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Fodder Potentiality and Ecology of Some Non-Conventional Forage Weeds in the Nile Delta Region, Egypt.

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THIS STUDY delt with the ecology, anatomy and fodder potentialities of selected eight species growing naturally in Nile Delta region. The studied plants included three species of family Cyperaceae; *Bolboschoenus glaucus* (Lam.) S.G.Smith, *Cyperus laevigatus* L. and *Schoenoplectus litoralis* (Schrad.) Palla and five species of family Gramineae (Poaceae); *Echinochloa stagnina* (Retz) P.Beauv., *Leptochloa fusca* (L.) Kunth, *Panicum repens* L., *Paspalidium geminatum* (Forssk.) Stapf, and *Sorghum virgatum* (Hack.)Stapf. The impact of the environmental factors prevailing in the habitats where the eight species live and grow were studied. The natural vegetation was analyzed to examine their abundance in relation to other associated species. Moisture content, dry matter, total ash content, total protein, total fat, total fiber content, total soluble sugars, content of glucose, sucrose and polysaccharides, nutritive value, metabolic energy, neto energy of lactation, total digestible nutrients as well as some elements were determined in the studied plants to evaluate their forage potentiality as non-conventional crops. Anatomical investigation of the chosen species was also carried out to detect the palatability of these forage plants.

Keywords: Nile delta region, Vegetation, Classification, Ordination; Anatomy, Forage plants, Phytochemistry.

Weeds represent biologically an important component of their environments. Their persistence is remarkable in view of the efforts to eliminate them and warrants greater attention (Radosevich & Holt, 1984). Management, control and phytosociology of weeds have a great interest all over the world. In Egypt, the efforts have directed towards the utilization of renewable resources of the cultivated and non-cultivated areas to produce more food and forage. Such efforts would be more successful and fruitful if they are based on previous knowledge of the environmental characteristics comprising soil, climate, vegetation, animals and human interference (Omar, 2006). The Nile Delta starts, 20 Km north of Cairo and it is embraced by the Rosetta and Damietta branches.

The area of the Nile Delta is about 22,000 Km^2 while the Nile Vally (cultivated lands) is about 12,000 km^2. The Delta, comprises, therefore, about 63% of the Egyptian fertile lands (Abu Al-Izz, 1971). The sampled stands are distributed in many localities representing five Governorates of the Nile Delta region of Egypt, namely: Damietta, El-Dakahlia, Kafr El-Sheikh, El-Behira and El-Gharbia. The northern part of the Nile Delta lies in the southern part of the semi-arid and arid regions. The climatic conditions are warm summer (20-30 °C) and mild winter (10-20 °C). Accordingly, the studied provinces as a part of the Nile Delta are belonging to the arid and/or semi arid climatic belts of the northern coastal region of Egypt (Ayyad *et al.*, 1983).

The objectives of the present study were: 1) Analysis of variation in environmental factors (edaphic) to determine the soil factors controlling the abundance and distribution of the identified weed communities. 2) Determination of the weed communities associated with the selected forage species in term of spatial variations in the abundance using multivariate analysis (classification and ordination). 3) Anatomical investigation of the selected forage species to evaluate their palatability. 4) Evaluation of the phytochemical constituents, nutrient status and nutritive value of the eight selected weeds aiming to be used as non-conventional forage. This will help to solve the problem of shortage in the green forage during summer season in Egypt.

Material and Methods

1.Selection of stands for vegetation analysis

The sampled stands are distributed in five Governorates of the Nile Delta region of Egypt, namely: Damietta, El-Dakahlia, Kafr El-Sheikh, El-Behira and El-Gharbia (Fig. 1). The recognizable surveyed habitat types in the study area included: Deltaic Mediterranean coast, cultivated lands, irrigation and drainage canals. Fifty five stands (area = 4 m^2 each) have been selected for sampling vegetation. Each stand was obtained as a sum of four quadrates (area 1m^2 each). The sampled stands were surveyed to represent eight selected non-conventional forage weeds namely, *Bolboschoenus glaucus* (Lam.) S.G. Smith, *Cyperus laevigatus* L., *Echinochloa stagnina* (Retz) P. Beauv., *Leptochloa fusca* (L.) Kunth, *Panicum repens* L., *Paspalidium geminatum* (Forssk.) Stapf, *Schoenoplectus litoralis* (Schrad.) Palla and *Sorghum virgatum* (Hack.) Stapf.

2. Estimation of species abundance

The standing crop phytomass of each species has been determined by the harvested quadrat method (Mueller-Dombois & Ellenberg, 1974). Relative value of standing crop phytomass was estimated for each plant species to indicate its importance value (IV) in each sampled stands. The identification and nomenclature of the species were constructed according to Boulos (1999 - 2005).

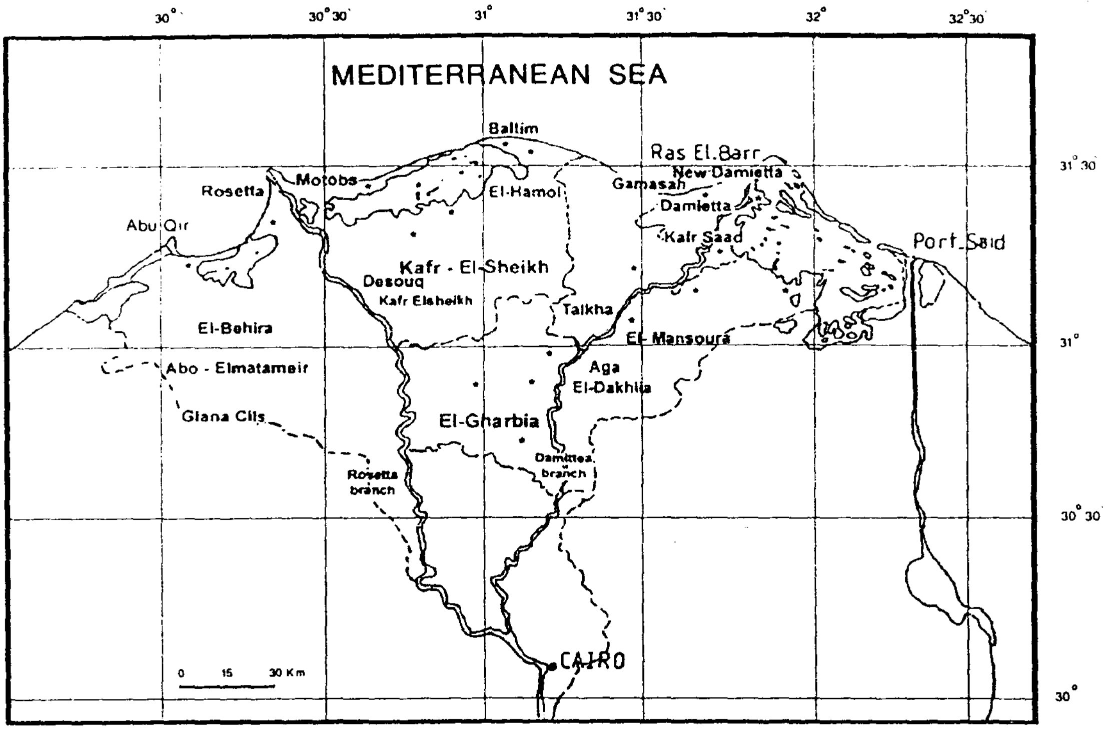

Fig. 1. Map of the Nile Delta region showing localities (sites) as indicated be (*) in the study area.

3. Soil analysis

Soil samples were collected from each quadrate which representing profile at a depth of 0-50 cm. In order to determine the particle sizes of the soil samples, the Bouyoucous hydrometer method was used. The percentage of sand, silt and clay was calculated according to Piper (1947). The water-holding capacity (W.H.C.) was determined using Hilgard Pan Box (Piper, 1947).The soil porosity was determined by the method described by Piper (1947). Calcium carbonate was determined according to Jackson (1962) by titration against 1N NaOH and expressed as percentage. Oxidizable organic carbon was measured using Walkely and Black rapid titration method as described by Piper (1947). The total soluble nitrogen was determined by the Kjeldahl method (Pirie, 1955). The soil solution (1:5) was prepared for each soil sample and electrical-pH meter was used to determine the soil reaction (Jackson, 1962). The electrical conductivity of the soil was measured using conductivity meter (Jackson, 1962). The estimation of chlorides was carried out by titration method using N/35.5 silver nitrate (Jackson, 1962). Sulphate content was estimated gravimetrically using barium chloride solution (Piper, 1947). Carbonates and bicarbonates were determined by titration method using 0.1N HCl (Pierce *et al.*, 1958). Total dissolved phosphorus (TDP) was determined by direct stannous chloride method (American Public Health Association, 1998).The extractable cations Na^+ and K^+ were determined using Flame Photometer (Model PHF 80 Biologie Spectrophotometer), while Ca^{2+} and Mg^{2+} were estimated using atomic absorption spectrometer (A Perkin-Elmer, Model 2380,USA) according to Allen *et al.* (1974). The sodium adsorption ratio (SAR) and potassium adsorption ratio

(PAR) were calculated to express the combined effects of different ions in the soil as described by McKell and Goodin (1984).

