OnLine Journal of Biological Sciences 2(2): 136-142, 2002

Role of Indicator Range Species as Browsing Forage and Effective Nutritive Source, in Matruh Area, a Mediterranean Coastal Region, NW- Egypt

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Abstract: The study reveals that the area is occupied with 39 perennial and 43 annual species, Chamaephytes are the most dominant life-forms. Also the area (which include 32 sampling sites) composed of 5 different habitats. About 38% of the studied are sites suffering from high grazing pressure. In addition 66% of the habitats are found to be good pasture. Moreover based on abundance and palatability, 5 to 7 species are considered as indicator species in each habitat. *Atriplex halimus* and *Asphodelus ramosus* are the most common ones. About 51% of the perennial species are highly palatable. The grazing value (dependent upon the high content of crude protein, minerals, and low crude fibers content) was high for 69 and 49% for the perennials and annuals species respectively. Therefore the pasture condition in the studied area can be considered good. The average level of the digestible crude protein (DCP, 5.7%), total digestible nutrients (TDN, 67%), gross energy (GE, 3,976 kcal kg^{-1}), digestible energy (DE, 3,274 kcal kg^{-1}) and metabolizable energy (ME, 2,824 kcal kg^{-1}). In the study area all refer to that the present pasture is able to meet the feed demands of the grazing animals and these animals receive most of their energy requirements. The energy content is however equivalent 0.84 of the Scandinavian feed unit.

Key words: Palatability, nutritive value, indicator species, pasture condition, Matruh area

Introduction

The coastal Mediterranean region particularly the arid and semi-arid parts of Africa has a long history of intensive land-use, mainly for grazing and rainfed farming. According to Duivenbooden (1985) rangeland, the major feed resources, occupies an estimated 90% of the total area of such coastal zone. In this zone many areas their vegetation is dominated by shrubs and sub-shrubs. The annuals occur only in a limited extent because of weather conditions and the increased animal density. According to Le Houèrou (1980a), there are about 1.5 million heads of animals are normally present that overcome the feed from rangeland vegetation throughout the year that makes supplementary feed to be a must. Subsequently sustainable development and improvement of the grazing system (including biomass, and nutritive values) are very important for continuity, particularly in the present Mediterranean coastal area (e.g. Matruh).

The information needed about the pasture of the present coastal area are: (1) identification of range species and their life-forms, (2) estimatation of the physical grazing characters of the rangeland species and assessment to their grazing value and palatability (3) determination of the nutritive value of the plants in a purpose to evaluate the quality and quantity of the forage, and (4) focusing or throwing light on the role of the browse species in the grazing system (these species which are most efective in the range system, called key species). Key mangement species are however those on which the grazing management of a specific range is based. The key species serve as indicator of management effectiveness. Generally, when the key species are wisly used, the entire pasture is considered to be correctly used.

The present study is initiated to collect information about pasture in Matruh area which is one of the most richest area for grazing in the Egyptian coastal region. It is worthy to mention that in Egypt there are about 2.5 million hectares of arid rangelands of the chamaephytic steppe type (Le Houèrou, 1980a), 50% of this area occurred in its North West of the coastal region on the Mediterranean sea.

Materials and Methods

The study area is about 200 km west of Alexandria. Its area extends to about 30 km southwords in the inland plateau and transversely to about 10 km from west to east parallel to the sea shore. It lies between the following longitudes and altitudes (30° 30' – 31° 10'N, 27° 30' – 28°E). The area includes different physiographic units leading to variety of habitats Geomorphologically, it is a part of the Egyptian western desert and it is a plateau with numerous large and deep topographic depressions. Its soil is young, and essentially alluvial (Kamal, 1988). They are derived from two main sources (a)- the table land (inland plateau) composed essentially of limestone alternating with strata and shale; and (b)- beach deposits composed of calcareous oolitic grains. The dominating land use is grazing by domestic animals. Climatologically, this area is classified as arid with mild winter and warm summer (UNESCO, 1977).

The present study was carried out during the two climatic conditions charecterzing this area of the Mediterranean region, the wet season (winter and spring) and the dry season (summer and autumn). The study area was geomorphlogically classified into 5 habitats (Table 3) rocky plateau, flat plateau, rocky ridge, non-saline depression and saline depression. At the beginning of the study several flocks of grazing animals (sheep, goats and camels) were observed at each site for several times, to explore which species is preferred applying same methods of Abdel-Razik *et al.* (1988a, b); Genin and Badan-Dangon (1989) and Heneidy (1992 and 1996). The grazing pressure was assessed by: (1) determination of the stocking rate at each site, and (2) according to the status and abundance of the vegetation. These two parameters were taken to estimate the grazing pressure and pasture condition (El-Kady, 1983 ; Heneidy and Bidak, 1998). Floristic identification was made according to Täckholm (1974) and the Latin names of species were updated following Boulos (1995). Pasture condition based on the distribution and the valuable of rangeland species were recorded at each site

Selection of the key species: At each habitat the key species (indicator species) are selected according to abundance and palatability of the plant species. At each site from five to seven species are recorded in each site as key species. Key management species are those on which the grazing management of a specific range is based. These species are ligneous plant and considered of constant biological resource, i.e., most of them are the main feeding source throughout the year (Holechek, 1988). The key species also serve as indicators of management effectiveness.

