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RESEARCH ARTICLE

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ECOLOGY AND NUTRITIVE STATUS OF *SISYMBRIUM IRIO* L. IN THE NILE DELTA, EGYPT

ABSTRACT:

The present study was conducted to evaluate the ecology and nutritive potential of the wild herbal weed *Sisymbrium irio* in the Nile Delta region. Vegetation and soil were sampled in 50 stands distributed in different habitats in the Nile Delta region of Egypt where *Sisymbrium irio* was recorded. The present study was investigated in cultivated lands, road-sides, wastelands, orchards and canal banks in five Governorates of the Nile Delta: El-Sharkia, El-Gharbia, El-Behira, Kafr El-Sheikh and El-Dakhlia. The total number of the recorded plant species was 104, belonging to 88 genera and related to 31 families. Floristic analysis revealed that the recorded species were classified into three major functional groups according to their duration (life-span) as follows: 72 annuals, 3 biennials and 29 perennials. Therophytes exhibited the maximum number of species (72.13%). Seven vegetation groups (VG) were identified by the application of TWINSPAN and DECORANA as classification and ordination techniques, respectively. Each of these groups inhabited one or more distinct type of habitats. S. *irio* was recognized as dominant species for most of these groups and as an important species in group E certain species may show a local dominance/co-dominance, or may be distinctly the most important in a group of stands. The correlation between vegetation and soil characteristics is indicated on the ordination diagram produced by the Canonical Correspondence Analysis (CCA). Sand, silt, clay, pH, calcium carbonate, organic carbon, and water- holding capacity were the most significant soil factors controlling the abundance and distribution of the vegetation groups. The community of *S. irio* (dominant species in Groups B, F, and G) was affected by, calcium carbonate, water holding- capacity, Mg, Ca, and K. Evaluation of the nutritive status of *S. irio* shoots showed that sodium, potassium, calcium, magnesium, iron, zinc, and phosphorous were detected in adequate amounts, while copper, manganese, and nickel were below the maintenance level. The present study evaluated the nutritive status of *S. irio* as good forage.

KEY WORDS:

Chorotypes, classification, ordination, soil, vegetation, nutrients

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INTRODUCTION:

Weed communities are affected by many factors as farm management practices (Thomas and Frick, 1993), crop type (Andreasen and Skovgaard, 2009), season (El-Demerdash *et al.*, 1997) and soil characteristics (Pinke *et al.*, 2010). *Sisymbrium irio* generally is found in abandoned fields, waste places, roadsides, orchards, off-highway vehicle staging areas, pastures and livestock watering sites, and open deserts (Rollins, 1993; Wilkin and Hannah, 1998). Felger (1990) described *S. irio* as being found in disturbed sites, along with being well-established in the natural desert and semi-desert habitats, *S. irio* reproduces entirely by seed. Wilkin and Hannah (1998) suggest that *S. irio*, like other colonising mustards, is self-compatible and self-pollinated, as suggested by its small flowers. It has been estimated that a large plant can produce 9500 seeds or more (Guertin, 2003). Guil *et al.* (1997) investigated the antinutritional and toxic components (oxalic acid, nitrate and erucic acid) in *S. irio* and other wild edible plants, they showed that only low amounts of erucic acid were found in *S. irio.*

Sisymbrium irio is winter annual without any means of vegetative reproduction. The seeds seem to be able to survive in low numbers in the seed bank. Täckholm (1974) and Boulos (2009) recorded the distribution of *S. irio* in the following phytogeographical regions: Nile region, Mediterranean region, Eastern desert, Res Sea coastal strip, Gebel Elba and Sinai (St. Katherine) in Egypt. According to Shaltout *et al.* (2010), the distribution of *S. irio* in the Nile Delta region includes the Nile valley, Nile Faiyum, the western and eastern Mediterranean regions, and the Isthmic Desert (northern Sinia). Phytochemical screening analysis revealed that *S. irio* contained secondary metabolites like flavonoids, alkaloids, oils and glycosides (Krets *et al.,* 1987).

The life form of plants is an adaptive response to environment and provides an ecological classification vegetation structure that may be indicative of habitat conditions (Box, 1981; Archibold, 1995).

The Cruciferae contains numerous species which are of economic importance, as succulent fodders for livestock (Core, 1955).The family also owes its position of economic importance to the widely variable, succulent, fodder plant types found in the genus *Brassica* (Bell, 2011). The Cruciferae includes the genus *S.* which includes *S. irio*.

According to Le Houérou (1980), the forage value of the consumed plant is the result of its nutritive value, i.e. chemical composition, digestibility and it is highly affected by the stage of maturity, edaphic influence, climate, and range condition. Wild *S. irio* is a winter and spring active annual (Mashaly and Awad, 2003). Mossallam (2007) recorded *S. irio* as one of the palatable species for grazing animals in Saudi Arabia.

The vegetation and nutritional values of *S. irio* have not previously been studied. Therefore, the objectives in the present study are (i) to characterize the community type of *S. irio* and to study the life- forms of the associated weeds of S. *irio* in the study area, (ii) to detect the phytogeographical significance of the floristic components and to find out the floristic relationships between the study area and the rest of Egypt as well as the adjacent countries, (iii) to determine the effective soil factors controlling its distribution, and (v) to evaluate the nutritional status of *S. irio* that may influence its fodder potentiality.

MATERIAL AND METHODS:

Study area:

The area of the Nile Delta is about 22,000 km^2 compared with 13,000 km^2 for the Nile Valley area. It comprises about 63% of Egypt's productive agricultural area. The surface of the Nile Delta in the south is relatively smoother than that in the north. This may be due to long time absence of agriculture in the north. This has permitted the old branches of the Nile Delta to run freely over the surface, building natural levees and dikes. The region of the mid-Delta slopes, generally from east to west, makes the level of the Damietta branch higher than that of the Rosetta branch by two meters (Abu Al-Izz, 1971). The Nile Delta is like the Mediterranean climatic zone. According to global map of the world distribution of arid regions (UNESCO, 1977) the north of the Nile Delta lies in an arid region, while the southern part lies in the hyper-arid region. The climatic conditions are warm summer (20 to 30ºC) and mild winter with mean temperature above 10ºC. Because of many years of agricultural activities, all soils with exception of the northern most part, are man-made and are regarded as anthropoid variants of the Gleysols and Fluvisols. The sampled stands are distributed in many localities (east, west, and north of the Nile Delta), representing five Governorates of the Nile Delta region: El-Sharkia, El-Gharbia, El-Behira, Kafr El-Sheikh, and El-Dakhlia Governorates (Fig. 1). The Nile Delta region and the studied provinces within it belong to the arid belts of the northern coastal region of Egypt (Ayyad *et al.,* 1983).