4. Treatment of data

The classification technique applied here was the Two-Way Indicator Species Analysis (TWINSPAN). However, the ordination technique applied was Detrended Correspondence Analysis (DECORANA) (Hill, 1979a& b). The statistical analyses of the data were carried out according to Snedecor & Cochran (1968) and Anonymus (1993).

5. Phytochemical analysis of the selected forage species

The succulence (fresh weight/dry weight) was determined according to Tiko (1975). The moisture content was calculated and expressed as percent moisture (AOAC methods 926.08 and 925.09, 1990). The total ash content, total fat and total fiber were determined according to AOAC (1990). The total nitrogen was determined by the Kjeldahl method (Pirie,1955). Total protein was calculated by multiplying the total nitrogen by the factor 6.25 (AOAC, 1990). Total soluble sugars was estimated according to Southgat (1991). Glucose was determined based on the method of Feteris (1965). Sucrose was determined according to Handel (1968). Polysaccharides were estimated by the method of Thyumanavan and Sadasivam (1984). The metabolic energy (ME MJ/Kg) and Neto energy of lactation (NEL MJ/ Kg) of examined forage were estimated according to Nauman and Bassler (1993) and Baranauskas *et al.* (1998) formula. The nutritive value was estimated according to Indrayan *et al.* (2005). The total digestible nutrient was estimated according to the equation described by Abu El-Naga & El-Shazly (1971). Na^+ and K^+ were determined photometrically whereas Ca^{++} and Mg^{++} were measured spectophotometrically according to Allen *et al.*(1974).

6. Anatomical features

For anatomical investigation, samples of stem and leaf or culm were fixed in formalin-acetic acid-alcohol. After fixation, specimens were dehydrated in tertiary butyl alcohol series and embedded in paraffin wax according to Johansen (1940). Sections of 10-12 micron thick were made using a rotatory microtome and double stained with safranin and fast green, mounted in canada balsam and examined by a full automatic Olympus microscope. Sections were photographed at 40X, 100X, and 400X.

Results

1. Vegetation analysis

1.1. Classification of stands

The application of TWINSPAN classification based on the importance values of 63 plant species recorded in 55 sampled stands representing different habitat types of the study area resulted in the recognition of four vegetation groups (Fig. 2 and Table 1).

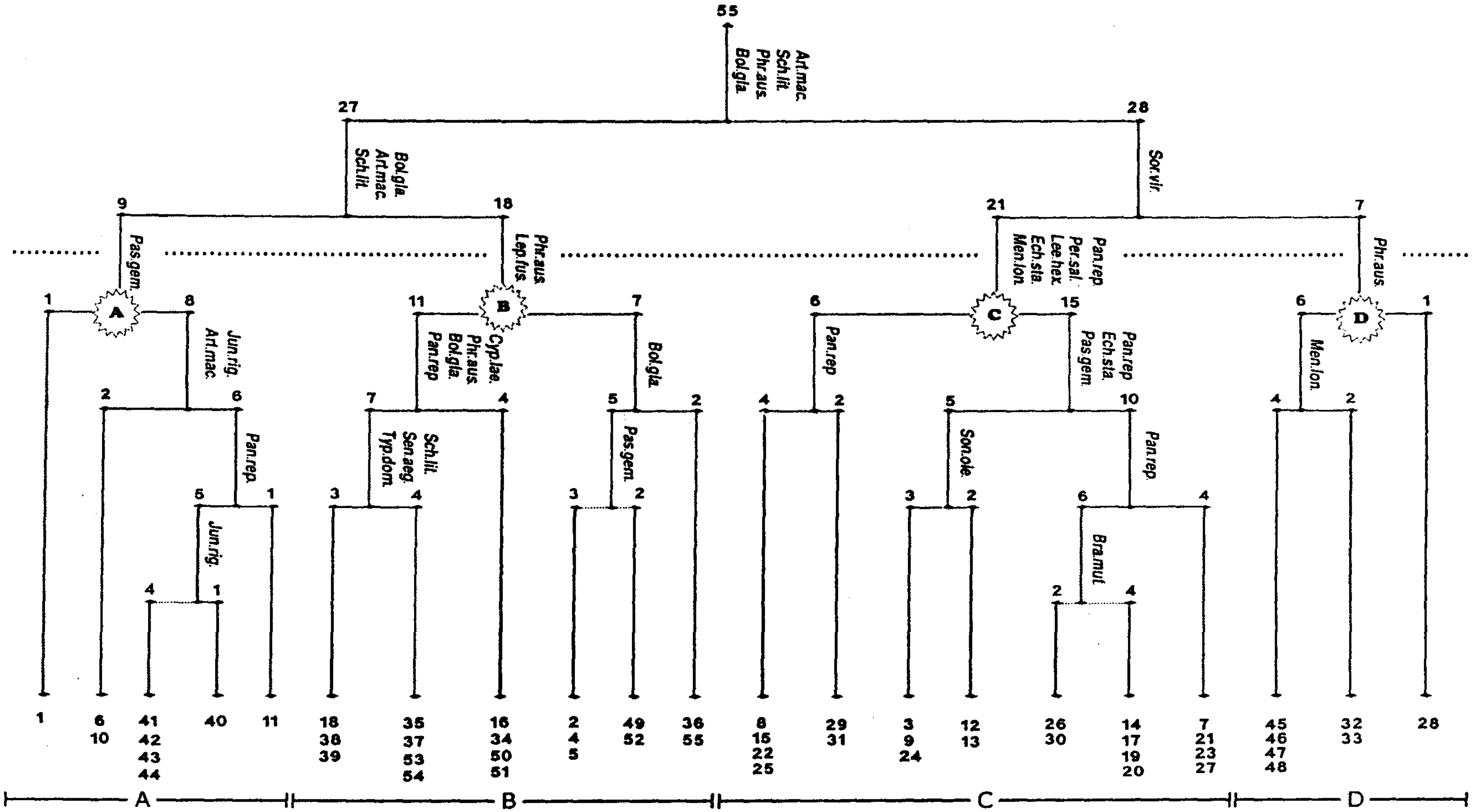

Fig. 2. Two way indicator species analysis (TWINSPAN) dendrogram of the 55 sampled stands based on the importance value of the 63 species. The indicator species are abbreviated by the first three letters of genus and species, respectively.

TABLE 1. Mean value and coefficient of variation (value between brackets) of the importance value of indicator and preferential plants in the different vegetation groups resulting from TWINSPAN classification of the study area.

Species	Vegetation Group			
	A	B	C	D
Alternanthera sessilis (L.)DC.	—	—	0.09(4.58)	—
Amaranthus lividus L.	—	—	0.02(4.58)	—
Ammania baccifera L.	—	—	0.03(4.58)	—
Arthrocnemum macrostachyum (Moric.)K.Koch	8.57(0.91)	0.52(4.24)	—	—
Atriplex portulacoides L.	2.23(1.82)	—	—	—
Bidens pilosa L.	—	—	—	0.56(2.65)
Bolboschoenus glaucus (Lam.) S.G.Smith	0.04(3.0)	26.60(0.84)	2.33(4.58)	—
Brachiaria mutica (Forssk.)Stapf	—	0.85(4.24)	4.80(2.64)	1.50(2.65)
Capsella bursa-pastoris (L.) Medik	—	—	—	0.05(2.65)
Chenopodium murale L.	—	—	—	2.49(1.63)
Convolvulus arvensis L.	—	—	0.01(4.58)	1.89(1.79)
Conyza bonariensis (L.)Cronquist	—	—	0.05(4.58)	—
Cynodon dactylon(L.)Pers.	0.67(3.0)	0.03(4.24)	1.33(3.86)	7.20(0.84)
Cyperus alopecuroides Rottb.	—	—	4.04(2.04)	—
Cyperus articulatus L.	—	—	0.60(4.58)	—
Cyperus laevigatus L.	8.39(3.0)	8.26(2.96)	—	—
Cyperus rotundus L.	—	—	—	0.61(1.74)
Desmostachya bipinnata (L.) Stapf	—	—	1.32(4.58)	—
Echinochloa stagnina (Retz)P.Beauv.	—	0.39(3.84)	21.01(1.46)	—
Eclipta prostrata (L.) L.	—	—	1.15(3.18)	—
Euphorbia helioscopia L.	—	—	—	0.05(2.65)
Euphorbia heterophylla L.	—	—	—	4.12(1.81)
Euphorbia peplus L.	—	—	—	1.11(2.17)
Imperata cylindrica (L.)Raeusch	—	—	2.38(3.17)	—
Juncus acutus L.	0.56(3.0)	—	—	—
Juncus rigidus Desf.	14.49(1.51)	0.08(4.24)	—	—
Lamium amplexicaule L.	—	—	—	0.11(2.65)
Leersia hexandra Sw.	—	—	4.93(2.43)	—
Leptochloa fusca (L.)Kunth	—	22.57(1.50)	1.68(4.58)	—
Limbarda crithmoides (L.)Dumort.	1.34(1.75)	—	—	—
Lotus glaber Mill.	—	0.16(4.24)	—	—
Ludwigia stolonifera (Guill.&Perr.)Raven	—	—	0.24(4.58)	—
Medicago intertexta (L.)Mill.	—	0.17(4.24)	—	—
Melilotus indicus (L.)All.	—	0.66(4.22)	—	—

TABLE 1. Contd.