Chemical analysis: Chemical analysis was carried out on the samples collected during the wet season (the growing season) where, the maximum consumption of the rangeland species. These samples are eaten parts (grazeable parts) of each indicator species at each site. Before analysis the samples were cleaned and dried. The analysis performed were to determined the following parameters: (a) total carbohydrates (nitrogen free extract, (NFE) according to Murata *et al.* (1968). (b) Crude protein CP, © ether extract (EE) and ash content according to Allen *et al.* (1974). (d) Crude fiber (CF) using the formula [CF = 100 – (CP + EE + NFE

+ ash)] after Le Houèrou (1980b). (e) Digestible crude protein (DCP) using Demarquilly's equations DCP = 0.93 CP – 3.52 after De Ridder *et al.* (1982). This equation is only valid in the case of nitrogen concentration among of 3 to 0.61 % (or CP > 3.81 %) TDN after Abu-El- Naga and El Shazly (1971). (f) Energy contained in food (gross energy, or energy intake, GE) was determined according to Petrusewicz (1976). (g) The diet gross energy was calculated from its approximate analysis components multiplied by their average of heat of combustion (Lofgreen, 1951). (h) Digestible and metabolizable energy (DE and ME) were calculated according to Crampton and Harris (1969).

Through the long and continuous field observations, the degree of preference for each species was assessed and the consumption rate of each species was determined. After getting the results of the above mentioned parameters palatability can be assessed (Heneidy, 1992 , 1996; Heneidy and Bidak, 1996)

Results

The study shows that the grazing system in the present investigated Matruh area composed of eighty two species [out of them 39 are perennials and the rest (43) are annuals]. Table 1, contains the list of the families, life-forms, palatability rate, grazing value, consumed parts and livestock (that each species) prefer of the plant species found. From the Table it is easy to see that the most abundant life-forms of the species are chameophytes. Also, about 51% of the perennial species are highly palatable, while the palatable and low palatability are only 38 and 10%, respectively. On the other hand, for annual species there are only 30% highly palatable, while the palatable and low palatability, are representing 44 and 16% respectively. The rest (9%) are unpalatable species (occasionally palatable) for livestock.

In addition, about 82% of the perennial species attained high grazing value (51% of them are of very highly-, 31% high-, and 18% low- grazing value). On the other hand, the annuals about 49% attained high grazing value (only 5% of these are of very highly grazing value), and 51% attained low grazing value. The perennial indicator species are frequently found at each site of the study area (Table 2). The woody species *Atriplex halimus* is the most frequent indicator species (found in 59% of the total sites) in the study area. This followed by *Asphodelus ramosus* and *Salsola tetrandra* in 56 and 50% of the total sites respectively.

Table 3 shows that pasture condition, grazing pressure and the amount of rainfall of the different sites of the study area. It is clear that about 59% of all sites is generally a good pasture condition depending upon the type of the vegetation, the dry matter production and the contribution of the palatable species. In the mean time 22% of the total sites are fair pasture condition while, the rest (19%) are poor pasture condition. Generally on habitat levels about 38% of the habitats are suffering from highly grazing pressure while, 34 and 28% under moderate and low grazing pressure respectively. Fifty nine percent of habitats are good pasture while, 22 and 19% may be considered to have fair and poor pasture condition respectively. The maximum amount of rainfall (173 mm) is attained at site number 16, while the minimum is (6.5 mm) at site 26. The maximum average rainfall is noticed in the saline depression 107 ± 9 mm, followed by 77.8 ± 13.7 mm in the rocky plateau habitat.

The individuals indicator species in all sites were difficult to organize for chemical analysis so that all individuals at each habitat were collected together in a composite sample for chemical analysis as a habitat indicator species. Results of the chemical composition of the indicator species (grazeable parts) of each

Table 1: List of plant species, families, life-forms, palatability, grazing value, stock type and consumed part in Matruh area