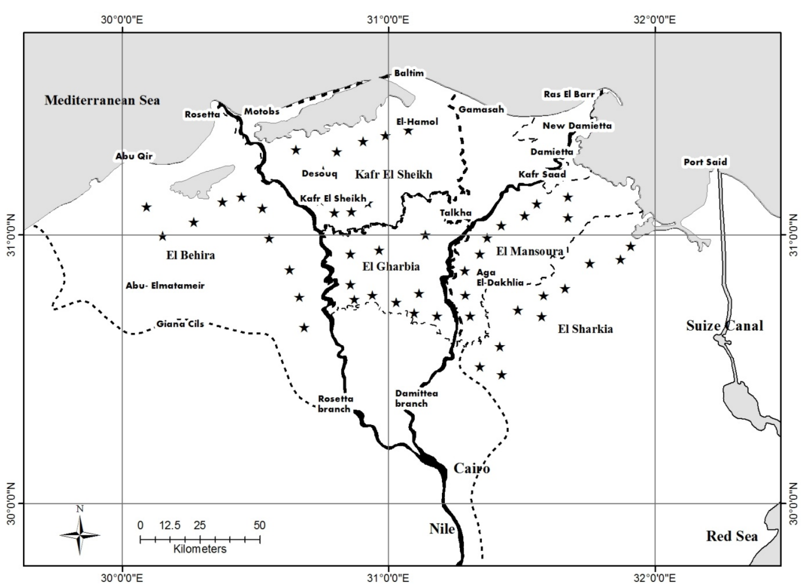

Fig. 1. Map of the Nile Delta of Egypt showing the different locations (*) of the study area

Floristic and vegetation analyses:

After regular visits during winter and spring (2012 - 2013), 50 sampled stands (each 50 m^2) were selected randomly in five Governorates; El-Sharkia, El-Gharbia, El-Behira, Kafr El-Sheikh, and El-Dakhlia. These stands were distributed in five different habitats: cultivated lands, road-sides, wastelands, orchards and canal banks.

A chorological analysis of the floristic categories of species was made to assign the recorded species to world geographical groups according to Zohary (1966 & 1972), Feinbrun-Dothan (1978 & 1986) and Wickens (1978). The plants were identified according to Täckholm (1974) and up to date by Boulos (1999, 2000, 2002, 2005, & 2009). Species were categorized in terms of their life forms according to Raunkiaer (1934) into therophytes, hemicryptophytes, geophytes,helophytes, chamaephytes, phanerophytes, parasites, and lianas.

Species density was recorded according to Shukla and Chandel (1989) and plant cover was estimated for each species using the line-intercept method (Canfield, 1941). The relative values of density and cover were calculated for each species and summed to give an estimate of a species' importance value (IV) in each stand which is out of 200. Voucher specimens were deposited in El-Zagazig University Herbarium.

Soil analysis:

Three composite soil samples were collected from each stand as a profile of 0 - 50 cm below the soil surface. Soil texture, porosity and water-holding capacity were determined according to (Allen *et al*., 1986). Calcium carbonate was determined by titration against 1N NaOH (Jackson, 1969). The oxidisable organic carbon (OC) was determined using Walkely and Black's rapid titration as menthioned by Piper (1947). Soil water extracts of 1:5 were prepared for the determination of salinity (EC), pH, chlorides, soluble carbonates and bicarbonates, sulphates, calcium, magnesium, sodium, and potassium. Sodium adsorption ratio (SAR) and potassium adsorption ratio (PAR) were calculated to express the combined effects of the different ions in the soil as mentioned by Allen *et al.* (1986).

Data analysis:

Two- Way Indicator Species Analysis (TWINSPAN and Canonical Correspondence Analysis (CCA) according to ter Braak (1988). Data of soil analyses were subjected to analysis of variance (ANOVA) and the mean values were separated based on the least significant differences (LSD) at the 0.05 propability level using the COSTAT ver. 6.3 program.

Phytochemical analysis:

Shoots of the studied species were collected from several stands from the cultivated fields in El-Zagazig area, El-Sharkia Governorate, Egypt. The sampled materials were kept in paper bags and brought to the laboratory shortly after collection. Moisture content and ash percentage were estimated according to AOAC (1990). Nutrients and heavy metals were extracted from 0.5 to 1 g samples using mixed-acid digestion method. Total nitrogen (N) was assessed by the Kjeldahl method, Na, Ca, and K using a flame photometer (Model CORNING M410), Mg, Fe, Cu, Mn, Zn, Ni, and Pb using atomic absorption (Shimadzu AA-6200). Phosphorous was estimated by applying molybdenum blue method using a spectrophotometer (Model CECIL CE 1021). Ether extract (crude fat) and crude fiber were determined by the Soxhlet extraction method. All these procedures are according to Allen (1989). Crude protein (CP) was calculated by multiplying the nitrogen concentration by the factor of 6.25 (Adesogon *et al*., 2000). Total carbohydrates were calculated according to the equation of Le Houe´rou (1980): NFE (in % dry matter) = 100 – (CP + CF + crude fat + ash), where NFE: Nitrogen free extract (mainly carbohydrates), CP = crude protein and CF = crude fibre. Digestible crude protein (DCP) was calculated according to the equation of Demarquilly and Weiss (1970): DCP (in % dry matter) = 0.929 CP (in % dry matter) – 3.52.

Energy measurements of *S. irio* shoots:

The prediction of the energy value of the aboveground parts of *S. irio* as a feed material was estimated by using equations based on its chemical composition (Shaltout *et al*., 2008) as follows:

Total digestible nutrients (TDN) was estimated according to the equation applied by Abu El-Naga and El-Shazly (1971), TDN (in% dry matter) = 0.623 (100 + 1.25 EE) – P 0.72, where EE = percentage of ether extract and P = percentage of crude protein. Digestible energy (DE) was estimated following this equation (NRC, 1984): DE (Mcal kg^{-1}) =0.0504 CP (%) + 0.077 EE (%) + 0.02 CF (%) + 0.000377 $(NFE)^2$ (%) + 0.011 (NFE) (%) – 0.152. Metabolized energy (ME) = 0.82 DE (Garrett, 1980), ME (Le Houérou, 1980).

Gross energy (GE) was calculated following this equation (NRC, 1984): GE (Kcal 100 g^{-1}) = 5.72 CP (%) + 9.5 EE (%) + 4.79 CF (%) + 4.03 NFE (%). Nutritive value (NV) was calculated as follows (Abu-El-Naga and El- Shazly, 1971): NV (% in DM) = TDN/CP.

Net energy (NE) was estimated as follows (Rivière, 1977): NE (MJ/kg DM) = {(TDN (%) X 3.65 – 100) / 188.3} x 6.9 Caloric value (CV) was calculated using the equation of Onyeike *et al*. (1995): CV (kcal / 100 g DM = (4 CP + 9 EE + 4 dc).

RESULTS:

Floristic composition, life- span, and life form spectra:

A total 104 species belonging to 87 genera in 31 families were recorded in the different habitats of the study area (Table 1).

The most species-rich families were Gramineae that comprised 22 species (21.12%) of the total recorded species and Compositae 18 species (17.28%) followed by Chenopodiaceae 9 species (8.64%) and Cruciferae 6 species (5.76%).