Species	Vegetation Group			
	A	B	C	D
Mentha longifolia (L.) Muds.	–	–	0.66(2.57)	0.61(1.95)
Oxalis corniculata L.	–	–	–	0.50(1.74)
Panicum repens L.	0.89(3.0)	7.92(2.60)	–	–
Paspalidium geminatum (Forssk.) Stapf	0.31(3.0)	8.23(2.44)	–	–
Pennisetum glaucum (L.)R.Br.	–	–	–	0.19(1.80)
Pennisetum setaceum (Forssk.)Chiov.	–	–	0.79(4.58)	8.91(2.65)
Persicaria lapathifolia (L.)Gray	–	–	1.02(4.58)	0.77(2.65)
Persicaria salicifolia (Brouss.ex Willd.)Assenov	–	–	4.84(1.86)	2.68(1.66)
Phragmites australis (Cav.) Trin.ex Steud.	2.88(2.67)	8.80(1.19)	1.27(2.01)	0.88(2.65)
Phyla nodiflora (L.)Greene	–	–	0.22(4.58)	–
Plantago major L.	–	–	–	1.45(1.66)
Pluchea dioscoridis (L.)DC.	–	–	0.68(2.51)	–
Polygonum equsetiforme Sm.	–	0.19(4.24)	0.01(4.58)	–
Polypogon monspeliensis (L.)Desf.	–	0.11(4.24)	–	–
Rorippa palustris (L.) Besser	–	–	1.91(4.58)	–
Rumex dentatus L.	–	–	0.23(4.31)	0.39(1.28)
Schoenoplectus litoralis (Schrad.) Palla	58.51(0.54)	8.95(2.93)	–	–
Senecio aegyptius L.	–	0.48(2.94)	–	–
Solanum nigrum L.	–	–	0.31(4.58)	2.63(1.39)
Sonchus oleraceus L.	–	0.04(4.24)	0.22(2.36)	8.28(1.21)
Sorghum virgatum (Hack.)Stapf	–	–	–	51.65(0.37)
Suaeda pruinosa Lange	–	–	0.88(4.58)	–
Symphyotrichum squamatum (Spreng.)Nesom	–	2.15(3.91)	0.42(3.72)	–
Tamarix nilotica (Ehrenb.)Bunge	–	0.73(4.24)	–	–
Torilis arvensis (Huds.)Link	–	–	–	0.38(2.65)
Typha domingensis (Pers.)Poir.ex Steud.	1.11(2.67)	2.11(2.54)	0.15(4.58)	–
Urtica urens L.	–	–	–	0.14(2.65)
Vicia sativa L.	–	–	0.40(3.47)	0.09(2.65)
Withania somnifera (L.)Dunal	–	–	–	0.77(2.65)

Group A comprised 9 stands dominated by the sedge *Schoenoplectus litoralis* which had the highest importance value of this group (IV= 58.51). The other important and indicator species which attained relatively high importance values in this group were *Juncus rigidus* (IV=14.49), *Arthrocnemum macrostachyum* (IV=8.57) and *Cyperus laevigatus* (IV=8.39) respectively.

Group B included 18 stands codominated by the sedge *Bolboschoenus glaucus* (IV=26.60) and the grass *Leptochloa fusca* (IV=22.57). The other important and indicator species which attain relatively high importance values in this group are *Schoenoplectus litoralis* (IV=8.95), *Phragmites australis* (IV=8.80), *Cyperus laevigatus* (IV=8.26), *Paspalidium geminatum* (IV=8.23) and *Panicum repens* (IV=7.92) respectively.

Group C involved 21 stands dominated by the grass *Echinochloa stagnina* (IV=21.01). In this group, the other important and indicator species were *Leersia hexandra* (IV=4.93), *Persicaria salicifolia* (IV=4.84), *Brachiaria mutica* (IV=4.80) and *Cyperus alopecuroides* (IV=4.04) respectively.

Group D involved 7 stands dominated by the grass *Sorghum virgatum* (IV=51.65). The other important species were *Pennisetum setaceum* (IV=8.91), *Sonchus oleraceus* (IV=8.28) and *Cynodon dactylon* (IV=7.20). The indicator species in this group includes *Phragmites australis* (IV=0.88) and *Mentha longifolia* (IV=0.61) with relatively low importance values.

1.2 Ordination of stands

The ordination of stands in the different habitats of the study area indicated by Detrended Correspondence Analysis (DCA) is shown in Fig. 3. The DCA ordinations of stands were indicated on the plane of the first and second DCA axes. It was clear that the vegetation groups obtained by TWINSPAN classification were markedly distinguishable and having a clear pattern of segregation on the ordination plane.

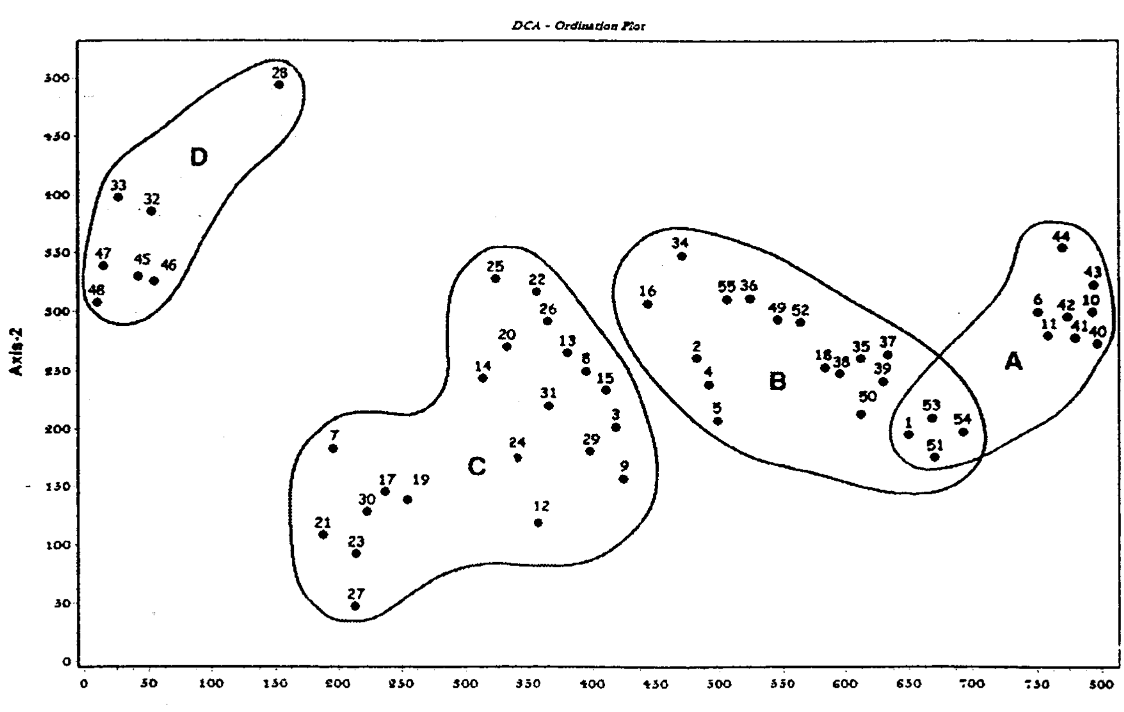

Fig. 3. Detrended correspondence analysis (DCA) ordination diagram of 55 sampled stands.

Group A dominated by *Schoenoplectus litoralis* and group B codominated by *Bolboschoenus glaucus* and *Leptochloa fusca* were separated at the right side of the DCA diagram and showed also superimposed intercept. On the other hand, group C dominated by *Echinochloa stagnina* was separated at the middle part of the DCA diagram. Group D dominated by *Sorghum virgatum* was obviously separated at the upper left side of the DCA diagram.

2. Vegetation-soil relationship

2.1 Relationship between soil variables and vegetational groups

The variations in soil variable (mean value ± standard error) within the groups of sampled stands represented by the TWINSPAN classification in the different habitats of the study area are shown in Table 2. The physical soil variables were comparable in all groups. The greatest percentage of coarse fractions (sand=93.86%) was obtained in group D and that of clay fraction (3.33%) was attained in group A whereas greatest percentage of silt (9.76%) was obtained in group C. In the contrary, the lowest percentage of sand (86.95%) was obtained in group C but the lowest percentage of clay (2.0%) was obtained in group D, while the lowest percentage of silt (3.89%) was obtained in group A. Soil porosity attained the greatest value (44.35%) in group D, while the lowest value (38.58%) was recorded in group C. Water-holding capacity showed the greatest value (61.52%) in group C, while it showed the lowest value (49.58%) in group A.

