbien (1997); Kisiel (1998) and Kisiel and Braszcz (1998). Lipids, carbohydrates, minerals, proteins, fatty acids, alkaloids, fibers, inorganic salts, amino acids and sterols were studied in genus *lepidium*, by certain authors (El-Shintinawy and Selim, 1995; Comas, *et al.*, 1997; Bettach, *et al.*, 1997; Maier, *et al.*, 1998; Andersson, *et al.*, 1999). In genus *Lolium*, Tase, *et al.* (1996); Marstop (1996) and Saito, *et al.* (1999) studied the proteins, amino acids, carbohydrates and B-carotene content, respectively. Sulfite oxidase enzyme, polysaccharides and sterol were studied by Ganai, *et al.* (1997); Atkhomova, *et al.* (1998) and Sharma and Ali (1999) in genus *Malva*. Sakai, *et al.* (1996); Boehm and Boehm (1996); Ohsak *et al.* (1997) and Garti, *et al.* (1999) studied the monoterpene glucosides, betalains, fatty acids, clerodane diterpenoid and gums in genus *Portulaca*. Lingle (1997) studied the sugars in genus *Saccharum*. From the above screening of literature, one can expect the prime importance of individuals belonging to these genera. The present study is a contribution to the previous investigation. It aims at the quantitative evaluation of the nutritive and economic potentialities of the following wild taxa in the Nile Delta: *Bidens pilosa, Digitaria sanguinalis, Echinochloa crus-galli, Lactuca serriola, Lepidium sativum, Lolium perenne, Malva parviflora, Paspalidium geminatum, Portulaca oleracea* and *Saccharum sportaneum*.

MATERIALS AND METHODS

During the year 1999, several field trips were organized to Damietta Province for collecting the samples of the concerned plants. *Digitaria sanguinalis, Lolium perenne and Paspalidium geminatum* were collected from Damietta district. *Biden spilosa, Lactuca serriola* and *Lepidium sativum* were collected from Kafr-Saad district, *Malva paroiflora* and *Portulara oleracea* were obtained from Farskor district, while *Echinochloa crus-galli* and *Saccharum spontaneum* were obtained from El-Zarka district. The shoot system of each species was cleaned, air dried in shade and ground to fine powder and preserved in a well stopped bottles ready for chemical analyses.

After air drying, moisture contents of each sample were studied according to Ward and Johnson (1962). Total ash, water soluble ash and acid

insoluble ash were determined according to Egyptian Pharmacopoea (1953). Total soluble sugars, glucose, sucrose and polysaccharides were determined according to Yemm and Willis (1954); Feteris (1965) and Thayumanavan and Sadasivan (1984). Crude fiber and total lipids contents were determined according to A.O.A.C. (1970). Total nitrogen content was determined according to Delory (1949) and Naguib (1964). Protein content was determined according to the method of Bradford (1976).

The preliminary phytochemical screening of different speices were studied according to Egyptian Pharmacopea E.P. (1953). Sodium, potassium, calcium, magnesium, iron, manganese, zinc, copper, lead and cadmium were determined by atomic absorption spectrophotometer using the method described by Allen *et al.* (1974).

The identification and quantitative determination of amino acid composition in the plant powders were carried out according to Moore and Stein (1958).

The cluster analysis using Bray-Curtis dissimilarity index under the Multivariate Statistical Package MVSP program is an explicit way of identifying similar groups in raw data (Jongman *et al.*, 1987).

RESULTS

Preliminary-Phytochemical Screening

It is evident that, the preliminary phytochemical screening revealed the presence of carbohydrates, sterols, alkaloids, flavonoids, saponins, chlorides and sulphates in all the studied plants. Tannins were recorded only in *Bidens pilosa*, *Echinchloa crus-galli*, *Lactuca serriola, Lepidium sativum, Lolium perenne* and *Saccharum spontaneum.* Resin was recorded in all the studied plants except *portulaca oleracea.*