Table 1. Families, number of species in each family, number of genera included in each family, Life- span, Life form and Chorology of the plant life of the study area

Families and Species	No. of genera	Life- span	Life- form	Chorological element
Family Compositae	17			
Bidens pilosa L. var. *minor* Sch. Bip.		Annual	Thr	NEO
Calendula arvensis L.		Annual	Thr	ME+IR-TR+SA-SI
Carduus pycnocephalus L		Annual	Thr	SA-AR
Carthamus tenuis (Boiss & Blanche) Bornm		Annual	Thr	ME
Conyza aegyptiaca (L.) Dryand		Annual	Thr	ME
Conyza bonariensis (L.) Cronquist		Annual	Thr	NEO
Eclipta prostrata (L) L.		Annual	Thr	NEO
Lactuca serriola L.		Annual	Thr	ME+IR-TR+ER-SR
Launaea nudicaulis (L.) Hook. f.		Perennial	Hem	SA-SI+IR-TR+S-Z
Pluchea dioscoridis (L.) DC.		Perennial	Nan	SA-SI+S-Z
Pseudognaphalium luteo album (L.) Hilliard & B.L. Burtt		Annual	Hem	COSM
Reichardia tingitana (L.) Roth.		Annuall	Thr	ME+SA-SI+IR-TR
Senecio glaucus subsp. *coronopifolius* (Maire) C. Alexander		Annual	Thr	ME+SA-SI+IR-TR
Sonchus oleraceous L		Annual	Thr	COSM
Symphyotrichum squamatum (Spreng.) Nesom		Perennial	Cha	NEO
Xanthium strumarium L.		Annual	Thr	COSM
Urospermum picroides (L.) F.W. Schmidt		Annual	Thr	ME+IR-TR
Silybum marianum (L.) Gaertn.		Annual	Thr	ME+IR-TR+ER-SR
Family Gramineae	17			
Avena fatua L		Annual	Thr	COSM
Bromus catharticus Vahl		Annual	Thr	ME+ER-SR+IR-TR
Bromus diandrus Roth		Annual	Thr	ME+IR-TR+SA-SI
Bromus rubens L		Annual	Thr	ME+SA-SI
Cutandia memphitica (Spreng.) Benth.		Annual	Thr	ME +SA-AR+ IR-TR
Cynodon dactylon (L.) Pers.		Perennial	Geo-Hel	COSM
Dactyloctenium aegyptium (L.) Willd.		Annual	Thr	ME+PAL
Digitaria sanguinalis (L.) Scop.		Annual	Thr	PAL
Echinochloa crus-galli(L.) P. Beauv		Annual	Thr	ME+IR-TR+ER-SR
Eleusine indica (L.) Gaertn.		Annual	Thr	PAL
Hordeum murinum subsp. *leporinum* (Link)Arcang.		Annual	Thr	ME+IR-TR
Imperata cylindrica (L.) Raeusch.		Perennial	Hem	ME+PAL
Lolium multiflorum Lam.		Annual	Thr	ME+ER-SR+IR-TR
Lolium perenne L.		Perennial	Thr	ME+ER-SR+ IR-TR
Panicum repens L.		Perennial	Geo-Hel	PAN
Panicum turgidum Forssk.		Perennial	Geo-Hel	ME+SA-SI
Pennisetum glaucum (L.) R. Br.		Annual	Thr	PAL
Phalaris minor Retz.		Annual	Thr	ME+IR-TR
Phragmites australis (Cav.) Trin. ex Steud.		Perennial	Geo-Hel	COSM
Polypogon monspeliensis		Annual	Thr	COSM
Setaria verticillata (L.) P. Beauv.		Annual	Thr	COSM
Poa annua L.		Annual	Thr	ME+ IR-TR +ER-SR
Family Chenopodiaceae	5			
Atriplex portulacoides L.		Perennial	Cha	ME+IR-TR+ER-SR
Atriplex semibaccata R.Br.		Perennial	Cha	AUST
Bassia indica (Wight) A.J.Scott.		Annual	Thr	IR-TR+S-Z
Beta vulgaris var *maritima* (L.)		Biennial	Thr	ME+IR-TR+ER-SR
Chenopodium album L.		Annual	Thr	COSM
Chenopodium ambrosioides L		Biennial	Thr	COSM
Chenopodium giganteum D.Don		Annual	Thr	ME+ER-SR
Chenopodium murale L.		Annual	Thr	COSM
Suaeda pruinosa Lange		Perennial	Cha	ME

Families and Species	No. of genera	Life- span	Life- form	Chorological element
Family Cruciferae	5			
Brassica tournefortii Gouan		Annual	Thr	ME+ SA-SI+ IR-TR
Cakile maritima Scop. subsp. *aegyptiaca (*Willd.) Nyman		Annual	Thr	ME+ER-SR
Coronopus didymus (L.) Sm.		Annual	Thr	COSM
Coronopus squamatus (Forssk.) Anch.		Annual	Thr	ME+ER-SR+IR-TR
Raphanus raphanistrum L. subsp. *rhaphanistrum*		Annual	Thr	ME+ER-SR
Sisymbrium irio L.		Annual	Thr	ME+IR-TR+ER-SR
Family Leguminosae	5			
Alhagi graecorum Boiss		Perennial	Cha	PAL
Medicago intertexta (L.) Mill. var. *ciliaris* (L.) Heyn		Annual	Thr	ME+ER-SR
Melilotus indicus (L.) All.		Annual	Thr	ME+SA-SI+IR-TR
Trifolium resupinatum L.		Annual	Thr	ME+IR-TR+ER-SR
Vicia sativa L		Annual	Thr	ME+IR-TR+ER-SR
Family Polygonaceae	4			
Polygonum equisetiforme Sm.		Perennial	Geo	ME+IR-TR
Emex spinosa (L) Campd.		Annual	Thr	ME+SA-SI
Persicaria salicifolia Brouss ex willd.		Perennial	Geo	PAL
Rumex dentatus L.subsp. *dentatus*		Annual	Thr	ME+ER-SR+IR-TR
Family Solanaceae	3			
Datura stramonium L.		Annual	Thr	NEO
Nicotiana glauca R.C. Graham		Perennial	Nan	NEO
Solanum nigrum L.		Annual	Thr	ME+ER-SR+IR-TR
Family Aizoacea	2			
Mesembryanthemum crystalinum L.		Annual	Thr	ME+ER-SR
Mesembryanthemum nodiflorum L.		Annual	Thr	ME+SA-SI+ER-SR
Trianthema portulacastrum L.		Annual	Thr	PAL
Family Boraginaceae	2			
Anchusa hispida Forssk.		Annual	Thr	SA-SI
Echium angustifolium Mill. subsp. *sericeum*		Perennial	Cha	ME
Family Convolvulaceae	2			
Convolvulus arvensis L..		Perennial	Hem	COSM
Cuscuta pedicellata Ledeb		Annual	Parasite	ME+IR-TR
Family Euphorbiaceae	2			
Euphorbia helioscopia L		Annual	Thr	ME+SA-SI+IR-TR
Euphorbia heterophylla L		Annual	Thr	ME+SA-SI+IR-TR
Euphorbia peplus L.		Annual	Thr	ME+ER-SR+IR-TR
Euphorbia terracina L.		Perennial	Hem	ME
Ricinus communis L.		Perennial	Nan	Cult.&Nat.
Family Labiatae	2			
Lamium amplexicaule L.		Annual	Thr	ME+IR-TR+ER-SR
Mentha longifolia (L.) Huds.		Perennial	Hem	PAL
Family Malvaceae	2			
Malva parviflora L.		Annual	Thr	ME+IR-TR
Lavatera cretica L.		Annual	Thr	ME
Family Scrophulariaceae	2			
Veronica anagallis-aquatica L		Perennial	Hel	COSM
Misopates orontium (L.) Rafin		Annual	Thr	ME+ER-SR
Family Umbelliferae	2			
Ammi majus L.		Annual	Thr	ME+IR-TR
Torilis arvensis (Huds.) Link,subsp. *neglecta* (Spreng.)		Annual	Thr	ME+IR-TR+ER-SR
Family Amaranthaceae	1			
Amaranthus hybridus L.		Annual	Thr	PAL
Amaranthus lividus L		Annual	Thr	ME+IR-TR
Family Asclepiadaceae	1			
Cynanchum acutum L.		Perennial	Lianas	ME+IR-TR
Family Caryophyllaceae	1			
Spergularia marina (L.) Griseb		Biennial	Thr	ER-SR+ME+IR-TR
Family Cyperaceae	1			
Cyperus rotundus L.		Perennial	Geo-Hel	PAN
Family Fumariaceae	1			
Fumaria densiflora DC.		Annual	Thr	ME