The chemical soil variables showed variations from one group to another. Calcium carbonate was the greatest (19.03%) and lowest (7.43%) in the soil samples of group B and D, respectively. The organic carbon content was the greatest in group C (1.01%) and the lowest in group A (0.37%). The soil reaction (pH) varied between pH=7.84 (slightly alkaline) in group C to pH=8.17 (moderately alkaline) in group A.. Electrical conductivity and chloride were high in group B (1787.78 µmhos/cm and 0.41%, respectively), while both variables were low in group D (154.73 µmhos/cm and 0.14% respectively). Group C had the greatest % of sulfate (0.40%) whereas group D had the lowest one (0.05%). The soluble carbonate was detected in very low content in all groups, the greatest (0.008%) and lowest (0.001%) values were found in group B and C, respectively. The bicarbonate content was also very low in all groups; the highest value (0.331%) was found in group B and the lowest value (0.083%) in group D. The total dissolved phosphorus was the lowest (0.18 mg/100g dry soil) in group B and the greatest (0.22 mg/100g dry soil) in group C. The greatest and lowest values of total nitrogen content were attained in group D (64.79 mg/100g dry soil) and group A (25.86 mg/100g dry soil) respectively. The concentrations of sodium and potassium were low in group D with mean values of 3.89 mg/100g dry soil and 4.42 mg/100g dry soil respectively. However, greatest mean values of 12.34 and 21.00 mg/100g dry soil were obtained in group C for Na^+ and group B for K^+. Calcium and magnesium attained the lowest mean values (12.90 and 3.51 mg/100g dry soil, respectively) in group D, while the greatest mean values of both cations (44.04 and 27.83 mg/100g dry soil) were attained in groups B and A, respectively. The sodium adsorption ratio (SAR) was high in group C (5.03) and low in group D (0.41), while the potassium adsorption ratio (PAR) varied from 1.59 in group D to 6.27 in group C.

2.2 Correlation between soil variables and vegetational gradients

The relationship between vegetation and soil characteristics is indicated on the ordination diagram produced by Canonical Correspondence Analysis (CCA) of the biplot of species and soil variables. The Canonical Correspondence Analysis (CCA) ordination of plant species recorded in the different habitats of the study area is shown in Fig. 4. The analysis indicated that, the electrical conductivity, sodium and calcium cations, clay, chlorides, magnesium, sand, silt, sodium adsorption ratio (SAR), potassium adsorption ratio (PAR), potassium, total nitrogen, total dissolved phosphorus and water-holding capacity were the most effective soil variables which had high significant correlations with the first and second axes. In the upper right side of CCA diagram, *Sorghum virgatum* which was a dominant species in group D, *Panicum repens* and *Paspalidium geminatum* which were two important species in group B, *Leersia hexandra* which is an indicator and important species in group C, *Cynodon dactylon* which was also indicator and important species in group D and *Mentha longifolia* which was an indicator species in this group were collectively showed a close ralationships with sodium, magnesium, sodium adsorption ratio, water-holding capacity, silt and total dissolved phosphorus. However, in the upper left side, *Bolboschoenus glaucus* and *Leptochloa fusca* which were two codominant species in group B, *Phragmites australis* which was the important species in group B, *Senecio aegyptius* and *Typha domingensis* showed a limited relationships with calcium carbonate content only. In the lower right side, *Echinochloa stagnina* which was the dominant species in group C, *Persicaria salicifolia, Bracharia mutica* and *Cyperus alopecuroides* which were the important species in group C, showed a close relationships with electrical conductivity, clay, chlorides, calcium, potassium, potassium adsorption ratio, total nitrogen and organic carbon. In the lower left side, *Schoenoplectus litoralis* (dominant species in group A), *Cyperus laevigatus, Arthrocnemum macrostachyum* and *Juncus rigidus* (the important species also in group A), showed a close relationship with sand fraction only.

TABLE 2. Mean value and standard error of the different soil variables at depth (0 – 50 cm) in the sampled stands representing the different vegetation groups obtained by TWINSPAN classification of the different habitats in the study area.

Soil Variable		Vegetation Group A	B	C	D
Sand	(%)	92.78±1.53	90.72±1.38	86.95±1.81	93.86±0.96
Silt	(%)	3.89±1.56	6.11±1.35	9.76±1.77	4.14±0.99
Clay	(%)	3.33±0.50	3.17±0.24	3.29±0.30	2.00±0.22
Porosity	(%)	42.89±1.78	42.76±1.03	38.58±1.31	44.35±1.18
W.H.C.	(%)	49.58±5.17	57.53±4.26	61.52±2.50	55.09±6.44
$CaCO_3$	(%)	18.06±6.38	19.03±3.35	8.88±1.30	7.43±0.84
Organic Carbon	(%)	0.37±0.14	0.94±0.23	1.01±0.12	0.66±0.08
pH		8.17±0.13	8.10±0.12	7.84±0.14	7.91±0.06
EC (µmhos/cm)		1,561.33±476.18	1,787.78±241.68	1,262.64±291.59	154.73±20.82
Cl^-	(%)	0.37±0.21	0.41±0.10	0.18±0.06	0.14±0.12
SO_4^{--}	(%)	0.17±0.04	0.18±0.04	0.40±0.20	0.05±0.01
CO_3^{--}	(%)	0.003±0.002	0.008±0.003	0.001±0.001	0.002±0.002
HCO_3^-	(%)	0.112±0.031	0.331±0.133	0.087±0.007	0.083±0.010
TDP	(mg / 100 g dry soil)	0.21±0.04	0.18±0.02	0.22±0.03	0.19±0.04
TN	(mg / 100 g dry soil)	25.86±12.69	41.35±15.13	47.56±10.72	64.79±38.72
Na^+	(mg / 100 g dry soil)	9.96±1.48	8.61±0.184	12.34±4.04	3.89±0.58
K^+	(mg / 100 g dry soil)	18.19±9.64	21.00±7.10	14.45±3.05	4.42±0.94
Ca^{++}	(mg / 100 g dry soil)	37.69±10.99	44.04±11.30	35.03±6.59	12.90±1.89
Mg^{++}	(mg / 100 g dry soil)	27.83±14.36	25.03±7.96	25.24±8.28	3.51±0.51
SAR		1.59±0.37	1.14±0.16	5.03±3.63	0.41±0.14
PAR		3.10±0.37	2.16±0.17	6.27±3.73	1.59± 0.67

Abbrevialims

W.H.C.=Water-holding capacity **SAR =Sodium adsorption ratio** **TDP =Total dissolved phosphorus**

TN =Total nitrogen **PAR =Potassium adsorption ratio** **E.C. = Electrical conductivity**

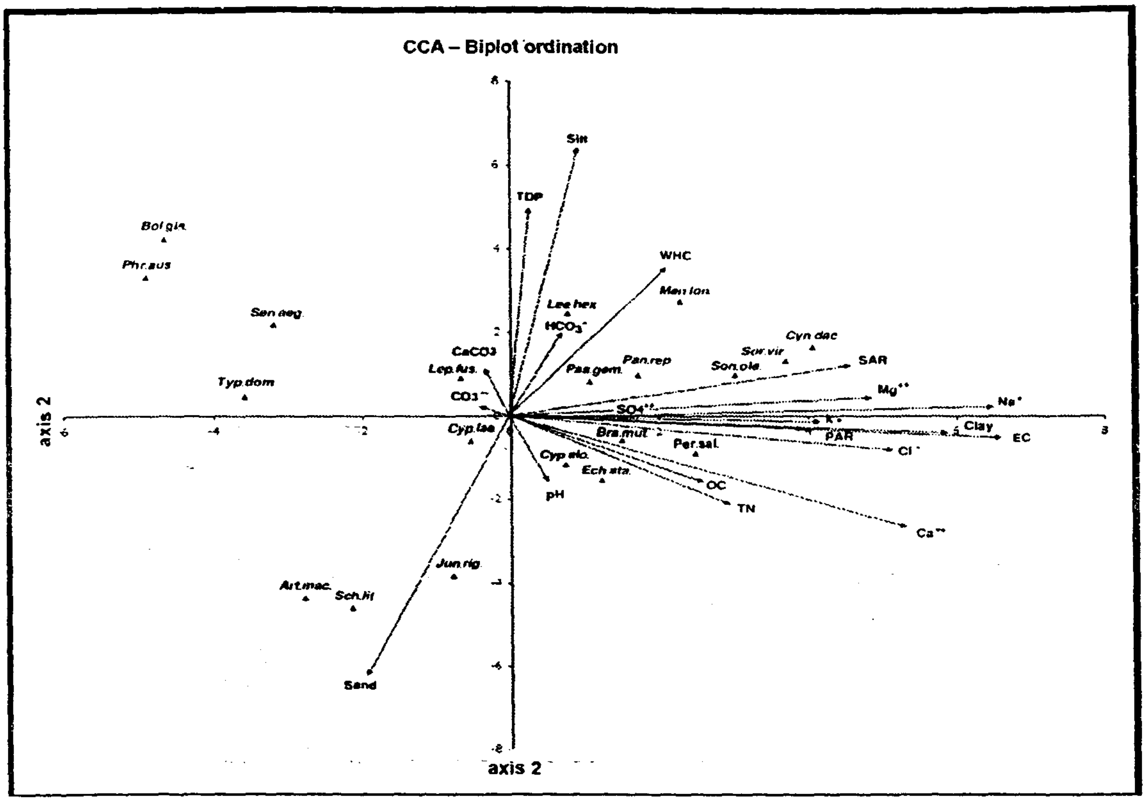

Fig. 4. Canonical correspondence analysis (CCA) ordination diagram of plant species along the gradient of environmental variables (arrows). The indicator and preferential species are indicated by first three letters of genus and species, respectively.

