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ECO-PHYSIOLOGICAL STUDIES ON THE VEGETATION OF WADI EL-BRUK AT MIDDLE SINAI

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ABSTRACT

The present investigation was conducted to evaluate the ecophysiological characteristics of the natural vegetation of the main channel of wadi el-bruk at middle sinai, in addition to provide some information about chemical compositions of the plants as a nutritional value for constitution, in future, range models through the sustainable development plan for desert areas.

Results of the present investigation showed that the study area was characterized by: 1) - flat, plain and wideness land, 2)- sand loamy textured class, 3)- low salinity level, alkalescent with calcareous features and 4)- mild climate. Phytosociologically, there is no zonation pattern of vegetation due to topographic regularity of the wadi bed. Woody perennials are the most dominant species, while the presence of herbs and annuals depends up on the amount of rainfall. Plant palatability was evaluated on the bases of field observations and chemical composition. The results, also indicated that there is an intimate relation between accumulation of different plant constituents and the environmental stresses. Some species are electrolytic dependent, while others are nen-electrolytic dependent in their adaptive responses to the prevailing environmental conditions.

Key words: ecophysiology, vegetation, wadi el-bruk, palatability, chemical composition.

INTRODUCTION

Wadi El-Bruk is one of the major hydrographic basins of Wadi El-Arish. The upstream portion of Wadi El-Bruk forks into two principal channels; Wadi El-Natila and El-Seheimi (35 and 42 km in length, respectively). These channels join together to form Wadi El-

Bruk master stream, which excavates in the vast rolling plain ranging between 2 km and 6 km in width. Wadi El-Bruk main channel consists of two segments nearly perpendicular to each other (Fig. 1 and 2). The first segment extends in a north-south direction for about 19 km with straight to slightly curved channel with width ranging from 3-5 km. The floor of this channel segment is dominated by sand, silt with some gravel deposits, which support dense vegetation, small farms and orchards. However, the second segment in ENE-WSW direction for about 43 km from Bir Tamada to the junction of Wadi El-Arish. The channel floor of the down stream portion of Wadi El-Bruk is occupied by thick alluvium deposits which are highly eroded by the recent storms forming dissected terrain (Mohammed, 1997).

Sinai region comprises mainly about 61000 Km^2 of misused range land where the scanty vegetation cover provides limited grazing for livestock. In winter season, there are some annual and perennial species flourish depending upon little amount of rain fell on a narrow belt parallel to the coast. During the summer period, there is almost a complete absence of green fodder and animals face a deficiency in feed stuff.

The vegetation survey of any area poses great importance for any agricultural development plan. Plant collection and identification are the starting point for any range ecology investigation. Since species identification is essential for possible use in range improvement. studying individual plant species include evaluation of native range plants

Natural vegetation studies had been attracted the attention of various investigators, since ancient time. This is because vegetation is important for human and livestock. In Egypt, study of natural plant distribution and chemical contents were suggested by some scientists, especially for the south and middle Sinai region. Moreover, Batanouny (1973) and Moussa (1994 and 2001) referring to the effect of moisture availability under natural habitat conditions, pointed out that the topographic irregularities in Wadi beds are among the most obvious factors affecting the distribution and growth of natural vegetation.

Physiological adjustment of plants to adverse habitat conditions has been extensivelyinvestigated (e.g. Ahmed and Girgis, 1979; El-Monayeri *et al.,* 1979; Zaghloul and Moussa, 2005 and Moussa and Farida, 2007) where they concluded that maintaining a favourable water potential gradient is among the most challenging factors in adjustment of plant species to harsh stress conditions.

Natural vegetation plays a main role as a fodder resource in the world for its importance to the increase non-domestic animal productivity. Range species are very diverse in terms, plant classification, biology, ecology , and nutritive values. They include annual and perennial herbaceous species as well as shrubs and trees (Le Houerou, 1994).

The present investigation was an attempt to evaluate the ecophysiological responses of the natural vegetation occur at the main channel of Wadi El-Bruk (Middle Sinai). The study, in addition to phytosociological characteristics, provides some information about nutritional value that can be used to establish range models for sustainable development plan of the Desert Research Center in future.

MATERIALS AND METHODS

Soil sampling and climate:

The soil samples were taken at one depth (0-60cm) along the main Wadi bed. Because of steeples and flat feature of the main channel, soil samples were mixed together to form one composite sample and were analyzed for electrical conductivity (EC), pH, soluble cations (Na, K, Ca and Mg) and anions (Cl, SO_4), in addition to $CaCO_3$ according to Jachson (1967). The soil particles distribution was carried out according to Kilmer and Alexander (1949). Data of soil analysis and climate are presented in Table (1: A, B and C).

Vegetation study:-

The phytosociological characteristics of vegetation at the main channel of Wadi El-Bruk were studied during spring and autumn in years 2005 and 2006. The vegetation was investigated through ten sites covered the wadi bed. Fifty quadrates of area 5 x 5 m^2 were randomly laid out in each site. The individual species were listed and were identified according to Bolous (1995). Plant cover, abundance, density and frequency were the main criteria determined according to Braun-Blanquet (1964). Also, life form and palatability of each species were evaluated.

Physiological study:-

The plant materials were collected from the main bed of Wadi El-Bruk during spring and autumn seasons. The fresh weight of plant samples were determined then oven dried at 70 ^{0}C to estimated the dry weight. The dried samples were ground to fine powder before subjected to the following measurements:-

Crude protein content: total nitrogen was determined by modified microkjeldahl method according to Peach and Tracey (1956) and multiplied by 6.25 to calculate the CP content.

Total carbohydrate content: was determined according to the method outlined by Dubois *et al*. (1951). Crude fiber and total ash contents: were also determined by using the method described in A.O.A.C. (1970).