Species	Family	Life-form	Palata-Bility	Grazing value	Stock type	Consumed part
Perennials						
Anabasis articulata (Forssk.) Moq	Chenopodiaceae	Ch.	P	VH	CSG	Yb, F
Anabasis oropediorum Maire	Chenopodiaceae	Ch.	VHP	VH	CSG	Yb, F
Artemisia herba-alba Asso.	Compositae	Ch.	VHP	VH	SGC	Yb, F
Argyrolobium uniflorum (Decne.) Jaub&Spach	Leguminosae	Ch.	VHP	VH	SGC	Yb
Asphodelus ramosus L.	Liliaceae	G.	HP	VH	GS	Yl,Dl,l
Astragalus sieberi DC	Leguminosae	Ch.	HP	VH	CGS	Yb. Fl
Astragalus spinosus (Forssk.) Muschl	Leguminosae	Ch.	VHP	VH	CGS	Yb, Fl
Atriplex halimus L.	Chenopodiaceae	Ch/P	HP	H	CSG	Yb. L
Carthamus lanatus L.	Compositae	Ch.	P	H	CGS	Head,L
Centaurea alexandrina Descr & Delile	Compositae	Ch.	LP	L1	CGS	Head
Deverra tortuosa (Desf.) DC., Prodr	Caryophyllaceae	Ch.	VHP	L1	SGC	Yb
Echiochilon fruticosum Desf.	Boraginaceae	Ch.	VHP	VH	SGC	Yb, L
Echinops spinosissimus Turra.	Compositae	Ch.	P	H	CGS	Head,Yb
Gymnocarpos decandrum Frossk.	Caryophyllaceae	Ch.	VHP	H	SGC	Yb, L
Haloxylon scoparia Pomel Noum.	Chenopodiaceae	Ch.	P	VH	CSG	Yb, L
Helianthemum kahiricum Del.	Cistaceae	Ch.	HP	VH	SG	Yb. L
Helianthemum lippii (L.) Pres.	Cistaceae	Ch.	VHP	VH	SG	Yb, L
Kickxia aegyptica Dumart.	Scrophulariaceae	Ch.	P	H	CGS	Yb, L
Launaea nudicaulis (L.) Hook.	Compositae	Hc	VHP	VH	SG	Ab.Gr
Lygeum spartum Loefl. Ex. L.	Gramineae	Hc	P	H	SG	Ab.Gr
Lycium shawii Roem & Schult.	Solanaceae	Ch.	HP	VH	SGC	Yb, L
Noaea mucronata (Frossk.) Asch.&Schwei.	Chenopodiaceae	Ch.	HP	VH	CSG	Yb, L
Periploca angustifolia Labill..	Asclepiadaceae	Ch.	VHP	VH	SGC	Yb, L
Plantago albicans L.	Plantagonaceae	Hc.	VHP	L1	SG	Ab.Gr
Polygonum equisetiforme Sm.	Polygonaceae	Ch.	P	H	SG	Ab. Gr
Salvia aegyptiaca L.	Labiatae	Ch.	P	VH	SG	Yb, L
Salvia lanigra L.	Labiatae	Ch.	P	VH	SG	Yb, L
Salsola tetrandra Forssk.	Chenopodiaceae	Ch.	P	VH	CGS	Yb
Salsola tetragona Del.	Chenopodiaceae	Ch.	VHP	VH	SGC	Br, L
Salsola vermiculata Poir	Chenopodiaceae	Ch.	P	H	CGS	Yb, L
Scorzonera undulata Vahl.	Compositae	G.	VHP	VH	SG	Ab. Gr
Stipa parviflora Desf.	Gramineae	Hc.	VHP	VH	SG	Ab, Gr
Suaeda pruinosa Lange.	Chenopodiaceae	Ch.	P	H	CGS	Yb, L
Suaeda vermiculata Forssk. Ex. J. F.Gmel	Chenopodiaceae	Ch.	P	H	CGS	Yb, L
Suaeda volkensii C.B.Clarke	Chenopodiaceae	Ch.	P	H	CGS	Yb
Teucrium polium L.	Labiatae	Ch.	LP	L1	GS	Yb, Fl
Thymelaea hirsuta (L.) End..	Thymelaceae	Ch.	P	L1	GS	Yb, Dbr
Verbascum letourneuxii Asch.&Schwei.	Scrophulariaceae	Ch.	LP	L1	GSC	Yb, L
Zilla spinosa (Turra).Prantl	Cruciferae	Ch.	LP	L1	CG	Yb, L
Annuals						