Families and Species	No. of genera	Life- span	Life- form	Chorological element
Family Nyctaginaceae	1			
Boerhavia diffusa L.		Perennial	Cha	SA-SI
Family Oxalidaceae	1			
Oxalis corniculata L.		Perennial	Hel	COSM
Family Plantaginaceae	1			
Plantago lagopus L.		Annual	Thr	ME+IR-TR
Family Portulacaceae	1			
Portulaca oleracea L.		Annual	Thr	COSM
Family Primulaceae	1			
Anagallis arvensis var. *arvensis.*		Annual	Thr	COSM
Family Ranunculaceae	1			
Ranunculus sceleratus L.		Annual	Thr	ME+ER-SR+ IR-TR
Family Tamaricaceae	1			
Tamarix nilotica (Ehrenb.) Bunge		Perennial	Nan	SA-SI+S-Z
Family Typhaceae	1			
Typha domingensis (Pers.) Poir. ex Steud		Perennial	Geo-Hel	ME+IR-TR
Family Urticaceae	1			
Urtica urens L.		Annual	Thr	ME+ ER-SR
Family Verbenaceae	1			
Phyla nodiflora (L.) Greene		Perennial	Cha	PAN
Family Zygophyllaceae	1			
Tribulus terrestris L.		Annual	Thr	ME+S-Z

Abbreviations: Thr = Therophyte, Geo = Geophytes, Nan = Nanophanerophyte, Hem = Hemicryptophyt, Cha = Chamaephyte, Hel = Helophyte, Cry = Cryptophyte , COSM = Cosmopolitan, PAN = Pantropical, PAL = Palaeotropical, NEO = Neotropical, ME = Mediterranean, IR-TR = Irano-Turanian; SA –SI = Saharo - Sindian, S-Z=Sudano- Zambezian ER- SR : Euro - Siberian, S – Z = Sudano - Zambezian, AUST = Australian, Cult. & Nat. = Cultivated & Naturalized

The recorded species can be classified into three major functional groups according to their duration (life- span) as follows: 72 annuals (69.23%), 3 biennials (2.88%) and 29 perennials (27.88%). The therophytes, chamaephytes, hemicryptophytes, geophytes-helophytes, nanophanerophytes, geophytes, parasites, and lianas are represented by 75, 8, 7, 5, 4, 3, 1, and 1 species, respectively (Fig. 2), which represented (72.13%), (7.69%), (6.73%), (4.81%), (3.84%), (2.88%), (0.96%), and (0.96%), respectively.

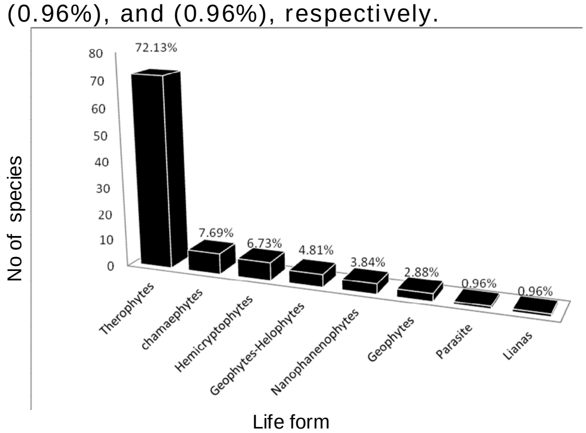

Fig. 2. Life form spectra of species in the area based on Raunkiaer system (1934)

Chorological affinities:

Chorological analysis revealed that the cosmopolitan, monoregional, biregional and pluriregional species constituted 16.3%, 22.1%, 26.9%, and 34.7% of the recorded species, respectively, whereas 60 species (57.69%) are of Mediterranean origin. The other floristic elements such as Palaeotropical, Neotropicaland Pantropical, are represented by 6 species (5.77%), 4 species (3.84%), and 2 species (1.92%), respectively (Table 2).

Table 2. Number of species and percentage of various floristic categories recorded in the study area

Chorotypes	number of species	percentage
COSM	17	16.3
Monoregional		
ME	6	5.77
PAL	6	5.77
NEO	4	3.84
AUST	1	0.96
SA - SI	3	2.88
PAN	2	1.92
Cult. & Nat.	1	0.96
Subtotal	23	22.1
Biregional		
ME+ IR - TR	10	9.61
ME + ER - SR	7	6.73
Me + SA - SI	3	2.88
ME + PAL	2	1.92
SA - SI + S - Z	2	1.922
SA + SI	2	1.922
IR - TR + S - Z	1	0.96
ME + S - Z	1	0.96
Subtotal	28	26.9
Pluriregional		
ME+IR-TR+ER-SR	20	19. 22
ME+SA-SI+IR-TR	8	7.69
ME+IR-TR+S-Z	7	6.73
SA-SI+IR-TR+S-Z	1	0.96
Subtotal	36	34.7
Total	104	100%

Classification of stands:

The TWINSPAN classification was based on the importance values of 104 species recorded in 50 stands and led to the recognition of seven vegetation groups (Table 3 & Fig. 3). Group A comprises one stand dominated by *Xanthium strumarium* which has the highest importance value in this group (IV = 58.61). The other important species which attained relatively high importance values in this group was *Trianthema portulacastrum* (IV = 31.49). Group B includes four stands co-dominated by *S. irio* (IV = 18.29) and *Euphorbia peplus* (IV = 18.90). The other important species in this group were *Datura stramonium* (IV = 17.78) and *Bromus catharticus* (IV = 15.74). Group C comprises 12 stands dominated by *Brassica tournefortii* (IV = 24.01). In this group, the other important species were *Cynodon dactylon* (IV = 17.12) and *Chenopodium murale* (IV = 17.00). Group D includes three stands dominated by *Polypogon monspeliensis* (IV = 39.61). The other important species were *Malva parviflora* (IV = 31.48) and *Conyza bonariensis* (IV = 26.58). Group E comprises 14 stands dominated by *Malva parviflora* (IV = 43.83).*Phragmites australis* (IV = 25.75) was also the most important species in this group. The other important indicator species which attained relatively high importance values in this group were *Chenopodium murale* (IV = 18.40), *Rumex dentatus* (VI = 16.93) and *S. irio* (16.07). Group F comprises ten stands dominated by *S. irio* (IV = 28.62). In this group, the other important indicator species were *Cynodon dactylon* (IV = 19.44), *Chenopodium murale* (IV = 18.33), *Malva parviflora* (IV = 16.92) and *Polypogon monspeliensis* (IV = 16.77). Group G includes six stands co-dominated by *S. irio* (IV = 21.81) and *Malva parviflora* (IV = 19.71). In this group, the other important indicator species *were Polypogon monspeliensis* (IV = 16.77) and *Phragmites australis* (IV = 14.65).