Hexane extract content: This constituent was determined by using soxhelt and hexane as a solvent according to A.O.A.C. (1970), potassium and sodium were determined by flame photometer as described by Dewis and Freitas, (1970), chloride content was determined according to Jackson and Thomas (1960).

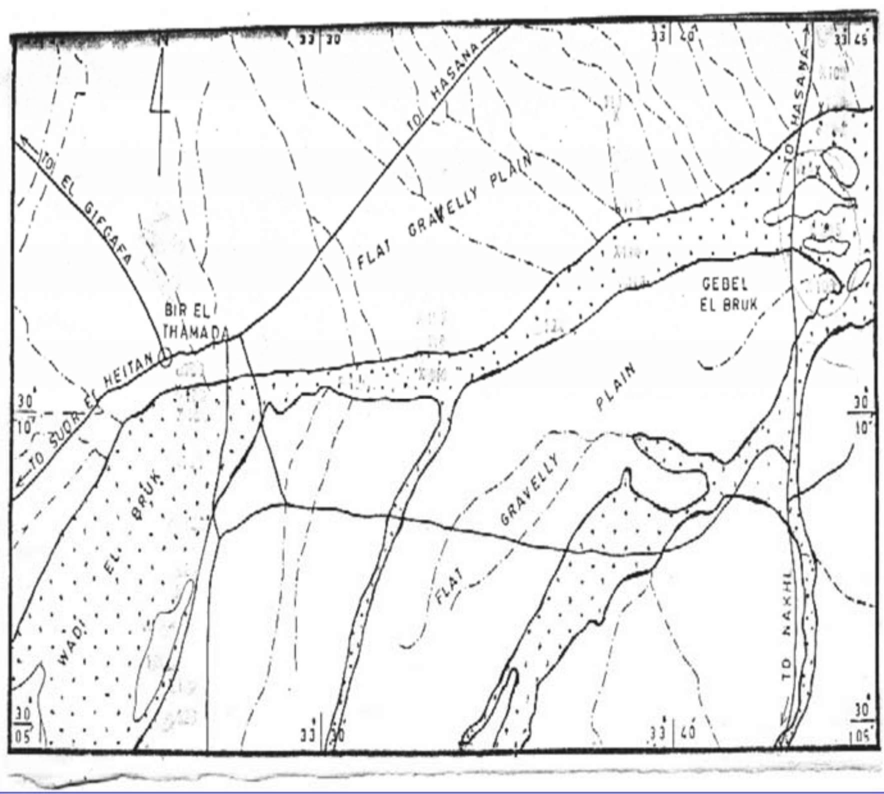

Fig.1. A general map showing the location of Wadi El-Bruk at Middle Sinai

RESULTS AND DISCUSSION

Soil and climate:-

Edaphic and climatic characteristics of the study area are outlined in Table (1: A, B and C). Table (1: A and B) shows the relevant physical and chemical characteristics of Wadi El-Bruk soil. Data of the present investigation showed that the soil was characterized by sand loam texture where the fine fraction (fine sand 47.74, silt 14.93 and clay 18.7 %) were dominant, while the percentage of coarse sand was low (19.16%). Flat, plain and vastness land are the most obvious features of the master channel of Wadi El-Bruk.

Chemically, soils of Wadi El-Bruk are characterized by low salinity level (8.3 Ds/m^{-1}), alkalinity (pH 8.1) and calcareous features ($CaCo_3$ 24.5 %). Both soluble cations and anions exhibit low levels and were 78.5, 0.55, 18.1 and 7.6 me/L for Na, K, Ca and Mg ion contents, respectively, and 78.3 and 23.6 me/L for Cl and SO_4 ion contents. It is evident from the data in Table (1:B) that NaCl is most dominant salt. Shaltout and Sharaf El-Din (1988), Zahran *et al.* (1990), Sheng *et al.* (1994), Moussa (2001) and Zaghloul and Moussa (2005) have clearly demonstrated the importance of edaphic factors, specially salinity, $CaCo_3$ content, topography and moisture availability on vegetation distribution, plant constituents and structure of different plant materials.

Annual climatic conditions recorded by El-Maghara Meterological Station, are presented in Table (1 C) which reflects the medial aridity at middle Sinai, with mild maximum average annual temperature (26.9 ^{o}C) while the minimum temperature reaches (13.2 ^{o}C). The average annual rainfall recorded was 8.67 mm / year during the period of the study. The mean annual evaporation was low, where it reached 11.7 mm / day. The relative humidity reached 49.6 %.

Vegetation:

The floristic composition of the natural vegetation of study area (master channel of Wadi El-Bruk) was qualitatively and quantitively determined in spring and autumn seasons during the two successive years (2005 and 2006) and results are presented in Tables (2 and 3).

Table (1): Soil characteristics and climatic peculiarities of the study area.

Study area	A- Soil particle distribution (%)								
Wadi El-Bruk (Middle Sinai)	Coarse sand	Fine sand	Silt	Clay	Texture class				
	19.16	47.74	14.93	18.17	Sandy loam				
	B- Soil chemical characteristics								
	EC Ds/M^{-1}	pH	$CaCo_3$	Soluble cations me/L				Soluble anions me/L	
				Na	K	Ca	Mg	Cl	SO_4
	8.3	8.1	24.5	78.5	0.6	18.1	7.6	78.3	23.6
	C- Annual average of climatic peculiarities of El-Maghara meteorological station(Middle Sinai)								
	Temperature ^0C		Rains mm / year	R.H. %	Evaporation Mm / year				
	Max.	Min.							
	26.9	13.2	8.7	49.6	11.7				

Regarding the phytosociological characteristics Table (2 and 3), the topographic regularities (flat, plain and sleepless of master channel of Wadi El-Bruk) pointed out the similarity of vegetation, i.e. there is no zonotion pattern of vegetation along the Wadi bed. Data presented in tables (2 and 3) clearly shows that 35 species were identified, of which 31 were perennials. The surveyed species are belonging to 17 plant families. Family chenopodiaceae ranked first with six species, followed by asteraceae and poaceae (4 species each), fabeceae and brassicaceae (3 species), and solanaceae (2 species). The other 11 families each had only one species. *Zilla spinosa* had the highest value of abundance (11.3 %), plant density (0.237/plant) and frequency (73.33 %), while *Lygos raetam* showed the highest value of coverage (34.07 %) during spring seasons of 2005 and 2006, and autumn season of 2006, but *Lygos raetam* showed the highest value of abundance (10.50 %), plant density (0.222/plant), frequency (80.00 %) and coverage (38.21 %) during autumn season 2005.