Phytochemical analysis

The different chemical constituents of the selected forage species were presented in Table 3. The succulence of the different investigated forage species showed narrow range of variation. It varied from 2.82 in *Leptochloa fusca* to 4.96 in *Echinochloa stagnina*. The highest percentage of moisture content (12.14%) was recorded in both *Cyperus laevigatus* and *Panicum repens*. Both species had the lowest percentage of dry matter (87.86%). The total ash content varied drastically among the eight species. It varied from 7.40% in *Schoenoplectus litoralis* to 15.37% in *Sorghum virgatum*. The highest percentages of total protein (16.79%) and total lipids (2.20%) were recorded in *Echinochloa stagnina*, while the highest percentage of crude fiber (19.26%) was found in *sorghum virgatum*. The total nitrogen content varied from 1.96 mg/g dry weight in *Panicum repens* to 28.15 mg/g dry weight in *Echinochloa stagnina*. The nutritive value of the investigated forage plants varied from 294.56 Cal/100g in *Sorghum virgatum* to 338.80 Cal/100g in *Echinochloa stagnina*. *Panicum repens* had the greatest percentages of total digestable nutrients (62.82%), metabolic energy (13.12 MJ/kg) and neto energy of lactation (3.38 MJ/kg).

TABLE 3. **Phytochemical analysis of the selected forage species.**

Plant species	Succulence	Moisture content	Dry matter	Total ash	Crude protein	Crude fiber	Crude lipids	Total nitrogen	Carbohydrates				Calculated Parameters			
									TSS	Glucose	Sucrose	Polysac	TDN	Nutritive value	ME	NEL
	Fresh wt/dry wt	(%)						(mg / g dry wt)					(%)	(Cal/100 g)	(MJ/kg)	
Bolboschoenus glaucus	3.93	11.68	88.32	10.64	6.12	8.83	1.40	9.79	169.24	4.22	9.55	252.19	58.98	317.72	12.36	7.83
Cyperus laevigatus	3.90	12.14	87.86	8.90	3.25	13.16	1.00	5.21	178.01	3.40	47.42	256.19	60.74	320.84	11.97	7.53
Echinochloa stagnina	4.96	10.13	89.87	7.92	16.79	16.20	2.20	28.15	127.06	1.71	33.4	294.20	51.92	338.80	10.23	6.32
Leptochloa fusca	2.82	10.83	89.17	13.03	10.98	14.63	1.60	17.57	147.65	1.83	18.92	264.19	55.64	312.56	11.00	6.86
Panicum repens	3.25	12.14	87.86	8.90	1.22	7.44	1.80	1.96	106.82	1.17	8.80	196.17	62.82	324.84	13.21	8.38
Paspalidium geminatum	3.50	10.83	89.17	13.03	3.95	12.45	1.60	6.32	91.13	1.09	24.98	202.17	60.70	312.56	12.12	7.61
Schoenoplectus litoralis	3.30	10.42	89.58	7.40	7.84	15.69	0.60	12.54	204.67	5.19	15.51	308.20	57.12	331.72	10.99	6.88
Sorghum virgatum	3.50	11.99	88.01	15.37	4.02	19.26	0.80	6.44	111.71	1.48	4.34	458.24	60.03	294.56	10.95	6.79

Abbreviations :

TSS = Total soluble sugars ME =Metabolic energy NEL = Neto energy of lactation
Polysac. = Polysaccharides TDN = Total digestable nutrients

The mineral analysis of the eight forage plants is presented in Table 4. The potassium concentration ranged from 8.48 mg/g dry weight in *Sorghum virgatum* to 16.86 mg/g dry weight in *Bolboschoenus glaucus*. The concentration of calcium was ranged from 2.55 mg/g dry weight in *Bolboschoenus glaucus* to 4.92 mg/g dry weight in *Echinochloa stagnina*. The greatest concentration of sodium (18.87 mg/g dry weight), magnesium (3.30 mg/g dry weight) and zinc (0.31 mg/g dry weight) were obtained in *Cyperus laevigatus*. *Leptochloa fusca* had the greatest concentration of iron (2.19 mg/g dry weight), copper (0.13 mg/g dry weight), manganese (0.32 mg/g dry weight) and lead (0.61 mg/g dry weight). *Panicum repens* contained the greatest concentration of cobalt (0.12 mg/g dry weight) and nickel (0.26 mg/g dry weight).

4. Anatomical investigation

4.1Boloboschoenus glaucus

The stem surrounded by incomplete layers of leaves, which are isobilateral and had several layers of palisade tissue with large lacunae alternate with spongy parenchyma. It also had bulliform cells. The vascular bundles showed different sizes (Plate 2).

4.2 Cyperus laevigatus

The culm is circular, with distinct epidermis. The assimilatory tissue bounded on the inner side by a well defined ring of mechanical cells. The vascular bundles connected by sclerenchyma cells in the outer most circle whereas, the remaining vascular bundles embedded in parenchyma cells (Plate 1).

4.3 Echinochloa stagnina

The center of the stem occupied by scattered vascular bundles embedded in parenchymatous cells. There was a large cavity in the center with remnants of the stellate parenchyma in it. The leaf was partially involuted, the adaxile surface with ribs. The epidermis intercepted by hing cells. Papillae absent from the abaxile surface, but adaxile ribs covered with small papillae (Plate 1).

4.4 Schenoplectus litoralis

The culm was triangular, the epidermis subtended by 2-3 layers of assimilating tissue. The vascular bundles scattered into the parenchyma of the ground tissue. Also the culm filled with large intercellular spaces (Plate 1).

4.5 Leptochloa fusca

The stem was circular, the epidermis followed by well defined ring of mechanical tissue. The vascular bundles arranged in one circle, the central part of stem occupied with large cavity. The leaf consist of narrow blade, the mesophyll tissue consist of radiate chlorenchyma which surrounded the vascular bundles. Microhairs or papillae found on the adaxile surface (Plate 1).

TABLE 4. Concentration of different cations (mg/g dry weight) of the selected forage species.

Species	Macro-elements				Micro-elements						
	Na	K	Ca	Mg	Fe	Cu	Co	Ni	Mn	Zn	Pb
Bolboschoenus glaucus	5.76	16.86	2.55	1.47	0.65	0.04	0.00	0.15	0.13	0.10	0.03
Cyperus laevigatus	18.87	10.78	4.05	3.30	0.69	0.04	0.01	0.12	0.17	0.31	0.04
Echinochloa stagnina	9.08	14.56	4.92	2.34	1.10	0.06	0.01	0.23	0.08	0.09	0.04
Leptochloa fusca	10.31	8.64	3.09	2.43	2.19	0.13	0.01	0.16	0.32	0.17	0.06
Panicum repens	6.46	9.13	2.70	1.42	0.84	0.04	0.01	0.26	0.07	0.15	0.05
Paspalidium geminatum	13.63	16.04	3.90	1.56	1.01	0.05	0.01	0.18	0.10	0.21	0.03
Schoenoplectus litoralis	12.76	10.78	2.64	1.80	0.58	0.02	0.01	0.24	0.11	0.06	0.05
Sorghum virgatum	3.49	8.48	3.30	2.19	0.97	0.04	0.01	0.13	0.03	0.19	0.04