Table 1: Continue

Species	Family	Life-form	Palata-Bility	Grazing value	Stock type	Consumed part
Adonis dentatus Delile	Compositae	Th.	LP	L1	SG	Fl.
Aegilops bicornis (Forssk.)						
Jaub& Spach.	Graminaea	Th.	VHP	H	SG	+
Aizoon canariense L.	Aizoaceae	Th.	NP	L1	--	--
Anacyclus alexandrinus Willd.	Compositae	Th.	P	H	GCS	Fl.
Anchusa aegyptiaca (L.) ADC.	Boraginaceae	Th.	P	H	SG	+
Anthemis microsperma						
Boiss & Kotschy	Compositae	Th.	P	H	SG	Fl.
Beta vulgaris L.	Chenopodiaceae	Th.	P	H	GS	+
Brassica tournefortii Gouan.	Cruciferae	Th.	P	L1	CG	+
Bromus rubens L.	Graminaea	Th.	HP	H	SG	+
Bupleurum semicompositum L.	Umblelliferae	Th.	P	L1	SG	+
Calendula arvensis L.	Compositae	Th.	P	L1	GS	Fl.
Carrichtera annua (L.) DC	Cruciferae	Th.	P	L1	SG	+
Centaurea glomerata Vahl.	Compositae	Th.	P	L1	SG	+
Chenopodium murale L.	Chenopodiaceae	Th.	NP	L1	--	--
Chrysanthemum coronarium L.	Compositae	Th.	NP	L1	--	--
Cutandia dichotoma (Forssk.) trab.	Graminaea	Th.	VHP	H	SG	+
Didesmus aegyptius (L.) Desv.	Cruciferae	Th.	LP	L1	SG	+
Filago desertorum Pomel.	Compositae	Th.	P	L1	SG	+
Herniaria hirsuta L.	Caryophyllaceae	Th.	LP	L1	SG	+
Hippocrepis araolata Desv.	Leguminosae	Th.	HP	H	SG	+
Hordeum leporinum (Link.) Arcong.	Graminaea	Th.	HP	H	SGC	+
Ifloga spicata (Forssk.) Sch.	Compositae	Th.	P	L1	GS	+
Lobularia arabica (Boiss) Musch.	Cruciferae	Th.	P	H	SG	+
Malva parviflora L.	Malvaceae	Th.	P	L1	SG	+
Matthiola livida (Delile) Maire	Cruciferae	Th.	P	L1	SG	+
Medicago laciniata (L.) Mill.	Leguminosae	Th.	HP	H	SG	+
Medicago truncatula Gaertm.	Leguminosae	Th.	HP	H	SG	+
Onobrychis crysta-galli (L.) Lam.	Leguminosae	Th.	HP	H	SG	+
Ononis serrata Forssk.	Leguminosae	Th.	LP	H	SG	+
Paronychia arabica (L.) DC.	Caryophyllaceae	Th.	LP	L1	GS	+
Phalaris minor Retz.	Graminae	Th.	HP	H	SG	+
Picris radicata (Frossk.) Less.	Compositae	Th.	P	L1	GS	Fl.
Plantago crypsoides Boiss.	Plantagonaceae	Th.	HP	H	SG	+
Plantago ovata Frossk.	Plantagonaceae	Th.	P	H	SG	+
Pseudorlaya pumila (L.) Grande	Umbelliferae	Th.	P	L1	SG	+
Reichardia tingitana (L.) Roth.	Compositae	Th.	P	L1	SG	Head
Scabiosa rhizantha Viv.	Dipsacaceae	Th.	LP	L1	SG	+
Schismus barbatus (L.) Thell.	Graminae	Th.	HP	H	SG	+
Silene villosa Forssk.	Caryophyllaceae	Th.	NP	L1	--	--
Spergularia marina (L.) Griseb.	Caryophyllaceae	Th.	LP	L1	SGC	+
Trifolium resupinnatum L.	Leguminosae	Th.	VHP	VH	SGC	+
Trigonella stellata Forssk.	Leguminosae	Th.	VHP	VH	SGC	+
Valantia hispida L.	Rubiaceae	Th.	LP	H	SG	--

Ch. = Chamaephytes, G. = Geophytes, Hc. = Hemicryptophytes, P. = Phanerophytes, Th. = Therophytes. VHP. = Very highly palatable, Hp. = Highly palatable, P. = Palatable, L.P = Low palatability, NP. = Unpalatable, VH.= Very high, H.= High. L1. = Low, S = Sheep, G. = Goats, C.= Camels, and + = Whole plant, Yb, = Young branch, Fl. = Flowers, L.= Leaves, Br.= Branch, I. = Inflorescences, Dl = Dead leaves, Dbr. = Dead branch, Ab. Gr. = Above ground.