The present investigation indicated that there is an intimate relation between topographic regularity of the wadi bed and the similarity of the vegetarian. In this regard, Batanouny (1973) and Moussa (1994) concluded that the topographic irregularities in Wadi bed are among the most obvious factors affecting distribution, type and growth form of the natural vegetation. Most of species growing in the main channel of Wadi El-Bruk are woody shrubs and presence of herbs and annuals depends on the amount of rains fall during the rainy season. The perennial species constitute about of 87.7 % of the total surveyed plants. The present results are coincident with the findings of earlier reports (e.g. Abo Deya, 1996, Foda *et al*., 1997 and Heneidy, 2000).

Table (2): Vegetation analysis in Wadi El-Bruk at Middle Sinai area during spring and autumn seasons 2005. A = Abundance, D = Density, F = Frequency C = Coverage

Scientific name	Family	Spring 2005				Autumn 2005			
		A%	D	F%	C%	A%	D	F%	C%
Pergularia tomentosa	Asclepiadaceae	1.41	0.030	13.33	0.087	1.05	0.022	13.33	0.053
Anabasis articulata	Chenopodiaceae	3.89	0.081	33.33	0.305	4.53	0.096	33.33	0.318
Anabasis setifera	,,	3.89	0.081	33.33	0.258	3.48	0.074	26.67	0.351
Atriplex halimus	,,	2.12	0.044	20.00	0.583	3.14	0.067	33.33	0.893
Hammada elegans	,,	2.83	0.059	26.67	0.528	3.48	0.074	33.33	0.578
salicornia fruticosa	,,	-	-	-	-	-	-	-	-
Sueada vermiculata	,,	2.12	0.044	20.00	0.171	-	-	-	-
Achillea fragrntisssima	Asteraceae	6.36	0.133	40.00	1.160	1.74	0.037	13.33	0.362
Artemisia judaica	,,	4.95	0.104	33.33	0.459	2.44	0.052	20.00	0.074
Artemisia monosprma	,,	2.83	0.059	20.00	0.257	2.09	0.044	20.00	0.108
Echinops spinosissimus	,,	0.71	0.015	6.67	0.171	-	-	-	-
Diplotaxis acris	Brassicaceae	-	-	-	-	-	-	-	-
Farsetia aegyptia	,,	6.71	0.141	46.67	0.377	3.48	0.074	33.33	0.073
Zilla spinosa	,,	11.3	0.237	73.33	5.635	8.36	0.178	66.67	1.503
Ephedra alata	Ephedraceae	1.77	0.037	13.33	0.135	-	-	-	-
Euphorbia peplus	Euphorbiaceae	1.41	0.030	13.33	0.131	0.70	0.015	6.67	0.015
Erodium hirtum	Geraniaceae	2.12	0.044	20.00	0.144	2.44	0.052	26.67	0.079
Monsonia senegalensis	,,	1.41	0.030	13.33	0.088	1.74	0.037	13.33	0.057
Chloris gayana	Poaceae	1.41	0.030	13.33	0.088	0.70	0.015	6.67	0.033
Eragrostis diplachnoides	,,	1.06	0.022	13.33	0.070	-	-	-	-
Panicum turgidum	,,	5.3	0.111	40.00	0.378	-	-	-	-
Pennisetum divisum	,,	3.18	0.067	26.67	0.262	1.39	0.030	13.33	0.110
Hedysarum spinosissimum	Fabeceae	-	-	-	-	-	-	-	-
Lygos raetam	,,	9.89	0.207	66.67	34.07	10.50	0.222	80.00	38.21
Trigonella stellate	,,	2.12	0.044	20.00	0.142	1.05	0.022	13.33	0.051
Aspargus stipularis	Liliaceae	2.47	0.052	20.00	0.193	3.48	0.074	33.33	0.164
Nitraria retusa	Nitrariaceae	0.71	0.015	6.67	0.171	2.09	0.044	20.00	0.676
Plantago albicans	Plantaginaceae	1.41	0.030	13.33	0.081	-	-	-	-
Hyoscyamus muticus	Solanaceae	2.47	0.052	26.67	0.242	2.09	0.044	26.67	0.230
Lycium shawii	,,	-	-	-	-	1.74	0.037	20.00	0.072
Tamarix aphylla	Tamaricaceae	2.12	0.044	26.67	9.386	1.74	0.037	26.67	6.321
Thymelaea hirsuta	Thymelaeaceae	1.06	0.022	13.33	0.063	2.44	0.052	26.67	0.123
Piituranthos tortnosus	Umbellipferae	2.12	0.044	20.00	0.679	0.70	0.015	6.67	0.087
Fagonia glutinosa	Zygophyllaceae	2.12	0.044	20.00	0.179	-	-	-	-
Zygophyllum album	,,	6.71	0.141	53.33	2.136	7.32	0.156	53.33	1.647

Table (3): Vegetation analysis in Wadi El-Bruk at Middle Sinai area during spring and autumn seasons 2006.