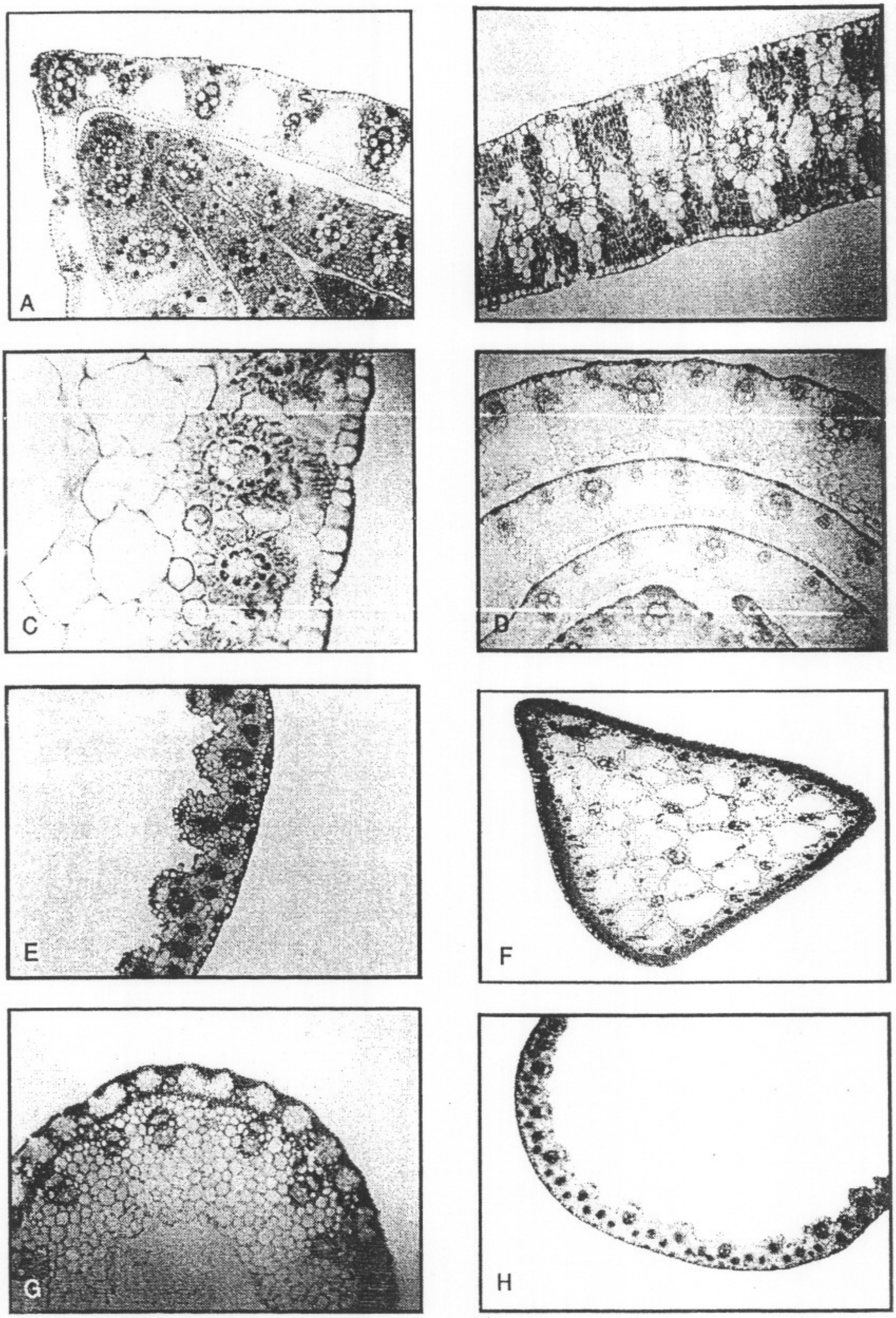

Plate 1. (A-H): A&B, Cross sections of *Bolboschoenus glaucus* stem and leaf respectively; C, *Cyperus laevigatus* culm; D&E, cross sections of *Echinochloa stagnina* stem surrounded by leaf sheath and leaf respectively; F, cross sections of *Schoenoplectus litoralis*; G&H, cross sections of *Leptochloa fusca* stem and leaf respectively.

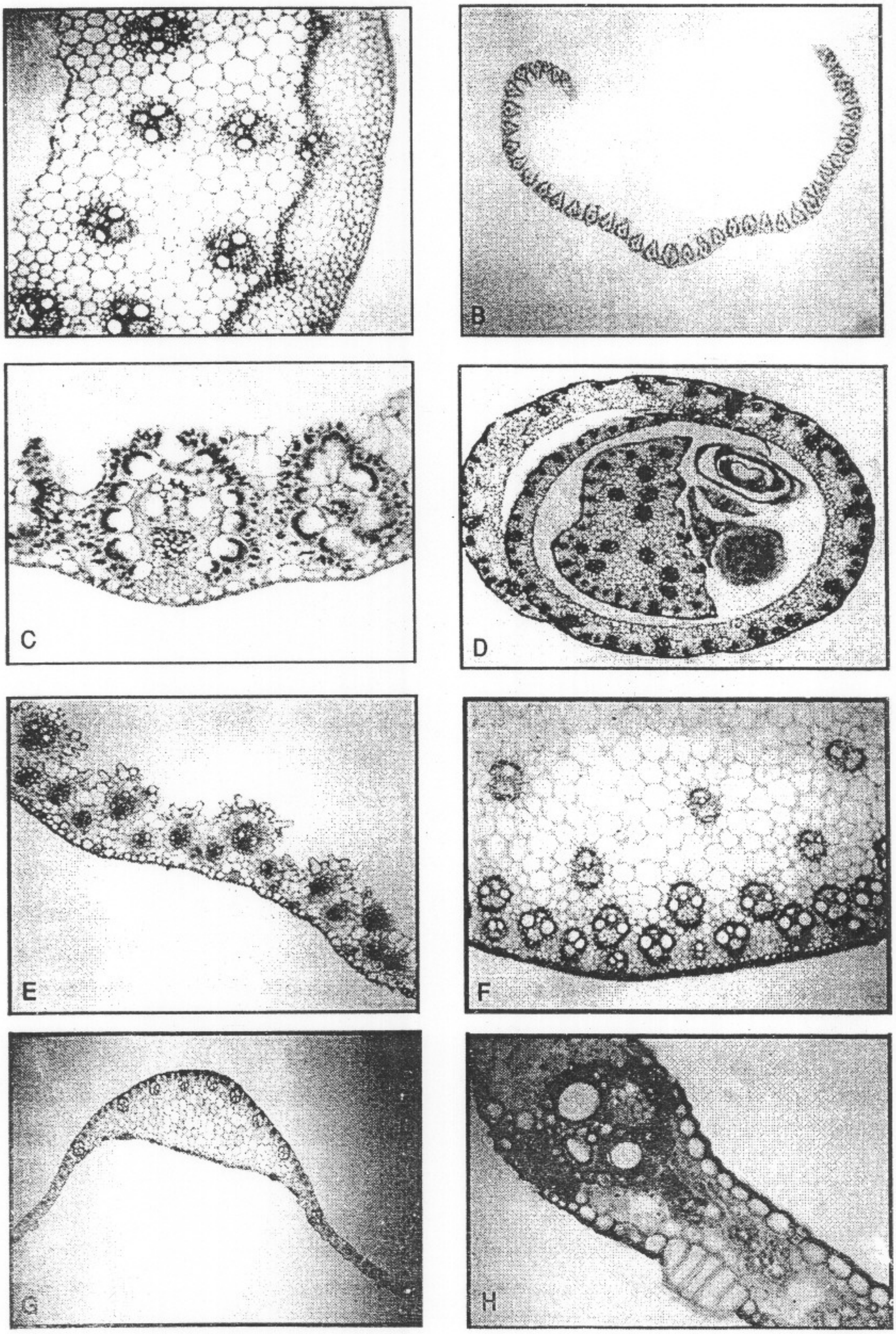

Plate 2. **(A-H): A,B&C, Cross sections of *Panicum repens* stem, leaf and enlarged part of leaf respectively; D&E, cross sections of *Paspalidium geminatum* stem and leaf; F,G &H, cross sections of *Sorghum virgatum* stem leaf and enlarged part of leaf respectively.**

4.6 Panicum repens

The stem with distinct epidermis followed by 5-6 layers of collenchyma tissue. The inner ground tissue consists of large thin walled radiate parenchyma. The vascular bundles scattered in the ground tissue and the stem had wide cavity. The venation of leaf was typically parallel, vascular bundles mostly small, crowded and conspicuously angular in outline and with bulliform cells (Plate 2).

4.7.Paspalidium geminatum

The stem surrounded by leaf sheath. The stem was not circular but it was wavy and occupied by small cavity. The vascular bundles were scattered in the ground tissue. The leaf was partially involuted. Bulliform cells found at the base of most of furrows, the mesophyll differentiated into palisade and spongy tissues and interdepted with the vascular bundle. Microhairs present and the papillae with conical shape found on the adaxile surface (Plate 2).

4.8 Sorghum virgatum

The stem was more or less circular, the outer most vascular bundles hold on sclerenchyma tissue, while the other inner one embedded in the parenchymatous ground tissue. The leaf has developed sclerenchyma, the mesophyll showed no distinct differentiation into spongy and palisade tissues. The bulliform cells were also found as well as few number of vascular bundles which were surrounded by single layer bundle sheath (Plate 2).

Discussion

The main aim of the present work was to investigate the ecological amplitude and economic potentiality of some non-conventional forage weeds inhabiting the Nile Delta region of Egypt. Concerning the ecological feature in the present study, it is very important to study the natural habitats and environmental factors under their effects, the plants grow and give their maximum yield of growth containing the highest product of active materials of high potential economic values. In the present study, the phytosociological analysis revealed that, the vegetation structure was classified by TWINSPAN classification into four vegetation groups. Group A was dominated by *Schoenoplectus litoralis*, group B was codominated by *Bolboschoenus glaucus* and *Leptochloa fusca*, group C was dominated by *Echinochloa stagnina* and group D was dominated by *Sorghum virgatum*. The vegetation groups identified in the current study were comparable to those reported by Mashaly *et al.* (2001), where they study the vegetation analysis along irrigation and drainage canals in Damietta Province and by Mashaly (2003) in his study on the phytosociology of the weed flora of crop lands in Kafr El-Sheikh Governorate. The application of the Detrended

Correspondence Analysis (DCA) ordination in the sampled stands of the present investigation indicated that, groups A and B were separated at the right side of the DCA diagram while groups C and D were segregated at the middle part and at the upper left side of the DCA, respectively. The previous results may be attributed to the dissimilarity between the floristic structures of the sampled stands of these groups. The application of Canonical Correspondence Analysis (CCA-biplot) suggested that, the most effective soil variables that had significant correlation with the abundance and distribution of vegetation groups were soil salinity (EC), sodium, calcium, clay, chlorides, magnesium, sand, silt, sodium and potassium adsorption ratios, potassium, total nitrogen, total dissolved phosphorus and water-holding capacity. Our finding is in agreement with those of Mashaly *et al.* (2001), Mashaly (2003) and Omar (2006).