Table 2: Indicator perennial species, the frequency and percentage of each species at the sampling sites of Matruh area at each site

Species	Total number of sites	Percentage
Anabasis articulata	4	13.0
Anbasis oropediorum	7	22.0
Artemisia herba-alba	3	9.0
Argyrolobium uniflorum	2	6.0
Asphodelus ramosus	18	56.0
Atriplex halimus	19	59.0
Carthamus lanatus	8	25.0
Deverra tortuosa	13	41.0
Echinops spinosissimus	9	28.0
Gymnocarpos decandrum	12	38.0
Haloxylon scoparia	6	19.0
Helianthemum kahiricum	1	3.0
Helianthemum lippii	1	3.0
Lycium shawii	4	12.5
Noaea mucronata	7	22.0
Periploca angustifolia	3	9.0
Salvia aegyptiaca	4	13.0
Salsola tetrandra	16	50.0
Salsola tetragona	13	41.0
Sasola vermiculata	2	6.0
Stipa parviflora	1	3.0
Suaeda pruinosa	4	13.0
Suaeda vermiculata	1	3.0
Thymelaea hirsuta	7	22.0
Zilla spinosa	1	3.0

habitats (means and standard errors) during the season of maximum consumption (Table 4). The numbers of indicators species differ from one habitat to another. The values of NFE ranges from a maximum of 34.1 ± 3.9% in the flat plateau to a minimum of 30.9 ± 4.7 % in the non-saline depression. Also, the indicator species of the flat plateau attained the maximum ash content (14.2±8.2 %). In addition the species of the non-saline depressions attained the maximum of CP, CF, DCP, and GE (10.7 ± 4.3, 36.9 ± 9.4, 6.4 ± 4.0% and 4.1 ± 0.23 Mcal kg^{-1} respectively). Moreover, TDN attained its maximum value in the species of saline depressions (67.2 ± 2.9 %). However, there was little variability in the percentages of chemical composition within different habitats. On the other hand, chemical analysis my be differ from one habitat to another for the same species. For example *A. ramosus* (perennial herb) is common in all habitats, where the NFE content was high (31.3%) in the rocky- plateau species and low (29.4%) in the flat plateau.

Averages of digestible (DE) and metabolizable energy (ME) contents (Mcal kg^{-1}) of the indicator species of different habitats of the study area are shown in Table 5. The highest DE and ME values was attained by the grazeable parts of *Periploca angustifolia* (3.84 and 3.32 Mcal kg^{-1} respectively) at the rocky ridge habitat while, the lowest contents were attained by *Salsola tetragona* from the saline depression and *Salvia aegyptiaca* in the non- saline depression habitats.

Table 3: The pasture condition, [grazing pressure, habitats and average of rainfall (mm)] at the different sites of Matruh area

Site number	Pasture condition	Grazing pressure	Habitat	Mean of rainfall(mm)
1	Poor	High	Rocky plateau	90.0
2	Fair	Moderate	Rocky plateau	31
3	Poor	High	Non-saline depression	67
4	Good	Low	Non-saline depression	110
5	Good	Moderate	Flat plateau	10
6	Good	Low	Flat plateau	20
7	Fair	High	Flat plateau	62
8	Good	Low	Rocky ridge	74
9	Poor	High	Rocky ridge	80
10	Good	Moderate	Flat plateau	87
11	Fair	Moderate	Flat plateau	78
12	Good	High	Flat plateau	87
13	Fair	High	Rocky ridge	105
14	Good	Moderate	Rocky plateau	102
15	Fair	High	Saline depression	120
16	Poor	High	Rocky plateau	173
17	Poor	High	Saline depression	84
18	Good	High	Non-saline depression	97
19	Fair	High	Flat plateau	162
20	Poor	High	Rocky plateau	85
21	Good	Low	Rocky plateau	66
22	Good	Low	Non-saline depression	84
23	Good	Moderate	Rocky plateau	30
24	Good	Moderate	Rocky plateau	55
25	Good	Low	Rocky plateau	116
26	Good	Low	Flat plateau	6.4
27	Good	Moderate	Flat plateau	51
28	Fair	Moderate	Flat plateau	66
29	Good	Moderate	Flat plateau	28
30	Good	Low	Rocky plateau	30
31	Good	Moderate	Non-saline depression	17
32	Good	Low	Rocky ridge	42

Table 4: Means and standard error of chemical composition {percentage of nitrogen free extract (NFE), crude protein (CP), ether extract (EE), crude fibre (CF), ash, digistable crude protein (DCP), total digistable nutrients (TDN), and gross energy (GE Mcal kg^{-1})} of the grazeable parts of the indicator species at the different habitats of Matruh area

	Percentage							Mcal kg^{-1}
Habitat	NFE	CP	CF	EE	Ash	DCP	TDN	GE
Rocky plateau	33.98±4.32	9.6±2.9	32.4±10.2	8.0±2.7	16.8±8.1	5.4±2.5	67.2±1.9	4.0±0.37
Flat plateau	34.1±3.9	10.1±2.5	30.2±9.2	7.1±1.9	19.2±8.2	5.9±2.3	66.6±1.5	3.9±0.39
Rocky ridge	33.7±5.0	10.4±2.7	32.2±4.7	7.1±1.5	16.9±6.2	6.1±2.5	66.7±1.4	3.9±0.32
Non-saline depression	30.9±4.7	10.7±4.3	36.9±9.4	6.9±2.5	13.7±5.4	6.4±4.0	66.4±1.9	4.1±0.23
Saline depression	31.6±5.8	9.2±1.9	33.2±13.4	7.6±2.4	18.6±6.9	4.9±1.1	67.2±1.9	3.9±0.26