Scientific name	Family	Spring 2006				Autumn 2006			
		A%	D	F%	C%	A%	D	F%	C%
Pergularia tomentosa	Asclepiadaceae	4.02	0.067	26.67	0.219	2.11	0.037	20.00	0.097
Anabasis articulate	Chenopodiaceae	3.57	0.059	26.67	0.247	3.80	0.067	26.67	0.149
Anabasis setifera	,,	4.46	0.074	26.67	0.289	2.95	0.052	20.00	0.217
Atriplex halimus	,,	4.02	0.067	26.67	0.594	4.64	0.081	40.00	1.127
Hammada elegans	,,	3.13	0.052	26.67	0.470	5.49	0.096	40.00	0.832
salicornia fruticosa	,,	0.89	0.015	6.67	0.048	-	-	-	-
Sueada vermiculata	,,	1.79	0.030	13.33	0.109	0.84	0.015	6.67	0.060
Achillea fragrntisssima	Asteraceae	10.30	0.170	53.33	1.699	3.80	0.067	33.33	0.781
Artemisia judaica	,,	2.68	0.044	20.00	0.212	3.38	0.059	26.67	0.085
Artemisia monosprma	,,	5.80	0.096	40.00	0.521	2.11	0.037	20.00	0.091
Echinops spinosissimus	,,	1.34	0.022	13.33	0.064	-	-	-	-
Diplotaxis harra	Brassicaceae	1.34	0.022	13.33	0.069	0.84	0.015	13.33	0.031
Farsetia aegyptia	,,	5.80	0.096	33.33	0.318	4.64	0.081	26.67	0.088
Zilla spinosa	,,	14.3	0.237	73.33	3.551	11.4	0.200	80.00	2.212
Ephedra alata	Ephedraceae	1.34	0.022	13.33	0.066	-	-	-	-
Euphorbia peplus	Euphorbiaceae	1.34	0.022	13.33	0.071	-	-	-	-
Erodium hirtum	Geraniaceae	2.68	0.044	20.00	0.114	2.11	0.037	20.00	0.061
Monsonia senegalensis	,,	1.79	0.030	13.33	0.091	2.11	0.037	20.00	0.051
Chloris gayana	Poaceae	0.89	0.015	6.67	0.035	1.27	0.022	13.33	0.044
Eragrostis diplachnoides	,,	-	-	-	-	0.84	0.015	6.67	0.051
Panicum turgidum	,,	7.59	0.126	40.00	0.512	2.95	0.052	26.67	0.231
Pennisetum divisum	,,	4.46	0.074	33.33	0.316	2.53	0.044	20.00	0.142
Hedysarum spinosissimum	Fabeceae	0.89	0.015	6.67	0.048	1.27	0.022	13.33	0.087
Lygos raetam	,,	11.6	0.193	60.00	34.38	11.00	0.193	73.33	34.480
Trigonella stellate	,,	1.79	0.030	13.33	0.095	-	-	-	-
Aspargus stipularis	Liliaceae	3.57	0.059	26.67	0.195	3.38	0.059	33.33	0.132
Nitraria retusa	Nitrariaceae	1.34	0.022	13.33	0.405	3.38	0.059	20.00	0.097
Plantago albicans	Plantaginaceae	1.79	0.030	13.33	0.084	2.95	0.052	26.67	0.231
Hyoscyamus muticus	Solanaceae	2.68	0.044	20.00	0.284	3.38	0.059	33.33	0.306
Lycium shawii	,,	1.79	0.030	20.00	0.093	-	-	-	-
Tamarix aphylla	Tamaricaceae	3.57	0.059	33.33	13.17	2.53	0.044	33.33	7.512
Thymelaea hirsute	Thymelaeaceae	-	-	-	-	3.80	0.067	33.33	0.157
Piituranthos tortnosus	Umbellipferae	7.59	0.126	46.67	1.719	1.27	0.022	13.33	0.127
Fagonia glutinosa	Zygophyllaceae	1.34	0.022	13.33	0.079	-	-	-	-
Zygophyllum album	,,	6.70	0.111	40.00	1.644	9.70	0.170	60.00	2.071

Physiological study:

In the present investigation, evaluation of the nutritive value and palatability of plants were based on their chemical composition and field observations. plant materials were analyzed for crude protein (CP), crude fiber (CF), total carbohydrate (TC), total ash (TA), dry matter (DM), hexane extract (HE) and mineral ion (Na, K and Cl) contents during spring and autumn. The results are presented in Tables (4 and 5).

The results showed that there was fluctuation in differences of all analyzed parameters of the plant materials within and between spring and autumn. Dry matter for example, fluctuated within a wide range during the two seasons; i.e. there is a pronounced increase of dry matter during autumn, while it decreased during spring. The total average dry matter reached 46.5 and 40.2 during autumn and spring, respectively. The total average dry matter reached 46.5 and 40.2 during autumn and spring, respectively. This may be due to the variation in water content of the plants during dry and wet seasons, Tables (4 and 5). In this regard, Ahmed and Girgis (1979), Zoghoul and Moussa (2005) reported that the creating a favorable water potential gradient is the most challenging factor in the physiological adaptation of the different species to environmental stress conditions.

Concerning organic constituent (CP, TC, CF and HE), results of the present study clearly indicated that their total averages varied within narrow ranges during the two seasons of the study. They were 9.34, 34.4, 26.4 and 3.15% for CP, TC, CF and HE, respectively during spring (Table 4), while the values were 8.73, 32.88, 28.56 and 3.41 during autumn (Table 5). It was found that, during spring, *Lygos raetam* had the highest value of CP (13.83 %), followed by *Panicum turgidum* (13.58 %), while the lowest value (6.23 %) was attained by *Hyoscyamus muticus*. Concerning total carbohydrate (TC), it is evident that *Pennisetum divisum* had the highest level (42.56 %), followed by *Anabasis articulatus* (39.57 %), while *Sueada vermiculata* had the lowest value (29.57 %). In regard to hexane extract (HE), it was found that *Artimisia monsperma* attained 5.12 %, while *Chlorus gayana* had the lowest level (1.97 %). These parameters were more or less the same during the autumn season with few exceptions (Table 5).