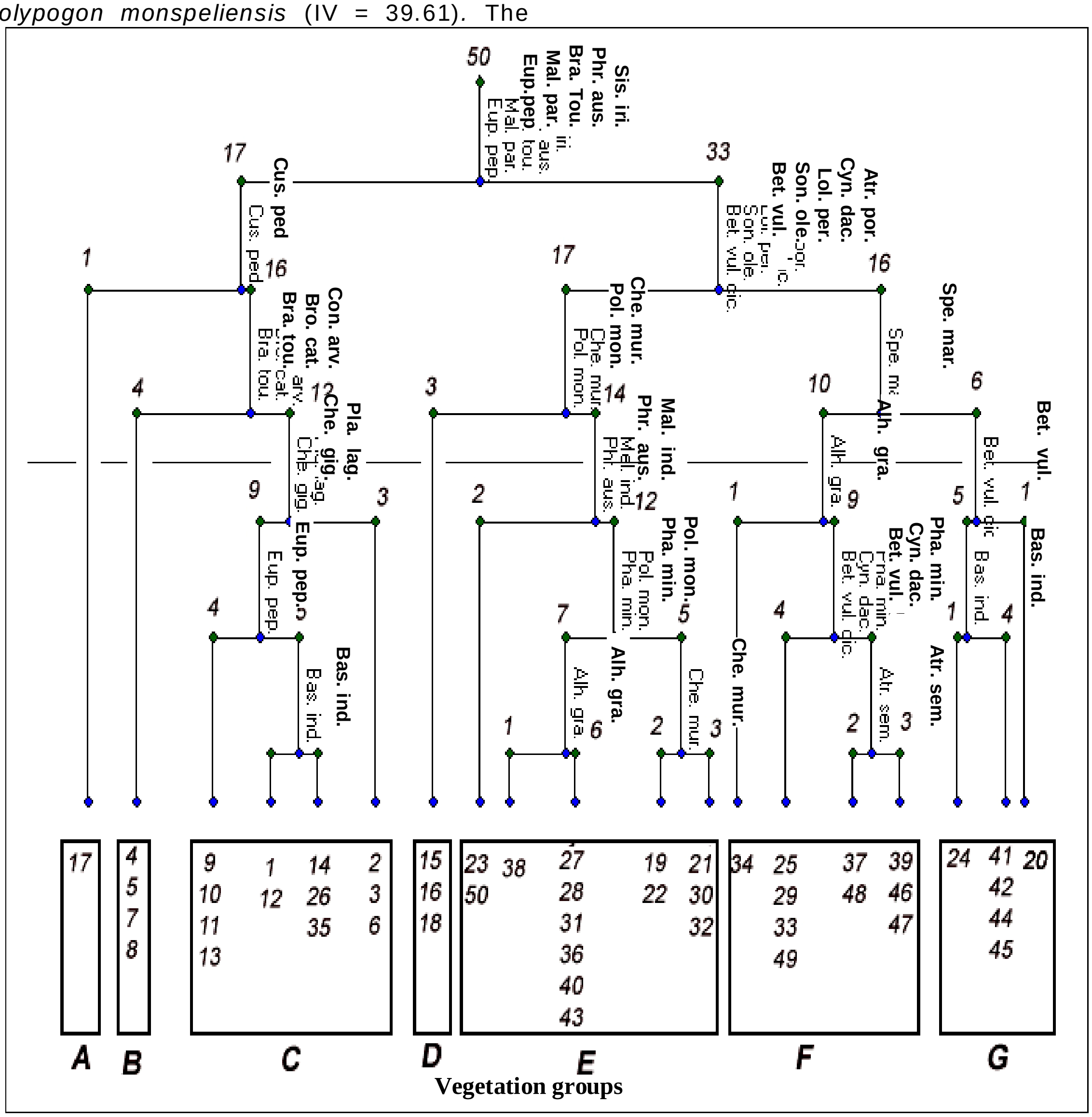

Fig. 3. Two Way Indicator Species Analysis (TWINSPAN) dendrogram of 50 sampled stands based on the importance values (IV) of 104 species. Indicator species names are abbreviated by the first three letters of both genus and species, respectively. Sis iri: *Sisymbrium iri*, Phr aus: *Phragmites australis*, Bra tou: *Brassica tournefortii*, Mal par: *Malva parviflora*, Euo pep: *Euphorbia peplus*, Atr por: *Atriplex portulacoides*, Cyn dac: *Cynodon dactylon*, Lol per: *Lolium perenne*, Son ole: *Sonchus oleracous*, Bet vul: *Beta vulgaris,* Cus ped: *Cuscuta pedicellata*, Spe mar: *Spergularia marina*, Che mur: *Chenopodium murale*, Pol mon: *Polypogon monspeliensis*, Con arv: *Convolvulus arvensis*, Bro cat: *Bromus catharticus*, Mei ind: *Melilotus indicus*, Pla lag: *Plantago lagopus*, Che gig: *Chenopodium giganteum,* Bas ind: *Bassia indica*, Pha min: *Phalaris minor*, Atr sem: *Atriplex semibaccata.*

Table 3. Characteristics of the different vegetation groups resulting from TWINSPAN classification of the study area

Group	No. of stands	Total spp.	Habitats	Dominant species	Other important species
A	1	13	CL	*Xanthium strumarium* (58.61[0.00])[a]	*Trianthema portulacas*trum (31.49 [0.00][a]
B	4	31	CL, WL, WL	*Sisymbrium irio* (18.29[1.40])[a] *Euphorbia peplus* (18.90[0.67])[a]	*Datura stramonium* (17.78[1.18])[a] *Bromus catharticus* (15.74[1.26])[a]
C	12	58	OR, WL	*Brassica tournfortii* (24.01[0.92])[a]	*Cynodon dactylon* (17.12[1.11])[a] *Chenopodium murale* (17.00[1.34])[a]
D	3	21	CL, CB	*Polypogon monspeliensis* (39.61[0.56])[a]	*Malva parviflora* (31.48[9.71])[a] *Conyza bonariensis* (26.58[0.87])
E	14	37	RS, Cl, CB	*Malva parviflora* (43.83[0.88])[a]	*Phragmites australis* (25.75[0.81])[a] *Chenopodium murale* (18.40[0.79])[a] *Rumex dentatus* (16.93[1.43])[a] *Sisymbrium irio* (16.07[0.36])[a]
F	10	33	CL, WL, CB	*Sisymbrium irio* (28.62[0.73])[a]	*Cynodon dactylon* (19.44[1.14])[a] *Chenopodium murale* (18.33[0.86])[a]
G	6	29	CB, RS	*Sisymbrium irio* (21.81[0.58])[a] *Malva parviflora (*19.71[0.58])[a]	*Polypogon monspeliensis* (16.77[1.07])[a] *Phragmites australis* (14.65[0.68])[a]

[a] (Important value [coefficient of variation]), CL: cultivated lands, WL: wastelands, OR: orchards, CB: canal banks, RS: roadsides.