Table 5: Average of digestible energy (DE) and metabolizable energy (ME) (Mcal kg^{-1}) in the indicator species in each habitat of Matruh area

	Habitat									
Species	Non-saline depression		Flat plateau		Rocky plateau		Rocky ridge		Saline depression	
	DE	ME	DE	ME	DE	ME	DE	ME	DE	ME
Anabasis articulta	--	--	3.1	2.7	3.3	2.8	--	--	--	--
Anabasis oropediorum	--	--	2.7	2.3	2.9	2.5	2.9	2.5	--	--
Artemisia herba-alba.	3.5	3.0	3.5	3.0	3.7	3.2	--	--	--	--
Asphodelus ramosus	3.2	2.8	3.4	2.9	3.5	3.0	3.3	2.8	3.4	2.9
Atriplex halimus	--	--	3.1	2.7	3.1	2.7	3.1	2.7	3.1	2.6
Convolvulus lanatus	3.3	2.8	3.5	3.0	3.4	2.9	3.3	2.8	3.4	3.0
Deverra tortuosa	3.5	3.0	3.4	2.9	3.6	3.1	3.4	2.9	--	--
Echinops spinosissimus	3.5	3.0	3.6	3.1	3.1	2.7	3.0	2.6	--	--
Gymnocarpos decandrum	3.2	2.8	3.2	2.8	3.5	3.1	3.5	3.0	--	--
Helianthemum kahiricum	--	--	3.6	3.1	--	--	--	--	--	--
Helianthemum lippii	--	--	3.0	2.6	--	--	--	--	--	--
Haloxylon scoparia	3.5	3.0	3.4	2.9	3.4	2.9	3.0	2.6	--	--
Lycium shawii	3.4	2.9	3.3	2.8	3.7	3.2	--	--	--	--
Noaea mucronata	3.4	2.9	3.5	3.0	3.2	2.8	3.4	2.9	--	--
Periploca angustifolia	--	--	--	--	3.7	3.2	3.8	3.3	--	--
Salvua aegyptiaca	3.5	3.0	3.5	3.0	--	--	--	--	--	--
Stipa parviflora	--	--	3.4	2.9	--	--	--	--	--	--
Salsola tetrandra	2.9	2.5	2.9	2.5	2.8	2.4	3.4	2.9	3.0	2.6
Salsola tetragona	--	--	2.7	2.3	2.9	2.5	--	--	2.9	2.5
Suaeda pruinosa.	--	--	2.7	2.3	2.7	2.3	2.9	2.5	--	--
Suaeda vermiculata	--	--	2.8	2.4	--	--	--	--	--	--
Thymelaea hirsuta	3.4	2.9	--	--	3.5	3.0	--	--	3.5	3.0
Zilla spinosa	--	--	--	--	3.3	2.8	--	--	--	--

Table 6: A comparison between the present annual average percentage of total digestible nutrients (TDN), digestible crude protein (DCP), gross energy (GE), digestible energy (DE) and metabolizable energy (ME) in Kcal kg^{-1} with those supplementary feed and other pastures

		%	Kcal kg^{-1}			
Fodder	References	DCP	TDN	GE	DE	ME
Supplementary feed	Soliman and El-Shazly (1978)					
Berseem		--	56	--	--	--
Barley		--	64	--	--	--
Corn		--	68	--	--	--
Western Mediterranean	Abdel-Salam (1985)	--	66	--	--	--
Desert Pasture (Omayed)	Abdel-Razik *et al.* (1988)	5.4	75	--	--	--
	Heneidy (1992)	4.9	72	3,606	2,610	2,278
Aqaba Gulf Area Pasture (Sinai)	Heneidy (1996)	4.6	66.5	4,100	2,650	2,200
Bisha area (Saudi Arabia)	Heneidy (2000)	8.8	74.8	3,974	3,292	2,874
East of Matruh	Present study	5.7	67.0	3,993	3,274	2,824

Discussion

The common livestock in the study area are sheep, goats and camels, which have different behavior, tasty and palatability for plant species. Young branches, leaves and sometimes dead parts, inflorescences are usually the common parts consumed by such livestock (Heneidy, 1992). Palatability of range plant species is a very complex notion and difficult to generalize as it is linked to many factors that vary in time and space and is relative to what other alternative are available. Some of these variables are linked to the plant, others to the animals while a third category depends on various environmental factors (Le Houèrou, 1980a; Heneidy, 1996; Heneidy and Bidak, 1996).