Determination of Certain Constants

Data in table (1) present certain pharmacopoeial constants of the studied species. It is obvious that the percent of moisture content were ranged between 8.93 and 12.64% in *Digitaria sanguinalis* and *Malva parviflora,* respectively. The maximum value of ash content was recorded in *Portulaca oleracea* (16.36%), while the minimum value was recorded in *Lepidium sativum* (7.92%). The highest value of water-soluble ash was 8.98% in *Malva parviflora* followed by 6.28 in *Portulaca oleracea*, 6.08% in *Lactuca serriola*, 5.56% in *Bidens pilosa*, 5.02% in *Paspalidium geminatum*, 4.06% in *Digitaria sanguinalis*, 3.60% in *Lepidium sativum*, 3.22% in *Echinochloa crus-galli*, 2.94% in *Saccharum spontaneum* and 2.56% in *Lolium perenne. Digitaria sanguinalis* contained a relatively high percentage of acid-insoluble ash being 5.96%, while *Lepidium sativum* contained a relatively low percentage being 0.54%. The percent of total nitrogen contents ranged between 136.00 mg/100 gm dry weight in *Lepidum*

sativum and 18.50 mg/100 g dry weight in *Digitaria sangiuinalis*. The maximum value of total lipid content (3.87%) was recorded in *Portulaca oleracea*, while the minimum value (0.47%) was recorded in *Echinochloa crus-galli*. *Malva parviflora* recorded high percentage of crude fiber content (48%) followed by *Digitaria sanguinalis* (45%), *Lepidium sativum* (40%), *Lolium perenne* (38%), *Paspalidium geminatum* (33%), *Saccharum spontaneum* (32%), *Lactuca serriola* (30%), *Portulaca oleracea* (30%), *Bidens pilosa* (24%) and *Echinochloa cruss-galli* (23%). The value of protein content was varied between 142.73 to 429.55 mg/100 g dry weight in *Malva parviflora* and *Paspalidium geminatum*, respectively. Concerning carbohydrates, *Lactuca serriola* was recorded the highest value of total soluble sugar, glucose, sucrose and polysaccharides being 151.50, 4.08, 19.37, 388.92 and 563.80 mg/g dry weight, respectively. *Portulaca oleracea* recorded the lowest value of total soluble sugars and sucrose (48.20 and 1.77 mg/g dry weight, respectively) while *Saccharum spontaneum* recorded the lowest value of glucose (0.261 mg/g dry weight) and *Echinochloa crus-galli* in polysaccharides (158.30 mg/g dry weight).

Analysis of Amino Acids of the Studied Plants

Quantitative and qualitative analysis of amino acids of the studied plants are shown in table (2). *Bidens pilosa* recorded the lowest amounts of aspartic acid (0.204 g/100 g dry weight) and the highest amounts of leucine and tyrosine (1.378 and 0.362 g/100 g dry weight, respectively). The lowest amounts of threonine, serine, glutamic acid, glycine, valine, leucine, phenylalanine, lysine and arginin were recorded in *Digitaria sanguinalis* being, 0.285, 0.275, 0.779, 0.293, 0.416, 0.477, 0.341, 0.328 and 0.375 g/100 g dry weight, respectively. The highest amounts of alanine (0.792 g/100 g dry weight) and valine (0.833 g/100 g dry weight) were recorded in *Echinchloa crus-galli*. The lowest amounts of methionine (0.059 g/100 g dry weight) recorded in *Lactuca serriola*; alanine (0.404 g/100 g dry weight), isoleucine (406 g/100 g dry weight) and tyrosine (0.161 g/100 g dry weight) recorded in *Paspalidium geminatum*. While proline (0.591 g/100 g dry weight) and histidine (0.176 g/100 g dry weight) recorded in *Saccharum spontaneum*. The highest amounts of proline (1.951 g/100 g dry weight) and isoleucine (1.039 g/100 g dry weight) recorded in *Lepidium sativum*, glutamic acid (1.580 g/100 g dry weight) and cystine (0.090 g/100 g dry weight) recorded in *Lolium perenne* while glycine (0.758 g/100 g dry weight), methionine (0.106 g/100 g dry weight) and phenylalanine (0.657 g/100 g dry weight) recorded in *Portulaca oleracea*. *Malva parviflora* recorded the highest amounts of aspartic acid, threonine, serine, histidine and lysine being 3.808, 0.951, 0.864, 0.645 and 0.955 g/100 g dry weight, respectively.

TABLE (1). Mean values of different constants and constituents of the studied plants.