Table (4): Chemical contents of native plants specie at Wadi El-Bruk in Middle Sinai area in spring season. Pal = Palatability P = Palatable Unp = Unplatable

Scientific name	Family	CP %	TC %	CF %	TA %	HE %	K %	Na %	Cl %	D.M %	Pal.
Pergularia tomentosa	Asclepiadaceae	7.35	35.58	23.21	27.85	3.09	2.87	2.44	1.67	43.57	P
Anabasis articulate	Chenopodiaceae	11.91	39.82	24.44	23.35	2.15	3.45	2.28	1.58	41.25	P
Anabasis setifera	,,	9.89	36.42	26.75	20.67	3.19	2.97	2.08	1.71	42.84	Unp.
Atriplex halimus	,,	13.11	34.55	24.62	23.45	2.85	2.35	3.57	2.45	39.14	P
Hammada elegans	,,	7.79	35.58	27.83	24.72	2.35	2.94	2.84	2.15	44.36	P
salicornia fruticosa	,,	6.56	31.20	27.59	27.69	3.12	3.08	2.24	1.87	44.59	Unp.
Sueada vermiculata	,,	8.35	29.57	27.36	26.41	3.24	3.08	2.10	1.98	37.28	P
Achillea fragrntisssima	Asteraceae	12.59	32.54	28.69	21.28	4.26	3.26	2.34	2.07	47.39	Unp.
Artemisia judaica	,,	10.59	37.52	24.78	20.85	4.67	2.67	2.25	1.78	31.59	P
Artemisia monosprma	,,	9.95	36.45	27.97	18.67	5.12	3.15	2.41	2.13	33.59	P
Echinops spinsissimus	,,	11.25	31.59	25.65	27.25	2.78	2.69	2.17	1.69	38.97	P
Diplotaxis harra	Brassicaceae	7.23	33.41	26.45	28.79	2.09	2.67	2.04	1.79	42.55	P
Farsetia aegyptia	,,	7.64	35.95	31.57	19.32	3.09	3.29	2.44	2.19	34.82	P
Zilla spinosa	,,	8.84	39.26	28.84	18.29	2.17	2.49	3.27	2.34	49.54	P
Ephedra alata	Ephedraceae	8.12	32.58	26.74	25.31	3.74	1.98	2.32	1.78	46.29	P
Euphorbia peplus	Euphorbiaceae	7.25	33.35	27.68	25.97	3.25	2.33	1.86	1.34	42.55	P
Erodium hirtum	Geraniaceae	7.51	34.56	25.16	26.49	2.97	2.25	1.99	1.23	47.79	P
Monsonia senegalensis	,,	6.98	34.58	28.34	23.38	3.16	2.68	2.37	2.05	42.55	P
Chloris gayana	Poaceae	8.39	36.47	26.58	24.28	1.97	3.29	2.49	2.27	48.39	P
Eragrostis diplachnoides	,,	9.65	33.68	27.91	23.75	2.56	2.34	3.04	2.29	40.19	P
Panicum turgidum	,,	13.58	34.68	24.21	29.64	2.08	3.46	2.16	1.88	38.99	P
Pennisetum divisum	,,	8.67	42.58	23.67	21.59	3.19	3.25	2.68	2.30	43.08	P
Hedysarum spinosissimum	Fabeceae	8.55	31.75	28.45	25.12	3.15	3.09	2.55	2.16	39.38	P
Lygos raetam	,,	13.83	35.44	21.57	23.74	3.22	3.09	2.57	2.42	39.25	P
Trigonella stellate	,,	12.35	31.89	26.48	22.51	3.67	2.15	3.11	2.27	37.88	P
Aspargus stipularis	Liliaceae	6.94	32.45	28.47	26.18	2.59	2.99	3.42	2.55	40.66	P
Nitraria retusa	Nitrariaceae	9.82	30.78	25.49	27.56	3.31	2.74	3.67	2.59	35.67	P
Plantago albicans	Plantaginaceae	10.25	34.15	22.94	24.19	4.07	2.41	2.88	1.75	37.48	P
Hyoscyamus muticus	Solanaceae	6.23	36.57	26.47	23.29	4.23	3.05	2.74	1.88	32.59	P
Lycium shawii	,,	9.98	35.41	27.84	21.64	3.24	3.14	2.77	2.23	45.85	Unp.
Tamarix aphylla	Tamaricaceae	8.32	35.29	29.14	22.53	2.61	2.79	3.21	2.26	43.67	P
Thymelaea hirsute	Thymelaeaceae	7.20	31.40	25.74	27.66	2.97	2.48	2.85	2.31	38.97	Unp.
Pituranthos tortnosus	Umbellipferae	9.53	33.62	26.25	22.13	3.52	3.29	2.64	2.19	34.57	P
Fagonia glutinosa	Zygophyllaceae	10.15	34.25	23.47	26.85	3.84	2.09	1.99	1.25	36.25	P
Zygophyllum album	,,	10.52	33.49	26.14	23.57	2.71	1.97	3.77	2.37	24.68	Unp.
Total average		9.34	34.43	26.41	24.17	3.15	2.80	2.62	2.02	40.23	

Table (5): Chemical contents of native plants specie at Wadi El-Bruk in Middle Sinai area in autumn season. Pal = Palatability P = Palatable Unp = Unpalatable