In study numerous factors were considered when classifying a plant as palatable or not; phenological stage, morphological form, odour, taste, chemical composition and its abundance. As a rule the palatability of a given taxon would increase with environmental aridity (Le Houèrou, 1992). However, the same species may be palatable in some places and unpalatable in the others (Le Houèrou, 1992; Heneidy, 1996). Palatability of species typically put all of their energy from photosynthesis into growth and reproduction, while unpalatable species put part of their energy into compounds

that discourage defoliation's. So the more productive and desirable vegetation decreased with an increase in the less palatable and poisonous plant species (Taylor and Ralphs, 1992). Most of the species in the study area however are found to be highly palatable (about 87% of perennials and 74% of annuals). This is in accordance with the results obtained by Heneidy (1992) and Heneidy and Bidak (1998) in other grazing areas.

The present study area is considerably one of the richest area vegetationally and in livestock on such coastal region. The most common life-form is shrubby species (browse species) which are the skeleton part of this system. The contribution of the shrubby species is about 30% of the perennial species some of them are woody, their heights reach to > 3m, while about 41% of them are sub-shrubs (dwarf shrubs). Where the fodder shrubs are essentially as supplementary or emergency feed (85% of shrubby species are highly palatable) for periods of grazing shortage that may occur in the dry season and/ or prolonged droughts (Le Houèrou, 1989).

Le Houèrou (1989); Heneidy and Bidak (1998) stated that the shrubby species are able to grow on marginal lands that are not fit for conventional family (dunes, steep slopes, stony soils, land prove to flooding and saline soils). Shrubby species are also play an important role in the protection of catchement basins, erosion control, fuel wood, and the strategy against decertification. Some of the shrubby species are able to improve the soil fertility and to increase the crop yield owing to the organic matter and nutrients, windbreak, they bring to the topsoil from deep layers of the subsoil and to their smoothly off the microclimatic condition (Le Houèrou, 1989).

The pasture condition is based on many factors, some of them are biomass, and accessible parts (actual production) for the livestock. On the other hand, there are other factors like palatability, types of life-forms and the plant species conditions (performance of plant species, availability, of the plant species, nutritive value, topographic factor, soil type) and finally actual field observation. According to Le Houèrou (1993) the pasture conditions divided into three categories (good, fair, and poor). However, the pasture condition in the study area is generally good where, 59% of the sites is good pasture and about 22% as fair. The grazing value of the plant species is influenced by many factors some of the most factors are chemical composition (mostly dependent upon the high percentage of crude protein, mineral nutrients and low concentration of crude fibers), morphology and vegetation composition. However, in the present study grazing value is mainly based on chemical composition especially, where the pasture has higher CP, minerals and lower CF. Eighty two percent of the perennial species and 44% of the annual species in the present study have highly grazing value.

Overgrazing is one of the most important issue of arid land especially in rangeland areas (Ayyad, 1978; Abdel-Razik *et al.*, 1988a,b; Le Houèrou, 1989 ; Heneidy, 1992). Based on the long field observation of different flocks at each site, plant status (degree of consumption), topography of the site, ratio of resistant species (to be palatable) and the position of the settlements. It is possible to estimate the grazing pressure in the different sites (cf. El-Kady, 1983; Heneidy, 1992; Heneidy and Bidak, 1998). In the present study 38% of the sites have highly grazing pressure, 34% have moderate and 28% have low grazing pressure. Rangeland under high grazing pressure needs rotational grazing management to reduce the grazing intensity. Actually, destocking deferred grazing and reduction of stocking rates are also effective means of regenerating these rangelands.

The present study indicates that the indicator species have relatively high contents of CP and low CF comparing with many desert plants (Le Houèrou, 1980b). CP and CF are viewed classically as an indicator of the nutritional value of plant as feed for ruminants (Bryant and Kuropat, 1983; Heneidy, 1992). In all habitats of the study area about 75% of the indicator species contained CP more than 8 and 50% of them contained CF less than 30 %, these considered good pasture where essential chemical composition meet demands of livestock compared with other areas. According to the percentage of CP the sites can be sorting into three groups. The first group includes 47% from the sites where, CP > 10%, the second group includes 31% of the sites, where CP > 8%, while the third group includes 22% of the sites where, CP < 8%.

The DCP % in the present study of indicator species varied from a minimum 4.9 (as an average) in the saline depression habitat to a maximum 6.4 in the non-saline depression. This however is comparable with that recorded in the salt-marshes area of the Mediterranean region of values ranged from 5.8 to 7.5 (Heneidy and Bidak, 1996) and with that (4.9) recorded by Heneidy (1992) in Omayed area (Table 6). This Table also contained the annual average DCP% in supplementary feed and other pastures. The

mean DCP% in the study area (5.7) is slightly higher than that recorded in the plants of Aqaba Gulf in Sinai area by Heneidy (1996). But it is within the range 4 - 20% of the dry matter of DCP% for woody steppe in arid zone Sarson and El-Hamrouni (1974).