Ordination of stands:

The stand ordination in the study area given by detrended correspondence analysis (DCA) is shown in figure 4. It is clear that, the vegetation groups A, B, C, and D identified by the TWINSPAN classification were clearly distinguishable and had a marked segregation pattern on the ordination planes. Group A lies towards the upper- right of the DCA diagram while group B is at the lower right side and Groups C and D are segregated near the middle side of the diagram. Meanwhile, Groups E, F, and G are roughly superimposed and are separated on the left side of the DCA diagram.

Vegetation-soil relationships:

Soil analysis:

The soil variables of the seven groups of stands derived from the TWINSPAN classification are presented in table 4. Except for group A the soil texture is formed mainly of sand with a small amount of silt and clay. Group A contains relatively high amounts of silt and clay and a correspondingly low amount of sand. Soil porosity, water- holding capacity and pH are comparable in the seven groups. Group A had the highest amount of calcium carbonates (27%) and bicarbonates (0.14%). Group D had the highest amount of both K (32.99 mg/100 g dry soil) and Ca (21.71 mg/100 g dry soil). The highest value of organic carbon (7.78%) and PAR (14.83) were determined in group E. The electrical conductivity (1019.09 µmhos/cm), chlorides (0.12%), Na (30.88 mg/100 g dry soil) and Mg (17.10 mg/100 g dry soil) were recorded in group F. Group G showed the highest sulphate content (0.20%) and SAR (13.94).

Analysis of variance showed that, there were highly significant differences (P ≤ 0.05) between the seven vegetation groups in sand, silt, clay, water- holding capacity, pH, organic carbon and bicarbonates. Electrical conductivity and Ca showed low significant differences between these groups but, porosity, chlorides, sulphates, carbonates, Na, K, Mg, SAR, and PAR were not significantly different (P ≤ 0.05).

Correlation between soil variables and vegetational gradients:

The correlation between vegetation and soil characteristics is indicated on the ordination diagram produced by the Canonical Correspondence Analysis (CCA). Thae biplot of species, groups, and soil variables (Fig. 5); sand, silt, clay, pH, calcium carbonate, organic carbon and water- holding capacity were the most significant soil factors affecting the abundance and distribution of the vegetation groups. The community of *S. irio* dominant species in groups B, F and G was affected by, calcium carbonate, water holding-capacity, Mg, Ca, and K.

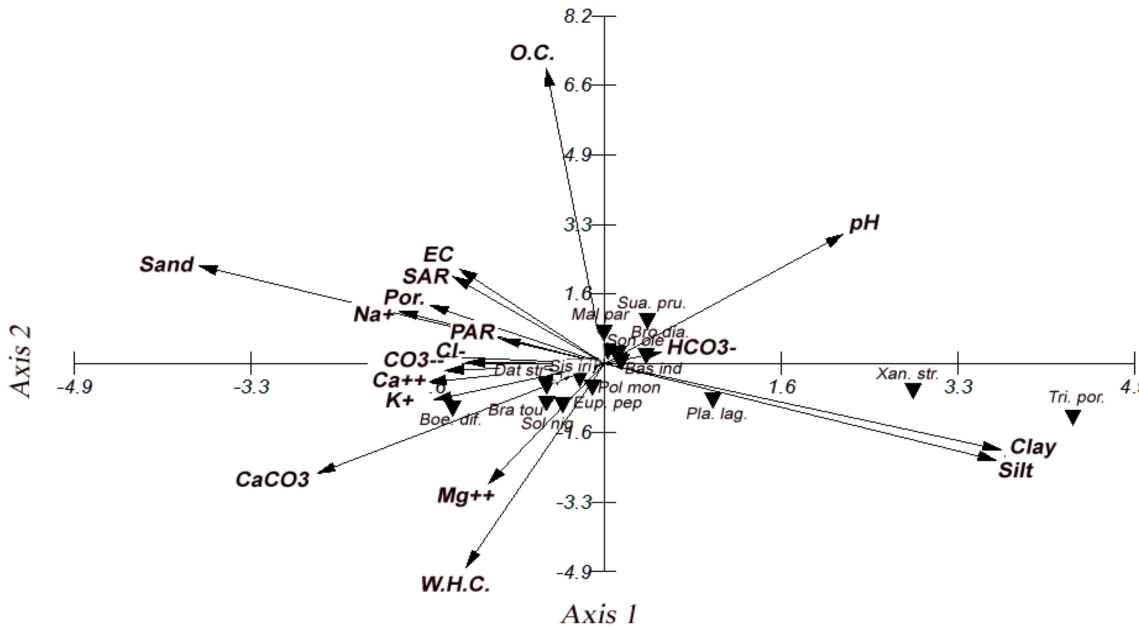

Fig. 5. *CCA species-soil variable biplot in different habitat types of the study area. EC: electrical conductivity, OC: organic carbon, SAR: sodium adsorption ratio, PAR; potassium adsorption ratio, Por: porosity, WHC: water holding capacity,Tri por: Trianthema portulacastrum, Xan str:Xanthium strumarium,Bas ind:Baassia indica, Pla lag: Plantago lagopus, Pol mon: Polypogon monspeliensis, Sua pru: Suaeda pruinosa, Mal par: Malva parviflora, Son ole: Sonchus oleracous, Sis iri: Sisymbrium irio, Boe dil: Boerhavia diffusa, Dat str: Datura stramonium, Bro dia: Bromus diandrus, Bra tou: Brassica tournefortii, Eup pep: Euphorbia peplus, Mal par: Malva parviflora, Sua pru: Suaeda pruinosa, Son ole: Sonchus oleracous.*

It is clear that *Xanthium strumarium* the dominant species in group A was affected by silt and clay. *Euphorbia peplus* (the co-dominant species in group B) was affected by water- holding capacity, calcium carbonate and Mg, while the community of *Brassica tournefortii* (the dominant species in group C) was also affected by calcium carbonate, K, and Ca. *Polypogon monspeliensis* (the dominant species in group D and an important species in group F) was affected by organic carbon, silt clay and water- holding capacity. *Malva parviflora* (the co-dominant species in groups E and G and an important species in groups D and F) were affected by organic carbon and pH.

Phyto Chemical analysis of *Sisymbrium irio*:

Variations in the average nutrient content of *S. irio* are shown in (Table 5). The percentages of dry matter, ash and moisture content is 91.98%, 22.69%, and 8.02%, respectively, while the crude fibre, crude fat, crude protein, and total carbohydrates reached 18.23, 2.65, 10.23, and 54.18%, respectively. The total digestible nutrients were 56.42%, while the gross energy of *S. irio* is 391.49 kcal/100 g.

The concentrations of Na, K, Ca and Mg were 1.57, 3.52, 1.6 and 2.01 mg/g dry weight, respectively. The concentrations of Fe, Cu, Ni, Mn, Zn, P and Pb were 0.6, 0.04, 0.01, 0.2, 0.3, 02.0, and 0.004 mg/g dry weight, respectively.