Species Constants & Constituents	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Moisture content (%)	10.37	8.93	11.04	11.91	12.06	10.52	12.64	10.52	9.65	9.43
Ash content (%)	15.80	13.18	10.76	12.76	7.92	10.42	14.28	11.96	16.36	11.38
Water-soluble ash (%)	5.56	4.06	3.22	6.08	3.60	2.56	8.98	5.02	6.28	2.94
Acid-insoluble ash (%)	4.30	5.96	3.78	2.34	0.54	5.72	1.00	4.88	3.64	5.00
Total nitrogen (mg/100 gm dry wt.)	44.67	18.50	31.37	30.67	136.00	51.37	18.67	19.30	34.67	23.57
Total protein (mg/100gm dry wt.)	363.64	212.73	250.45	207.27	216.36	295.45	142.73	429.55	220.91	409.55
Total lipid content (%)	0.80	1.80	0.47	0.96	2.07	0.90	1.77	0.83	3.87	3.45
Crude fibre content (%)	24.00	45.00	23.00	30.00	40.00	38.00	48.00	33.00	30.00	32.00
Carbohydrates (mg/g d. wt.):										
Total soluble sugar	60.70	56.90	55.60	151.50	108.30	93.50	60.80	58.40	48.20	53.80
Glucose	0.807	0.706	0.731	4.008	3.050	2.118	0.933	0.958	0.303	0.261
Sucrose	6.23	4.23	2.80	19.37	19.03	8.12	12.92	6.69	1.77	3.20
Polysaccharides	243.31	217.75	158.30	388.92	320.32	358.36	233.99	253.43	280.65	277.40
Total carbohydrates	311.05	279.59	217.40	563.80	450.70	462.10	308.64	319.48	330.92	334.66

1- Bidens pilosa *2- Digitaria sanguinalis* *3- Echinochloa crus-galli* *4- Lactuca serriola*
5- Lepidium sativum *6- Lolium perenne* *7- Malva parviflora* *8- Paspalidium geminatum*
9- Portulaca oleracea *10- Saccharum spontaneum*

TABLE (2). Amino acid analysis (g.A.A./100 g dry weight) of the studied plants.

Species / Amino acid	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	Mean
Aspartic acid	0.204	1.145	2.157	1.493	1.764	1.653	3.808	2.257	1.509	2.547	1.854
Threonine	0.533	0.285	0.475	0.345	0.794	0.650	0.951	0.541	0.570	0.611	0.576
Serine	0.422	0.275	0.455	0.287	0.652	0.574	0.864	0.544	0.504	0.566	0.514
Glutamic acid	1.374	0.779	1.373	0.943	1.523	1.580	1.480	0.878	1.265	1.067	1.226
Proline	1.393	0.693	1.763	0.704	1.951	1.224	1.268	0.964	1.285	0.591	1.184
Glycine	0.489	0.293	0.456	0.342	0.574	0.534	0.698	0.359	0.758	0.372	0.487
Alanine	0.651	0.442	0.792	0.436	0.586	0.568	0.579	0.404	0.620	0.544	0.562
Cystine	0.081	0.051	0.079	0.044	0.062	0.090	0.009	0.041	0.014	0.034	0.051
Valine	0.775	0.416	0.833	0.517	0.809	0.592	0.740	0.464	0.670	0.484	0.630
Methionine	0.126	0.080	0.155	0.059	0.130	0.106	0.151	0.094	0.166	0.124	0.119
Isoleucine	0.927	0.464	0.791	0.573	1.039	0.625	0.881	0.406	0.883	0.493	0.708
Leucine	1.378	0.477	0.892	0.609	0.938	0.736	0.898	0.559	0.902	0.588	0.798
Tyrosine	0.362	0.194	0.356	0.210	0.310	0.247	0.313	0.161	0.316	0.301	0.277
Phenylalanine	0.612	0.341	0.614	0.380	0.548	0.506	0.618	0.356	0.657	0.453	0.509
Histidine	0.322	0.220	0.356	0.228	0.451	0.426	0.645	0.230	0.629	0.176	0.368
Lysine	0.588	0.328	0.613	0.418	0.840	0.567	0.955	0.436	0.798	0.360	0.590
Arginine	0.757	0.375	0.605	0.387	0.775	0.572	0.873	0.523	1.113	0.448	0.643

1- *Bidens pilosa* 2- *Digitaria sanguinalis* 3- *Echinochloa crus-galli* 4- *Lactuca serriola*
5- *Lepidium sativum* 6- *Lolium perenne* 7- *Malva parviflora* 8- *Paspalidium geminatum*
9- *Portulaca oleracea* 10- *Saccharum spontaneum*