Scientific name	Family	Autumn season									
		CP %	TC %	CF %	TA %	HE %	K %	Na %	Cl %	D.M %	Pal.
Pergularia tomentosa	Asclepiadaceae	6.75	33.88	26.94	28.78	3.48	3.25	2.64	1.86	53.41	P
Anabasis articulate	Chenopodiaceae	10.25	36.48	27.58	25.99	2.64	3.26	2.74	1.95	52.39	P
Anabasis setifera	„	9.45	34.74	28.94	22.35	3.69	2.59	2.38	2.01	54.19	Unp.
Atriplex halimus	„	11.95	31.55	29.15	24.56	3.14	2.14	3.74	3.05	49.78	P
Hammada elegans	„	7.29	30.58	28.97	27.41	2.85	2.76	3.15	2.46	56.48	P
salicornia fruticosa	„	6.27	29.84	31.99	29.24	3.81	2.78	2.91	2.51	55.78	Unp.
Sueada vermiculata	„	7.98	28.78	31.58	27.55	3.56	2.71	2.55	2.19	46.17	P
Achillea fragrntisssima	Asteraceae	11.08	31.15	29.97	24.11	4.69	3.14	2.85	2.35	58.54	Unp.
Artemisia judaica	„	10.19	35.74	27.25	22.09	4.93	2.58	2.37	1.81	41.34	P
Artemisia monosprma	„	8.85	34.88	28.16	20.31	5.39	2.94	2.75	2.31	44.97	P
Echinops spinsissimus	„	10.88	30.54	27.49	27.12	2.89	2.56	2.51	2.08	45.88	P
Diplotaxis harra	Brassicaceae	7.05	32.52	28.67	29.49	2.67	2.31	2.32	1.83	51.64	P
Farsetia aegyptia	„	7.38	34.77	32.15	21.44	3.50	2.94	2.81	2.42	43.58	P
Zilla spinosa	„	8.19	37.59	30.45	20.56	2.88	2.34	3.45	3.17	62.17	P
Ephedra alata	Ephedraceae	-	-	-	-	-	-	-	-	-	-
Euphorbia peplus	Euphorbiaceae	6.95	32.08	28.99	27.19	3.45	2.18	2.25	1.84	52.69	P
Erodium hirtum	Geraniaceae	7.15	32.83	27.88	27.59	3.14	2.08	2.41	2.16	56.78	P
Monsonia senegalensis	„	6.51	33.84	28.94	25.74	3.84	2.55	2.61	2.18	53.19	P
Chloris gayana	Poaceae	7.95	34.92	28.09	27.41	2.55	2.86	2.78	2.39	62.57	P
Eragrostis diplachnoides	„	9.13	32.55	29.78	25.14	2.85	2.19	3.25	2.45	51.79	P
Panicum turgidum	„	12.53	33.84	27.81	29.85	2.67	3.15	2.75	2.29	46.66	P
Pennisetum divisum	„	8.24	39.87	26.55	22.74	3.45	2.94	2.88	2.43	52.71	P
Hedysarum spinosissimum	Fabeceae	8.15	30.25	30.16	26.22	3.59	2.85	2.79	2.39	47.7	P
Lygos raetam	„	12.25	33.78	24.57	24.39	3.45	2.91	2.84	2.65	43.67	P
Trigonella stellate	„	11.08	29.85	27.49	25.99	3.91	2.05	3.45	2.49	44.18	P
Aspargus stipularis	Liliaceae	6.29	30.75	30.14	27.92	2.84	2.65	3.55	2.74	49.87	P
Nitraria retusa	Nitrariaceae	9.06	28.89	27.59	28.47	3.55	2.43	3.78	2.95	47.34	P
Plantago albicans	Plantaginaceae	9.86	32.79	24.59	25.99	4.35	2.22	3.15	2.84	46.38	P
Hyoscyamus muticus	Solanaceae	6.17	33.95	28.78	25.46	4.65	2.84	2.91	2.42	37.49	P
Lycium shawii	„	9.04	33.65	28.49	23.75	3.56	3.64	2.93	2.56	53.69	Unp.
Tamarix aphylla	Tamaricaceae	7.92	33.77	29.80	24.70	2.89	2.67	3.45	2.86	52.18	P
Thymelaea hirsute	Thymelaeaceae	7.02	30.25	27.48	28.05	3.19	2.31	2.94	2.40	44.08	Unp.
Piituranthos tortnosus	Umbellipferae	9.23	32.84	27.55	23.47	3.72	2.99	2.83	2.30	41.32	P
Fagonia glutinosa	Zygophyllaceae	-	-	-	-	-	-	-	-	-	-
Zygophyllum album	„	10.08	31.29	28.45	24.58	2.77	1.77	3.86	3.00	28.49	Unp.
Total average		8.23	31.00	26.93	24.16	3.27	2.50	2.76	2.27	46.55	

With respect to inorganic intermediates (total ash, sodium, potassium and chlorides) all exhibited similar pattern as organic constituents. It was found during spring that the highest value of total ash content (29.64 %) was attained by *Panicum turgidum*, followed by *Deplotaxis harra* (18.29 %), *Pergularia tomentosa* (27.85 %) and *salicornia fruticosa* (27.69 %). The lowest ash accumulation (18.29 %) was gained by *Zilla spinosa*. The highest Na (3.77 %), K (3.46 %) and Cl (2.59 %) ions content were attained by *Zygophyllum album*, *Panicum turgidum* and *Nitraria retusa*, respectively, while *Euphorbia peplus*, *Zygophyllum album* and *Erodium hirtum* accumulated the lowest content of the these ions (Table 4).