Table 5. Proximate constituent analysis and energy measurements of *Sisymbrium irio* collected from the cultivated lands in El-Zagazig area, El-Sharkia, Egypt

Parameters		Value
Moisture (%)		8.02
Ash (%)		22.69
Dry matter (%)		91.98
Crude fiber (%)		18.23
Crude Lipid (%)		2.65
Crude Protein (%)		10.61
Carbohydrates %		54.18
Nutritive value (% in DM)		5. 31
Total digestible nutrients (%)		56. 42
Digestible energy (Mcal/kg)		2.63
Metabolized energy Mcal kg^{-1}		2.15
Digestible crude protein(% in DM)		6.33
Gross energy (Kcal 100 g^{-1})		391.49
Net energy Mcal kg^{-1}		3.88
Nitrogen		1.69
Na		1.57
K		35.2
Ca		16.0
Mg		20.1
Fe	mg/g dry weight	0.6
Cu		0.04
Ni		0.01
Mn		0.2
Zn		0.3
P		02.0
Pb		0.004

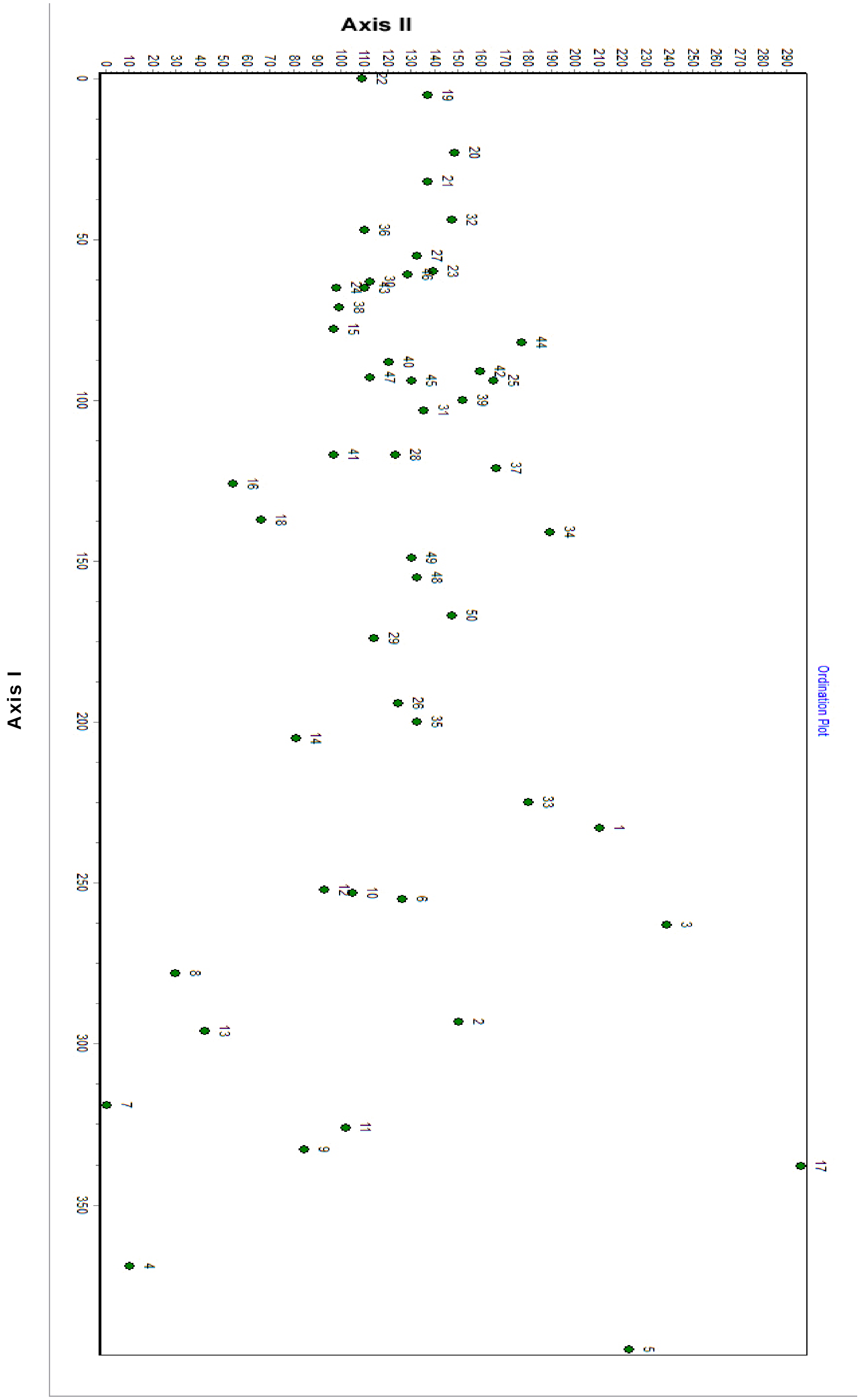

Fig. 4: Detrended Correspondence Analysis (DCA) ordination of 50 sampled stands

DISCUSSION:

The weed vegetation in the study area comprises 104 species belonging to 87 genera and to 31 families. Zohary (1973) reported that a striking feature in Egyptian flora is the large number of genera in proportion to that of the species (about 2: 1 species per genus). This is a very low figure compared with the global average which amounts to 13.6 (Good, 1977). The present study indicated that the flora of the study area goes below the average level of the Egyptian flora where the number of species per genus was 1.19, which is a close figure to 1.9 and 1.6 recorded for the Nile Delta (Ahmed, 2003). This means that the flora of the study area is relatively rich as the region that has a certain number of species, each of which belongs to a different genera, is relatively more diverse than a region with the same number of species but belongs to a fewer number of genera (Hawksworth, 1995).

The life form spectra provide information, which may help in assessing the response of vegetation to variations in environmental factors (Ayyad and El-Ghareeb, 1982). Therophytes had the highest contribution. The main advantage of being annual or geophytes is to have high degree of plasticity in growth rate, size and phenology and to remain dormant in years of climatic extremes (Khedr, 1999). The high percentage of therophytes in the present study (72.12%) may be related to the seasonal rainfall. This trend is similar to that of the whole Egyptian flora (Hassib, 1951). It is also necessary to point out that the increase in both Leguminosae and therophytes in a local flora can be considered a relative index of disturbance for Mediterranean ecosystems (Abdel Ghani and Abd El-Khalik, 2006). According to Mobayen (1995) the frequency of therophyte plants is a result of Mediterranean climate.

The three main families Gramineae, Compositae, and Chenopodiaceae which together contribute about 47.1% of the total plant species recorded, are clearly the leading taxa and constitute the bulk of the flora in the study area. These findings are in reasonably close agreement with those of a number of others for the Nile Delta region of Egypt region (Mashaly and Awad, 2003). In addition Gramineae is not only the largest family in the present list but also the largest and most widespread family of flowering plants in the world (Good, 1977). This can be attributed to their wide ecological range of tolerance, and to their efficient seed dispersal capability. Regarding the life-span of species (duration), the recorded weeds were categorized into three main groups: annual species (72), biennias (3) and perennial species (29). These findings agreed with El-Halawany *et al*. (2010). The low number of perennials (29 species) might be related to the intensive management used in the farming processes, such as ploughing, and furrowing operations, which affect vegetative growth structures, as well as the life cycles of the perennial weeds.