Elementary Analysis of the Studied Plants

The elementary analysis of the studied plants were presented in table (3). Sodium concentration showed a wide range of variations, its value ranged from 460 mg/100 g dry weight in *Bidens pilosa* to 2070 mg/100 g dry weight in *Paspalidium geminatum*. Potassium concentration was relatively higher in all the studied plants than that of sodium concentration, it ranged from 1326 mg/100 g dry weight in *Lolium perenne* to 3666 mg/100 g dry weight in *Portulaca oleracea*. *Malva parviflora* recorded the highest percentage of calcium concentration (333 mg/100 g dry weight) followed by *Portulaca oleracea* (312 mg/100 g dry weight), *Lactuca serriola* (165 mg/100 g dry weight), *Bidens pilosa* (158 mg/100 g dry weight), *Lepidium sativum* (144 mg/100 g dry weight), *Saccharum spontaneum* (105 mg/100 g dry weight), *Digitaria sanguinalis* (98 mg/100 g dry weight), *Paspalidium geminatum* (88 mg/100 g dry weight), *Echinchloa crus-galli* (74 mg/100 g dry weight) and *Lolium perenne* (60 mg/100 g dry weight). *Portulaca oleracea* recorded the highest value of both magnesium and iron being 26.32 and 171.42 mg/100 g dry weight, respectively. *Paspalidium geminatum* and *Echinochloa crus-galli* recorded the lowest value of magnesium and iron being 2.76 and 45.72 mg/100 g dry weight, respectively. The maximum value of manganese was recorded in *Echinchloa crus-galli* being 20.00 mg/100 g dry weight while the minimum value was recorded in *Lactuca serriola* being 7.50 mg/100 g dry weight. Zinc concentration in the studied plants was varied between 10.0 and 21.32 mg/g dry weight in *Lepidium sativum* and *Digitaria sanginalis*, respectively. Both *Echinochloa crus-galli* and *Lolium perenne* recorded the highest percentage of copper ion concentrations (5.32 mg/100 g dry weight) while both *Lactuca serriola* and *Paspalidium geminatum* recorded the lowest percentage (2.0 mg/100 g dry weight). The lead ion concentration varied between *Digitaria sanguinalis* (22.22 mg/100 g dry weight) and *Portulaca oleracea* (62.22 mg/100 g dry weight). Cadmium was absent in *Paspalidium geminatum* and *Lepidium sativum* but record a high value in both *Malva parviflora* and *Digitaria sanguinalis* (0.99 mg/100 g dry weight).

Cluster Analysis of the Studied Plants

A total of 41 parameter were used in the multivariant cluster analysis to find out the similarity between different studied plants as represented in dindrograme (Fig.1).

TABLE (3). **Concentration of cations expressed as (mg/100 g dry weight) in the studied plants**

Element / Species	Na	K	Ca	Mg	Fe	Mn	Zn	Cu	Pb	Cd
1- Bidens pilosa	460.0	2340.0	158.0	8.94	128.56	9.00	15.32	4.00	44.44	0.50
2- Digitaria sanguinalis	552.0	2652.0	98.0	16.04	65.72	11.00	21.32	2.66	22.22	0.99
3- Echinochloa crus-galli	690.0	1950.0	74.0	10.32	45.72	20.00	12.44	5.32	26.66	0.75
4- Lactuca serriola	506.0	2652.0	165.0	6.02	51.42	7.50	16.88	2.00	26.66	0.75
5- Lepidium sativum	506.0	1794.0	144.0	6.50	51.42	10.00	10.00	4.66	44.44	0.00
6- Lolium perenne	1058.0	1326.0	60.0	3.02	100.00	8.50	19.54	5.32	40.00	0.75
7- Malva parviflora	1840.0	2496.0	333.0	8.14	134.28	10.00	17.10	3.32	31.10	0.99
8- Paspalidium geminatum	2070.0	2028.0	88.0	2.76	108.56	12.00	15.76	2.00	31.10	0.00
9- Portulaca oleraçea	920.0	3666.0	312.0	26.32	171.42	14.00	12.44	4.66	62.22	0.75
10- Saccharum spontaneum	552.0	2496.0	105.0	5.74	68.56	8.00	13.32	4.00	26.66	0.75

TABLE (4). Comparison between some variables in the studied plants with other Egyptian wild plants.