During autumn (dry season) total average of some organic constituents such as crude fiber and hexane extract increased while percentage of TC and CP declined. Total average of organic in intermediates (CP, TC, CF and HE) reached the values of 8.73, 32.88, 28.56 and 3.41 %, respectively (Table 5). Similarly, the inorganic intermediates (total ash, sodium and chlorides) followed the same trend as organics during the two seasons. These traits, varied among the species. The highest values of total ash, K, Na and Cl ion contents were found in *Panicum turgidum* (29.85 %), *Lycium shawii* (3.64 %), *Zygophyllum album* (3.86 %) and *Zilla spinosa* (3.17 %), respectively, while the lowest content of the same constituents were attained by *Artimisia monsperma* (20.31 %), *Zygophyllum album* (1.77 %), *Euphorbia peplus* (2.25 %) and *Artemisia judaica* (1.81 %), respectively. These variations in accumulation of organic and inorganic constituents clearly indicate that some species are electrolytic dependants, while others are non-electrolytic dependants in their adaptive responses to the prevailing environmental conditions. The results of the present investigation were in accordance with those reported by Ahmed and Girgis (1979), El-Monayeri *et al.* (1986), Abd El-Rhman and Haraz (1994), Mosallam and Abd El-Maksoud (1996), Moussa (1994) and Zaghloul and Mussa (2005) where they concluded that plant species have two modes of physiological adaptation to the environment stresses; xerophytes depend to large extant on accumulation of organic constituents in building up their osmotic potential, whereas halophytes depend mainly on the accumulation of electrolytes and to less extent on organic intermediates.

Palatability evaluation:

In the present study, the palatability of plants consisted of qualitative and quantitative components; a) observations of grazed plants by animals and b) chemical compositions of plant species as nutritional value for domesticated and non-domesticated animals in the study area.

Seasonally, observations of the study area showed that a large number of perennials or annuals were palatable species (Tables 4 and 5). The palatable plants in turn are divided into palatable and unpalatable ones. Le Houerou (1980) stated that palatability of range plants is very complicated expressions, very difficult to be generalized as it is linked to many factors that vary with time and place. Some of these variables are linked to the plant, others to the animal variety, while a third category depends on various environmental factors.

From nutritional value point of view, palatability of the plants may be attributed to their chemical constituents; either organic or inorganic ones. Accordingly, data presented in Tables 4 and 5 clearly indicated that there were 29 palatable species while 6 species ranked as unpalatable.

The highly palatable plant species in the present study generally were found among *Panicum turgidum*, *Atriplex halimus*, *Plantago albicans*, *Lycium shawii* and *Lygos raetam*. The palatability of such species my be attributed to their high contents of CP, CF, TC and some mineral ions. In this regard, **Youssef (1999)** found that the factors related to plants palatability include their chemical make up.

Apart from ecological and physiological responses of plants to different environmental stresses, the palatability of natural vegetation requires further studies to put the optimal notion for building up an ideal forage models in desert areas.

Conclusion

The master channel of Wadi El-Bruk provides an ideal location for establishment of a good model of range map at middle Sinai due to its flat, plain and vastness land. Its soil characterized by alkalescent and low salinity levels, Accordingly, due to topographic regularity, there is no zonation pattern of vegetation along the wadi bed. The woody perennials (shrubs and under shrubs) are mostly represented , while the presence of annuals depends, to a large extent, on the amounts of rains.

Seasonally, it can be concluded that there is an intimate relationship between accumulation of organic or inorganic intermediates and the environmental stresses. The plant species of the study area vary considerably in their chemical composition, which affect their palatability. The woody perennials xerophytes *Lygos raetam, Pennisitum divisum, Tamarix aphylla, Artemisia monosperma* and *Panicum turgidum* were considered as the most important pasture for different livestock due to their higher crude fiber, hexane extract and total ash contents. They have a unique photosynthetic potential due to their life form, huge volume and canopy structure. Thus, it is necessary to improve the study area through better sustainable range management plan.

REFERENCES

Abd El-Rahman, K.M. and F.M. Harraz. 1995. Chemical composition and nutritive value of the two wild herbs: *Rhanterium epapposum* and *Francoeuria crispa* growing in the Qassim region, Saudi Arabia. Menofiya J. Agric. Res., 20(6): 2251-2260.

Abou Deya, I.B. 1996. Natural vegetation in arid condition range lands. . Desert Inst. Bull., A.R.E., 46(2): 353-364.

Ahmed A.M. and W.A. Girgis. 1979. Adaptive responses of plants of different ecological groups from Wadi Gharandal, Sinai, Egypt. Desert Inst. Bull., A.R.E., 29 (2): 487-512.

Association of Official Agriculture Chemists (A.O.A.C). 1970. Official Methods of Analysis. Washington, D.C., U.S.A. 11th ed. Pp.832.

Batanouny, K.H. 1973. Habitat features and vegetation of desert and Semi-desert in Egypt. Veget., 27: 181-189.

Boulos, L. 1995. Flora of Egypt check-list. Al-Hadara puplishing, Cairo, Egypt

Braun- Blanquet. J. 1964. Plant Sociology. Translated by G.D. Fuller and H.S. Conard. McGraw-Hill Book Co., Inc., New York.

Dewis, J. and F. Freitas. 1970. Physical and chemical methods of soil and water analysis. Food and Agric. Organ. United Nations. Soils Bulletin, No. 10.

Dubois, M.; K. Gillies; J.K. Hamilton; P.A. Rebers and F.Smith. (1951). A colourimetric method for determination of sugars. *Nature*: 164: 167-168.

El-Monayeri, M.O.; K.L. Hammadi and S.A. Al-Jasim. 1979. Eco-physiological studies of some plants of Safwan desert area, Iraq. 1-Natural vegetation and mineral accumulation. Desert Inst. Bull., A.R.E., 29 (2): 527-542.