The forage value of a consumed plant is the result of two main components: (1) palatability and voluntary intake by livestock and (2) nutritive value, *i.e.* chemical composition and digestibility (Le Houérou, 1980; Heneidy, 1996; Heneidy & Bidak, 2003). The total protein is proposed to be an indicator of the nutritional value of plants as food for ruminants (Bryant *et al.*, 1983). The selected forage species contained total protein comparable with those reported by El-Kady (1987). Although lipids are a concentrated source of energy, they do not constitute a major source of energy from forages (Chesworth, 1996; Heneidy, 2002). The lipid content, total fiber and ash content found in current work were similar to those reported by El-Halawany *et al.* (2002). The total digestible nutrient (TDN) is an approximate measure of the food energy available to animals after digestion (Lofgreen, 1951) and can be used as a measure of energy requirement of animals and the energy value of feeds. Crampton *et al.* (1957) reported that, the caloric value of TDN is very close to 4500 kcal/ kg TDN. In the present study, average TDN is about 58.49% DM. However, Abdel-Razik *et al.* (1988) reported annual average TDN value as 75% DM.

In comparison, Soliman and EL-Shazly (1978) calculated TDN values of Egyptian clover, barley and corn to be about 56, 64 and 68% DM, respectively. The metabolic energy and neto energy of lactation found in this study was greater than those reported by Balezentiere and Mikulioniene (2006). In the present study, *Echinochloa stagnina* showed the greatest nutritive value followed by *Schoenoplectus litoralis*, *Panicum repens*, *Cyperus laevigatus*, *Bolboschoenus glaucus*, *Paspalidium geminatum* and *Sorghum virgatum*. The concentration of macroelements (Sodium, Potassium, Calcium and Magnesium) and microelements (Iron, Copper, Cobalt, Nickel, Manganese and Zinc) reported in the selected forage species exceeded the requirements of animals according to Mayland and Hankins (2001).

Anatomical studies of grasses have provided some important diagnostic features in coastal and inter-coastal parts (Metcalfe, 1960; Ogundipe and Olatunji, 1992). The anatomical arrangement of tissues and the chemical composition and structure of cell walls largely determine the digestability of forage species (Ehike and Casler, 1985). Hanna *et al.* (1973) indicated that, a loose anatomical arrangement of tissues and large air space favors rapid digestion of range species. The previous findings agreed, to some extent, with the anatomical structure of highly palatable species in the study area such as *Cyperus laevigatus* and *Schenoplectus litoralis*, where rich parenchymatous tissues with large intercellular air spaces were observed in both the cortex and pith of these two studied species. Based on the anatomical investigation of the examined species and field observation, these selected taxa are considered as a potential forage species for grazing animals compared with common fodder crops. Presence of lignin, waxes and the cuticle of the epidermis covering plants resulted in restriction of microbe and enzyme access to forage tissues (Wilson and Kennedy, 1996). The epidermis of *Sorghum virgatum* stem and leaf were linked to thin-walled parenchyma cells, whereas in *Leptochloa fusca* culm was linked to thick-walled epidermis. Calcium oxalates (especially druses type) are relatively rare in monocotyledons than dicotyledons (Prychid and Rudall, 1999). However in the present study neither calcium oxalate crystals nor sclereides were observed in leaves or stems of the studied species, which make them useful as forage. It could be, therefore, concluded that the pasture in the study area was a suitable pasture for grazing animals. However, we recommend a better management to increase the productivity of the pasture.

References

Abdel-Razik, M., Ayyad, M. and Heneidy, S. (1988) Preference of Grazing Mammals for Forage Species and their Nutritive Value in a Mediterranean Desert Ecosystem (Egypt). *J. Arid Envir.*, **15**, 297-305.

Abu Al-Izz, M.S. (1971) "*Land Forms of Egypt*". The American Univ. in Cairo Press. Dar Al Maaref, Cairo.

Abu El-Naga, M.A. and EL-Shazly, K. (1971) The Prediction of the Nutritive Value of Animal Feeds from Chemical Analyses. *J. Agricultural Science, Cambridge,* **77**, 25–31.

Allen, S.E., Grimshaw, H.M., Parkinson, J.A., Quarmby, C. and Roberts, J.D. (1974) "*Chemical Analysis of Ecological Materials*". Blackwell Scientific Publications. Osney, Oxford, London.

American Public Health Association (APHA) (1998) "*Standard Methods for the Examination of Water and Waste Water*", 19th ed. American Public Health Association, American Eater Work Association, Water Pollution Control Federation, Washington, D.C.

Anonymous, (1993) SPSS Program for Windows. Base System User's Guide Release 5.0.2 Marija J. Norsis/SPSS INC.

AOAC Methods (1990) 922.06; 923.03; 925.09; 926.08. 954.02; 955.04C; 962.09; 979.09 In: "*Official Methods of Analysis*", 15th ed. Association of Official Analytical Chemists, Arlington, Virginia.

Ayyad, M.A., Abdel-Razik, M. and Mahanna, A. (1983) Climate and Vegetation Gradient in the Mediterranean Desert of Egypt. Pre-report of the Mediterranean Bioclimatology Symposium, Montepellier (France, 18-20 May, III-I-III-2-14).

Balezentiere, L. and Mikulioniene, S. (2006) Chemical Composition of Galega Mixture Silages. *Agronomy Research.* 4(2), 348-492.

Baranauskas, S., Mikulioniene, S., Kulpys, J. and Stankevicius, R. (1998) Evaluation of Energetic Value of Forage for Dairy Cows by Means of Hohenheim's test. *Veterinary & Zootechnics.* **6**(28), 62-65 (in Lithuanian).

Boulos, L. (1999-2005) *Flora of Egypt.* Vols. 1-4, Al Hadara Publishing, Cairo.

Bryant, J.R., Chapin, F.S. and Klein, D.R. (1983) Carbon/Nutrient Balance of Boreal Plants in Relation to Vertebrate Herbivory. *Oikos,* **40**, 357–368.

Chesworth, J. (1996) L'alimentation des ruminants. In: "*Edition Maisonneuve et Larose*". Centre Technique de Coop'eration Agricole et Rurale.

Crampton, E.W., Lloyd, L.E. and Mackay, V.G. (1957) The Caloric Value of TDN. J. *Animal Science*, **16**, 541–545.

Ehike, N.J. and Casler, M.D. (1985) Anatomical Characteristics of Smooth Bromegrass Clones Selected for in Vitro Dry Matter Digestibility. *Crop Science,* **25**, 513-1616.

El-Halawany, E.F., Mashaly, I.A. and Omar, G. (2002) Economic Potentialities of Some Plants Growing Naturally in the Nile Delta Region, Egypt. Egyptian *J. Desert Res.*, **52**(1), 21-35.

El-Kady, H.F. (1987) A Study of Range Ecosystems of the Western Mediterranean Coastal Desert of Egypt. *Ph.D. Thesis,* Berlin, Techn. Univ. German.

Feteris, A.W. (1965) A Serum Glucose Method Without Protein Precipitation. *American J. Medical Technology,* **31**, 17-21.

Handel, E.V. (1968) Direct Micro determinations of Sucrose. *Analytical Biochemistry,* **22**, 280-283.

Hanna, W.W., Monson, W.G. and Burton, G.W. (1973) Histological Examination of Fresh Forage Leaves After in Vitro Digestion. *Crop Sciences,* **13**, 115-123.

Heneidy, S.Z. (1996) Palatability and Nutritive Value of Some Common Plant Species from the Aqaba Gulf Area of Sinai, Egypt. *J. Arid Envir.,* **34**, 115-123.

Heneidy, S.Z. (2002) Browsing and Nutritive Value of the Most Common Range Species in Matruh Area. A Coastal Mediterranean Region, Egypt. *Ecologia Mediterranean,* Tome 28, Fascicule, **2**, 39-49.

Heneidy, S.Z. and Bidak, L.M. (2003) Association Between Calcium Oxalate Crystals and Potential Palatability of Some Range Plant Species in the Mediterranean Coastal Region, Egypt. *Bull.Fac. Sci., Assiut Univ.,* **31**(1-D), 151-163.

Hill, M.O. (1979a) DECORANA-a FORTRAN Program for Detrended Correspondence Analysis and Reciprocal Averaging. Section of Ecology and Systematic, Cornell Univ., Ithaca, New York.

Hill, M.O. (1979b) TWINSPAN-a FORTRAN Program for Arranging Multivariate Data in an Ordered Two Way Table by Classification of Individual and Attributes. Section of Ecology and Systematic Cornell Univ., Ithaca, New York.

Indrayan, A.K., Sharma, S., Durgapal, D., Kumar, N. and Kumar, M. (2005) Determination of Nutritive Value and Analysis of Mineral Elements for Some Medicinally Valued Plants from Uttaranchal. *Current Science*, **89**, 1252-1255.