Present and other studies Variables	Present study	El-Ghonemy *et al.*, 1977 30 species	El-Heneidy, 1987 36 species	El-Kady, 1987 26 species	El-Shamy, 1995 10 species	Sharaf El-Din, 1998 28 species
Na mg/g	4.6-20.7	0.7-50.3	-	-	-	2.6-20.0
K mg/g	13.3-36.7	6.8-99.0	-	5.5-39.8	-	2.4-11.0
Ca mg/g	0.6-3.3	4.2-29.3	-	2.9-67.3	-	2.0-6.0
Mg mg/g	0.03-0.26	1.2-20.7	-	1.5-11.9	-	0.7-5.4
Fe mg/g	0.46-1.7	0.9-8.1	-	-	-	0.3-4.3
Mn mg/g	0.07-0.20	0.05-0.76	-	-	-	0.02-0.33
Cu mg/g	0.02-0.05	-	-	-	-	0.001-0.140
Ash %	7.9-16.4	-	-	5.5-36.0	4.56-21.83	-
Total lipids %	0.47-3.87	-	7.4-20.8	0.8-8.3	0.52-5.47	-
Total carbohydrates mg/gm	308-564	-	178-324	271-519	-	-
Crude fiber %	23-48	-	24.4-28.7	14.6-35.6	17.83-63.29	-
Amino acids g/100 gm			-			
Aspartic acid	0.20-3.80	-	-	-	0.53-5.32	-
Threonine	0.29-0.95	-	-	-	0.38-1.61	-
Serine	0.28-0.86	-	-	-	0.07-2.57	-
Glutamic acid	0.78-1.60	-	-	-	0.13-8.91	-
Proline	1.95-0.59	-	-	-	0.08-1.88	-
Glycine	0.29-0.76	-	-	-	0.42-2.76	-
Alanine	0.40-0.80	-	-	-	0.07-2.37	-
Cystine	0.01-0.09	-	-	-	0.01-5.78	-
Valine	0.42-0.83	-	-	-	0.13-2.39	-
Methionine	0.06-0.17	-	-	-	0.10-1.13	-
Isoleucine	0.41-1.04	-	-	-	0.67-2.01	-
Leucine	0.48-1.40	-	-	-	0.40-3.83	-
Tyrosine	0.16-0.36	-	-	-	0.17-2.20	-
Phenylalanine	0.34-0.66	-	-	-	0.66-3.10	-
Histidine	0.17-0.64	-	-	-	0.13-1.78	-
Lysine	0.33-0.95	-	-	-	1.25-2.88	-
Arginine	0.37-1.11	-	-	-	0.3-4.36	-

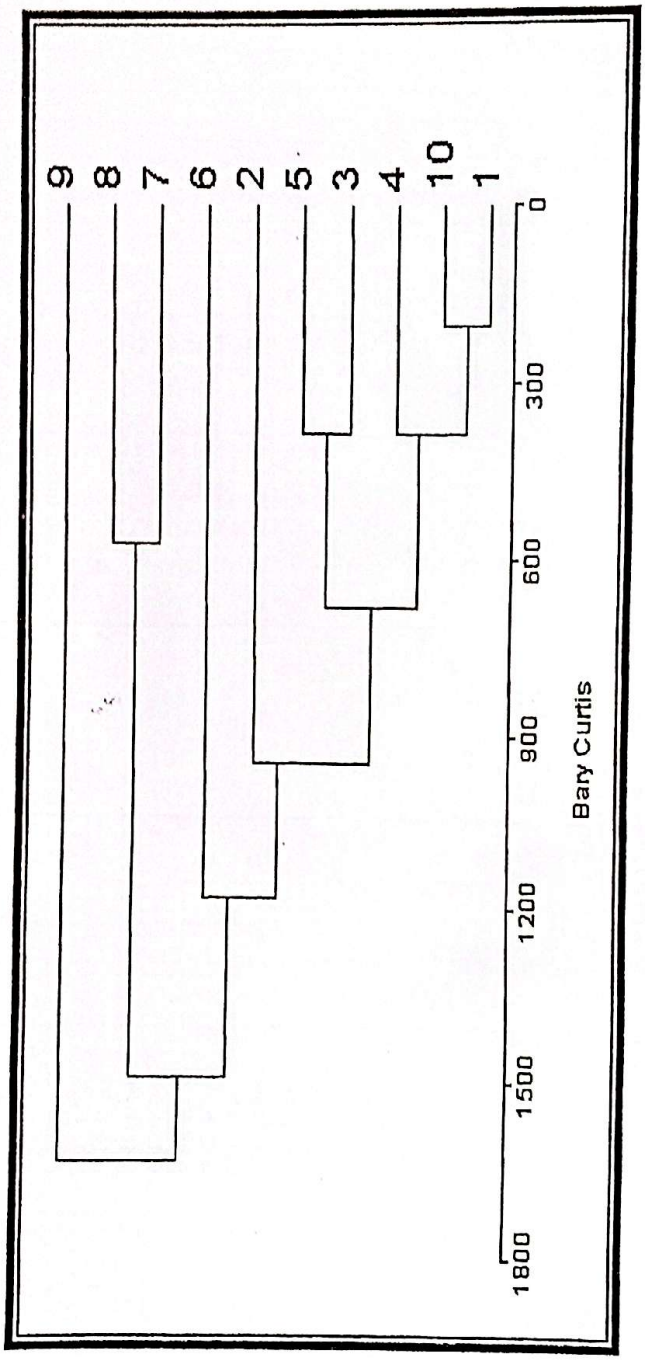

Fig. (1): Grouping of different studied plants according to the similarities in their different studied parameters (constant &constituents, amino acids analysis and cations) using Bray-Curtis measure of dissimilarity.