The term TDN (total digestible nutrients) is only an approximate measure of the food energy available to animal after the digestion losses have been deducted (Lofgreen, 1951). Therefore, TDN is a measure of energy requirement of animals and energy value of feeds. TDN values in the study area ranges from 66.4 ± 0.6% in the non-saline depression to 67.6 ± 1.1% in the flat plateau. The annual average percentage of TDN found in the present study is compared with that of the supplementary feed and other pastures as also showen in Table 6. The TDN value in the study area is 67.0% which agrees with that recorded other natural pasture from other studies (Heneidy, 1996) in the natural forage from Aqaba Gulf of Sinai region (e.g. 66.5%) and 66.2 % (Heneidy and Bidak, 1996) in salt marshes halophytes in the Mediterranean region. In the coastal region by Abdel-Salam (1985) and Abdel-Razik *et al.* (1988a) reported that the average of TDN % ranges from 66 to 75%. Soliman and El-Shazly (1978) found that the average of TDN in the supplementary feed (berseem, barley and corn) was 62.7%.

The average GE in the study area ranges from 3.9 ± 0.1 Mcal/kg in the habitat of the rocky ridge, to 4.1 ± 0.1 Mcal/kg in the non-saline depression. Lower GE values were recorded by Heneidy (1992) and Heneidy and Bidak (1996) in the western coastal region and (3.6 and 3.5 Mcal /kg) in the halophytic species of the Mediterranean region respectively. The average of DE in the study area was 3.27 ± 0.02 Mcal kg^{-1} which is less than 2.61 Mcal kg^{-1} calculated by Heneidy (1992) in Omayed area of the coastal region. Generally the averages of ME are 2.88 ± 0.04 in the non-saline depression, 2.8 ± 0.07 in the flat plateau, 2.84 ± 0.06 in rocky plateau, 2.79 ± 0.06 in the rocky ridge, and 2.81 ± 0.08 Mcal kg^{-1} in the saline depression habitat. Consequentially, the average of ME in the whole study area was 2.82 ± 0.01 Mcal kg^{-1} which is comparable with 2.2 Mcal kg^{-1} recorded by Heneidy (1996) in the natural forage in Aqaba Gulf.

Le Houèrou and Hoste (1977) reported that 1 SFU (Scandinavian Feed Unit) = 1,650 Kcal. Accordingly, the energy content in the study area is equivalent to 0.84 SFU. Comparing with the energy content of forage in Aqaba Gulf pasture was 0.66 SFU (Heneidy, 1996) and 0.76 SFU Heneidy and Bidak (1996) in halophytic pasture. Le Houèrou *et al.* (1982) recorded the energy content of one kg DM of the best fodder roughage and good fodder crops (alfalfa) as 0.8 and 0.6 SFU, respectively. It seems that the enrtgy content of the pasture in the study area is higher than the best fodder roughage.

The problem which faces the pastoralists in range lands areas is: low rainfall and how to prevent or reduced the land degradation. This is a matter of adjustment of stock numbers to the natural feed resources. Increasing the grazing pressure beyond the limits set by dry seasons reduces fodder resources and leads to depletion. It is therefore appropriate to manage vegetation properly and to think in terms of encouraging or propagation of the native species by using techniques which still have to be established. In particular the following points should be considered: 1- propagation of palatable and high grazing value species specially (browse species) those producing quantity of seeds (e.g. *Artemisia herba-alba, Anabasis oropediorum, Anabasis articulata, Atriplex halimus, Argyrolobium uniflorum, Gymnocarpos decandrum, Helianthmum lippii, Deverra tortuosa, Lycium shawii and Periploca angustifolia*), 2- increasing the shrub-land native species which have a good grazing value, (especially legume species), 3- reduce the intensity of grazing offers by building a good strategy to manage the use of grazing land, 5- it is practice means of range improvement especially in arid zone where, the climate is mostly limiting factor.

The natural forage of the study area may be enough to meet animal requirements provided a good management plan is prepared to advise inhabitants about using their range resources on an annual basis. In view of the fact that there is no adequate legislation covering the utilization of the rangeland of the region for ensuring long-term sustainable productivity, it is necessary to improve the rangeland through better management of the available browse plants. However, renewal of resources is generally achievable but for success it does require a higher level of involvement and collaboration of pastoralists, researchers, educators and Government in land management.

Aknowledgements

The author wish to record his thanks to the Project of Water/Land Management Northwest Coast of Egypt, and also to Prof. F. Abdel-Khader, as the principal investigator of this Project for permission to use all available facilities during this study. Sincere thanks are due to Professor K. H. Shaltout, and Professor El-Rayis, O. A. for their careful revision the manuscript although I should emphasize that outstanding errors are mine.

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