Jackson, M.L. (1962) "*Soil Chemical Analysis*". Constable and Co. LTD. London.

Johansen, D.A. (1940) "*Plant Microtechnique*". McGraw Hill Book Company, New York.

Le Houerou, H.N. (1980) Browse in Northern Africa. In: "*Browse in Africa*", Le Houerou, H.N. (Ed.), Addis Ababa: 55-82.

Lofgreen, G.P. (1951) The Uses of Digestible Energy in Evaluation of Feeds. *J. Animal Science,* **10**, 344–351.

Mashaly, I.A. (2003) Phytosociological Study on the Weed Flora of Croplands in Kafr El-Sheikh Governorate, Egypt. *El-Minia Sci. Bull.,* **14**(2), 127-153.

Mashaly, I.A., El-Halawany, E.F. and Omar, G. (2001) Vegetation Analysis Along Irrigation and Drain Canals in Damietta Province, Egypt. Online *J. Biol. Sci.,* **1**(12), 1183-1189.

Mayland, H.F. and Hankins, L.H. (2001) Mineral Imbalances and Animal Health: A Management Puzzle. In "*Anti-quality Factors in Rangeland and Pastureland Forages.*" (Ed.) Karen Launchbaugh, Idaho Forest, Wildlife and Range Experiment Station University of Idaho.

Mckell, C.M. and Goodin, J.K. (1984) A Brief Overview of the Saline Lands of the United States. Research and Development Seminar on Forage and Fuel Production from Salt Affected Wasteland Western Australia Dept. Agric. May 19-27.

Metcalfe, C.R. (1960) "*Anatomy of Monocotyledons,*" Clarendon Press, Oxford.

Mueller-Dombois, D. and Ellenberg, H. (1974) "*Aims and Methods of Vegetation Ecology*". John Wiley and Sons, New York, Chichester, Brisbane, Toronto.

Nauman, C. and Bassler, R. (1993) "*Die Chemische Undersuchung von Futtermitteln. Methodenbuch.*" Band III. Damstadt, Vdllifa.

Ogundipe, O.T. and Olatunji, O.A. (1992) Systematic-Anatomy of *Brachiaria* (Trin) Griseb. (Poaceae). *Feddes Repert.,* **103**, 19-30.

Omar, G.M. (2006) Plant Life of the Different Habitats in the North Nile Delta of Egypt: Ecology and Fodder Potentialities *Ph.D. Thesis,* Fac. Sci., Mansoura Univ., Egypt.

Pierce, W.C., Haenisch, E.L. and Sawyer, D.T. (1958) "*Quantitative Analysis*". Wiley Toppen, Tokyo.

Piper, C.S. (1947) "*Soil and Plant Analysis*", Interscience Publishers, Inc. New York.

Pirie, N.W. (1955) Protein. In: "*Modern Methods of Plant Analysis*" IV, 23, Springer Verlage, Berlin.

Prychid, C.J. and Rudall, P.J. (1999) Calcium Oxalate Crystals in Monocotyledons: A Review of their Structure and Systematics. *Ann. Bot.,* **84,** 725-739.

Radosevich, S.R. and Holt, J.S. (1984) "*Weed Ecology*". John Wiley and Sons, New York.

Snedecor, G.W. and Cochran, W.G. (1968) "*Statistical Methods*", 6^{th} ed., The Iowa State Univ. Press, USA.

Soliman, S.M. and EL-Shazly, K. (1978) Increasing the Productivity per Feddan from Total Digestible Nutrients. *Alexandria J. Agricultural Research,* **26,** 551–556.

Southgate, D.A.T. (1991) Determination of Food Carbohydrates. Elsevier Applied Science.

Thyumanavan, V. and Sadasivan, S. (1984) *Qual Plant Foods Hum Num Nutr.,* **34,** 253-257. "*Quoted form Biochemical Methods,*" 2nd ed., 11-12. New Ag. Inter. Limit. Publ., New Delhi, India.

Tiko, B.L. (1975) Ecophysiological Aspect of Halophyte Zonation in Saline Sloughs. *Plant and Soil,* **43,** 355-369.

Wilson, J.R. and Kennedy, P.M. (1996) Plant and Animal Constraints to Voluntary Feed Intake Associated with Fibre Characteristics and Particle Breakdown and Passage in Ruminants. *Asuit J. Agric. Res.,* **47,** 199-225.

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الإمكانات العلفية وبيئة بعض أعشاب الأعلاف غير التقليدية فــي دلتا النيل بمصر

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استهدف هذا العمل دراسة الملامح البيئية والإحتمالات العلفية لــبعض أعشــاب الأعلاف غير التقليدية التي تنمو برياً في منطقة دلتا النيل بمصر حيث تم اختيار ٥٥ موقعاً وذلك لاجراء تحليل كمي شامل للغطاء النباتى العشبى لتقــدير وفــرة الأنواع العشبية فى البيئات الرئيسية فى خمس محافظات فى دلتا النيــل بمصــر وهي دمياط والدقهلية وكفر الشيخ والبحيرة والغربية وذلك عــن طريــق قيــاس الكتلة الحية للغطــاء النبــاتي المصــاحب للنباتــات محــل الدراســة وهــي: دِيــسْ (*Cyperus laevigatus*) وبُــربيط (*Bolboschoenus glaucus*) وأمْشُوط (*Leptochloa fusca*) وسَــيِفُونْ (*Echinochloa stagnina*) وقِصَيبة (*Pasplidium geminatum*) ونِسيلة (*Panicum repens*) وسَمَارْ (*Sorghum virgatum*) وجَرَاوَة (*Schoenoplectus litoralis*).

ولتقدير وفرة الأنواع النباتية العشبية بالعشائر المختلفة فى منطقــة الدراســة فقد طبقت برامج التصنيف والتسلسل ثنــائى الاتجــاه (TWINSPAN) علــى البيانات الخاصة بوفرة الأعشاب والتى تتمثل بقيمــة الأهميــة (Importance value) وذلك حتى يمكن التعرف على المجموعات العشبية المميزة لتلك البيئات المختلفة . وأيضا تم تطبيق برنامج التوزيع التطابقى الانعكاسى (DCA) لمعرفة مواقع المجموعات العشبية بالنسبة لمحاور التسلســل ونســبة الاخــتلاف بيــنهم وأخيراً تم استخدام برنامج التوزيع التطابقى الكنسى (CCA) لتحديد أهم عوامل التربة إرتباطاً بتوزيع ووفرة الأنواع النباتيــة. وباســتخدام بــرامج التصــنيف والتسلسل ثنائي الاتجاه وتطبيقها على البيانات الخاصة بوفرة الأعشــاب أمكــن التعرف على أربع مجموعات من النباتات العشبية. وباستخدام برنــامج التوزيــع التطابقى الكنسى(CCA) فقد دلت التحاليل الإحصائية علــى ان اهــم عوامــل التربة تاثيراً علي وفرة الغطاء النبــاتي هــي ملوحــة التربــة ، الصــوديوم ، البوتاسيوم ، الكالسيوم ، الماغنسيوم ، قوام التربة ، الكلوريدات ، نسبة امتــزاز الصوديوم(SAR) ، نسبة امتزاز البوتاسيوم (PAR) ، النيتــروجين الكلــي ، الفسفور الكلي الذائب ، قدرة التربة علي الإحتفاظ بالماء. أما الهدف الثاني لهــذه الدراسة فإنه يرقى إلى دراسة الأهمية الاقتصادية والامكانــات العلفيــة لــبعض الأعشاب النامية طبيعياً فى منطقة دلتا نهر النيل بمصر حيث تمت دراسة العلاقة بين العوامل البيئية وانتشار ووفرة تلك النباتات وكذلك إجراء تحاليل فيتوكيميائية للنباتات المختارة سالفة الذكر حيث تم تقدير كل من: الغضاضة ، الرطوبــة ، والوزن الجاف، الرماد الكلى ، البروتين الكلى، الألياف الكلية ، الدهون الكليــة، النيتروجين الكلي ، نسبة الجلوكوز والسكروز ونسبة السكريات الطليقة والمعقدة وكذلك نسبة الكربوهيدرات الكلية ، المواد الغذائية الكلية المهضــومة ، القيمــة الغذائية ، الطاقة الايضية ، الطاقة الكليــة لادرار اللــبن ، المغــذيات المعدنيــة الكبري والصغري وأيضا تمت دراسة التركيب التشريحي لهذة النباتات وقد تبين ان هذة النباتات تحتوي علي كمية كبيرة من الانسجة البارنشيمية وكمية قليلة من الانسجة المغلظة، كما ان بعضها يحتوي علي فراغات هوائية كبيرة، كمــا لــم يوجد اي نوع من بلورات اوكسالات الكالسيوم وهذا يؤهلها لان تكــون نباتــات مستساغة. وقد أوضحت تلك النتائج أن هذه النباتات يمكن اضافتها للأعلاف غير التقليدية وكذلك يمكن استخدامها كأعلاف خضراء مستساغة للماشية في فصــلي الصيف والشتاء.