El-Monayeri, M.O.; O.A. Khafagi, A.M. Ahmed and H. El-Tantawy. 1986. Contribution to the chemical composition of plants belonging to various ecological groups in the Red Sea area. Desert Inst. Bull. A.R.E., 36 (2): 405-430.

Foda, H.A.; I.A.M. Tolba; A.K. Youssef and M.M. Morsi. 1997. Ecological and Eco-physiological studies on Sea Lavender *Limonium pruinosum L.* Var *hirtiflora*. Desert Inst. Bull., A.R.E., 47(2): 391-421.

Heneidy, S.Z. (2000). Palatability, chemical composition and nutritive value of some common range plants from Bisha, Asir region, South-Western Soudi Arabia. Desert Inst. Bull. Egyp, 5 (2): 345-360.

Jackson, M.L. 1967. Soil Chemical Analysis. Printce-Hall of India Privat Newdelhi, India.

Jackson, W.A. and Thomas, G.W. (1960). Effect of KCl and Dolometic limestone on growth and ion uptake of sweet potato. *Soil Sci*,, 89: 347-352.

Kilmer, V.J. and L.T. Alexander. 1949. Method of making mechanical analysis of soils. Soil Sci.; 68: 15-24.

Le-Houerou, H.N. 1980. Browse in Northern Africa. In: Le Houerou, H.N. (ed). Browse in Africa, Pp. 55-82. Addis Aboba: JLICA. 491-PP.

Le-Houerou, H.N. 1994. Forage Halophytes and Salt-Tolerant Fodder Crops in the Mediterranean Basin. In: Squires, V.R., and Ayoub, A.T. (eds), Halophytes as resource for livestock husbandry; Problems. Pp 123-137. Bordecht. The Neither Lands: Klower Academic Publisher.

Mohammed, H.A. 1997. Gelogical and geomorphological impact on the water resources in central Sinai, Egypt. Ph.D. Thesis, Geol-Dept. Fac. Sci., Ain Shams Univ.

Mosallam, H.A.M. and Kh.A. Abd El-Maksoud. 1996. Ecophysiological studies of some desert plants growing in different saline microhabitats in Salhyia area, Egypt. Desert Inst. Bull., A.R.E., 46(1):9.28.

Moussa, E.E.A. 1994. Studies on the plant ecology of the desert fringes and turtle backs of the Nile Delta. M. SC. Thesis, Botany Dep., Fac. Sci., Menofiya university.

Moussa, E.E.A. 2001. On the autecology of *Taverniera aegyptiaca* Boiss and *Ochradenus baccatus* Del. Ph. D. Thesis, Plant Dept., Fac. Sci., Ain Shams University.

Moussa, E.E.A and Farida, M. El-Saied. 2007. Ecophysiological and biotechnological studies on four species naturally growing in Siwa Oasis, Egypt, J. environ. Sci., 34: 65-91.

Peach, K. and M.R. Tracey. 1956. Modern Methods Plant Analysis. Vol.1 Springer Verlage, Berlin, 4: 643.

Shaltout, K.H. and A. Sharaf El-Din. 1988. Habitat types and plant communities of the common crops in the Nile Delta region. Feddes Report., 99: 153-162.

Sheng, O.W.; Qi-Yn. Wang and D.S. Xie. 1994. Quantitative analysis of weed communities of summer crops in Huqui Country of Anhui Province. J. Plant Resources and Environment., 3 (2): 39-44.

Youssef, K.M. 1999. Improving the palatability and nutritive value of some range plants for goat feeding in Sinai. Ph. D. Thesis, Fac. Agric., Ain Shams Univ., Cairo, Egypt.

Zaghloul, A.K. and E.E.A. Moussa 2005. Ecophysiological responses of some psammophytes at north Sinai and Siwa Oasis. Egyptian J. Desert Res., 55 (2): 281-295.

Zahran, M.A.; M.A. El-Demerdash and I.A. Mashaly. 1990. Vegetation types of the deltaic Mediterranean coast of Egypt and their environment, J. Veg. Sci., 1: 305-310.

دراسات ايكوفسيولوجية علي الغطاء النباتى بوادى البروك

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أجريت الدراسة الحالية بالمجرى الرئيسي لوادى البروك بمنطقة وسط سيناء لتقييم الصفات الايكوفسيولوجية للغطاء النباتى الطبيعى، بالإضافة إلى تقديم بعض المعلومات عن المكونات الكيميائية للنباتات كقيمة غذائية بهدف تأسيس نماذج علفية مستقبلا من خلال خطة التنمية المستدامة لمركز بحوث الصحراء فى المناطق الصحراوية.

- أوضحت النتائج أن منطقة الدراسة تميزت بالا راضى الواسعة المسطحة والممهدة- التربة ذات قوام رملى طينى – مستوى ملوحة منخفض، خفيفة القلوية وذات صفات كلسبة، كما تميزت أيضا بمناخ معتدل.

- كما أظهرت النتائج تماثل الغطاء النباتى وذلك نتيجة لطبوغرافية مجرى الوادى المنبسطة. سادت الأنواع المعمرة (شجيرى وتحت الشجيرى) و اعتمد ظهور النجيليات والحوليات على كمية الأمطار المتساقطة.

- تم تقييم الاستساغة النباتية على أساس المشاهدات الحقلية والتركيب الكيميائى.

- أوضحت الدراسة أيضا أن هناك علاقة وثيقة بين الظروف البيئية السائدة وتراكم المركبات سواء العضوية أو الغير عضوية خلال حوسمى الدراسة (الخريف و الربيع).

- اعتمدت بعض النباتات على تراكم المواد العضوية بصورة واضحة، بينما اعتمد البعض الأخر على تراكم العناصر المعدنية فى انضباضها الفسيولوجى تجاة الظروف البيئية المناوئة.