N.B. 1- *Bidens pilosa* 2- *Digitaria sanguinalis* 3- *Echinochloa crus-galli* 4- *Lactuca serriola*
5- *Lepidium sativum* 6- *Lolium perenne* 7- *Malva parviflora* 8- *Paspalidium geminatum*
9- *Portulaca oleracea* 10- *Saccharum spontaneum*

DISCUSSION

The nutritive value of any forage is dependent upon its content of energy producing nutrients as well as its content of nutrients essential to the animal body. Comparison between nutrient contents of the studied plants and those of the range vegetation in an Egyptian Mediterranean region (El-Ghonemy *et al.*, 1977 and El-Kady, 1987) indicated that the studied plants have relatively low contents of Na, K and Ca but high contents of Mg, Fe and Mn. Similar comparison between the studied plants and those growing naturally in the south eastern corner of Egypt was carried out by Sharaf El-Din (1998) who shows that the studied plants have relatively high contents of Na, K, Ca, Mg, Fe, Mn and Cu.

The source of energy for animals are carbohydrates, fats and proteins. The importance of these compounds to plants in terms of structure and use in metabolism is well known. These compounds are elaborated, stored and utilized by the plant itself as food for maintenance and for the development of new shoot and root growth. Comparison between the organic compounds in the studied plants and that of the Egyptian desert plants (El-Heneidy, 1987; El-Kady, 1987 and El-Shami, 1995) indicated that the contents of total lipids and total proteins are lower than those of the other species, while the reverse is true regarding total carbohydrates (Table 4).

Protein content in feeds is extremely important although its value has been over emphasized. Forage high in protein is used for energy and is required for repair and new growth of animal tissue, including such animal products as milk, animal tissues and hair. The present study points out the presence of seventeen amino acids in these species with different concentrations. The concentrations of amino acids are relatively low, compared with those concerned in the study of El-Shami (1995).

From this study, it may concluded that the studied species may be used on a wide range as a fodder plants due to their high contents of carbohydrates, lipids, proteins and minerals. The presence of sterols, flavonoids, tannins, saponins and resin in most of the studied plants may be considered as bases for future pharmaceutical or industrial research programs.

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الأهمية الاقتصادية لبعض النباتات النامية طبيعياً بمنطقة دلتا النيل – بمصر

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يهدف هذا البحث الى إجراء دراسات فيتوكيميائية على عشرة أنواع من النباتات التى تنمو طبيعياً بمنطقة دلتا النيل وهى : شوك الحدائق و الدفيرة والدنيبة وخس البقر وحب الرشاد والجزون والخبيزة والنسيلة والرجلة والقصب البرى وذلك بغرض تقدير أهميتها الاقتصادية.

تم قياس كل من الرطوبة والرماد والرماد الذائب فى الماء والرماد الذائب فى الأحماض ونسبة الألياف وكمية ونوعية السكريات وكمية النتروجين وكمية البروتين وكمية الدهون بهذه النباتات.

تم عمل مسح كيميائى أولى شامل للمواد الفعالة فى هذه النباتات حيث تبين وجود القلوانيات والكربوهيدرات والاسترويدات والصابونين والفلافونيدات والكلوريدات والكبريتات فى جميع النباتات تحت الدراسة.

تم تقدير عناصر الصوديوم والكالسيوم والبوتاسيوم والحديد والماغنسيوم والمنجنيز والكالسيوم والرصاص والزنك والنحاس ، كما تم التعرف على سبعة عشر حمضاً أمينياً وتركيز كل حمض منهم على حده. وقد أوضحت نتائج الدراسة مايلى :

١- النباتات تحت الدراسة تحتوى على مواد عضوية وغير عضوية تؤهلها كنباتات أعلاف للحيوانات.

٢- المواد الفعالة بها تؤهلها مع مزيد من الدراسة لاستخدامها فى المجالات الطبية والصناعية.