In the present study, the floristic analysis indicated that Mediterranean taxa represent a relatively high percentage of species (57.69%). This confirms the findings of many researchers for the Nile Delta region (Shaltout *et al.*, 2005). The floristic categories of the recorded species showed that pluriregional taxa had the highest contribution (36 species), followed by bi-regional (28 species), monoregional (23 species) and cosmopolitan (17 species). Zohary (1973) referred to the dominance of interregional species (bi, tri and pluriregionals) over monoregional ones to the presence of interzonal habitats, such as anthropogenic or hydro-, halo- and psammophilous sites. Neotropical, Irano-Turanian, Saharo-Sindian, Euro-Siberian, and Sudano-Zambezian elements were represented by different number of taxa, reflecting their capability to penetrate the study area which may be due to the human activities and agriculture history of the region.

In the present study, *S. irio* is a codominant species of group B and is one of the common associated species in all other vegetation groups. These findings are similar to those reported by El- Halawany *et al*. (2002).

In the present study, the application of TWINSPAN classification led to the recognition of seven vegetation groups (A-G). Group A is dominated by *Xanthium strumarium*, while group B is codominated by *S. irio* and *Euphorbia peplus.* Group C is dominated by *Brassica tournefortii*, whereas group D is dominated by *Polypogon monspeliensis*. Group E is dominated by *Malva parviflora* and group F is dominated by *S. irio*. Finally, group G is codominated by *S. irio* and *Malva parviflora*. These associations may be similar to those described by Shaltout *et al*. (1992), on the weed communities of the common crops in the Nile Delta, Mashaly (2003) on the weed flora of the main crops in Kafr El-Sheikh Governorate, Baraka and Al-Sodany (2003) on the habitat and plant life in El-Sharkia Governorate, Mashaly *et al*. (2012) on the cultivated land habitat in the Nile Delta of Egypt and Mashaly *et al*. (2013) on vegetation-soil relationship in the cultivated land habitat in El- Behira Governorate. Also, the vegetation groups yielded by TWINSPAN classification in the present investigation are markedly distinguishable and having a clear pattern of segregation on the ordination plane.

The correlation between vegetation and soil characteristics is indicated on the ordination diagram produced by the Canonical Correspondence Analysis (CCA). The biplot of species, groups and soil variables; sand, silt, clay, pH, calcium carbonate, organic carbon, and water- holding capacity were the most significant soil factors affecting the abundance and distribution of the vegetation groups. The community of *S. irio* (dominant species in groups B, F, and G) was affected by, calcium carbonate, water holding-capacity, Mg, Ca, and K. This agrees with the findings of (Mashaly and Awad, 2003). In addition, soil texture may affect soil or productivity via influence on the soil water holding capacity, infiltration rate, moisture availability for plants and consequently plant nutrition (Sperry and Hacke, 2002).

Proximate composition of aboveground parts of *S. irio* revealed that these parts contained moisture (8.02%) and ash (22.269%), in the present study the ash value was higher than the value reported by Heneidy and Helmy (2009). According to El-Shaer and Gihad (1994) the forage species having high ash (14%) had higher palatability, also moderate moisture content makes feed more palatable and therefore may increase DM intake. Linn (2004) indicated that *S. irio* has a high palatability.

Crude fibre (18.23%): Van Soest *et al*. (1978) indicated that increased fibre content is associated with low digestibility and low feed value. A high level of crude fibre usually shows a high level of lignifications and thus reduced the amount of available energy (Nordfeldt *et al*., 1961). In this study crude fibre was (18.23%).

Crude lipid (2.65%): Although, lipids are a concentrated source of energy they do not constitute a major source of energy from forages (Heneidy, 2002). In the present study, the total lipid was 2.65%. The importance of lipids (i.e., ether extract) to plants, in terms of structure and use in metabolism, is well known. However, Chapin *et al*. (1986) indicated that lipids are clearly unimportant as an energy source in some plants.

Crude protein (CP): According to Maiti *et al*. (2003) the aerial parts of *S. irio* in its vegetative stage contain high levels of protein (32%), so the species would seem to have potential as a food of high nutritional value and it could be considered an underexploited feed resource. In the present study crude protein was 10.61%, this value is within the limits of 6-12%recommended by the MAFF (1975).

The value of carbohydrates was 54.18%; this value is much higher than the suggested values of El-Beheiry (2009). High level of carbohydrate in fodder plants are considered better as they provide readily available energy and it is easily digestible.

Nutritive value (5.31%): In the present study, nutritive value was 5.31%, this value exceeds the nutritive value requirement (NRC, 1984).

Total digestible nutrients (TDN) measures the energy requirements of animals and the energy value of feeds (Heneidy, 2002).In this study, the TDN value of *S. irio* is about 56.42%. This value is less than (66.55) suggested by (Heneidy, 1996). However, it meets the requirement for breeding cattle (20.0%) as reported by NRC (1984). Chauhan *et al*. (1980) reported that a value of TDN (66.7%) for *Trifolium alexandrinum*. The sheep requires 61.7% TDN for good diet (NRC, 1985), while the breeding cattle requires 50.0% TDN (NRC, 1984).

Metabolized energy is the most suitable index for energy furnishing qualities for range forage .In the present study, digestible energy (DE) was (2.63) Mcal/kg, while the sheep are known to require 2.7 Mcal kg^{-1} of digestible energy (NRC, 1985), which is equivalent to that recorded in *S. irio* and lower than 2.9 Mcal kg^{-1} estimated for *Trifolium alexandrinum* (Chauhan *et al*., 1980).

In the present study, the value of metabolized energy was 2.63 Mcal kg^{-1}, which approximate the requirement of sheep and breeding cattle (NRC, 1984 & 1985) and is lower than the previous estimate for *T. alexandrinum* of 2.5 Mcal kg^{-1} (Chauhan *et al*., 1980). Gross energy represents the total combustible energy in a feed stuff, which is necessary for calculating metabolized energy (ME), gross energy of *S. irio* was 391.49 Kcal 100 g^{-1} which is comparable to the previous estimates of 4.7 Mcal kg^{-1} for *T. alexandrinum* (Chauhan *et al*., 1980).

The digestible crude protein “DCP” (6.33%): It is lower than the previous estimate of 13.3% for *T. alexandrinum* (Chauhan *et al*., 1980), but comparable to the value (6.1%) required for the sheep diet (NRC, 1985).

The grazing value is dependent on the high content of crude protein, minerals, low crude fibres content, high digestible crude protein (DCP) and high net energy (NE). In the present study net energy was 3.88 Mcal kg^{-1}; with this value the forage quality ranked as having good energy content according to the scale suggested by Boudet and Riviere (1968).

In the present study, sodium content was higher than the critical level of Na 00.6 mg/g dw DM (McDowell, 1985; NRC, 1985). According to Boudet (1975) the maintenance levels of sodium is 00.8 mg/g dw and the maximum tolerable level is 10 mg/g dw (NRC, 1984). Thus Na content in the present study meets the requirements of animals.

Some researchers have found that, K contents varied between 18.0 and 54.0 mg/g dw in wild forage species (Tan and Yolcu, 2001). According to Boudet (1975) the maintenance levels of potassium is 4.0 mg/g DW and the maximum tolerable level according to (NRC, 1984) is 30.0 mg/g DW. Thus potassium content of *S. irio* meet the level required for the maintenance of animals. Some researchers found that K contents varied between 18.1 and 54.4 mg/g dw in different wild plant species (Tan and Yolcu, 2001). K content of the studied plant was within these limits.

Calcium concentration in S. *irio* (16.0 mg/g dw) is higher than that reported by Heneidy and Helmy (2009), higher than the maintenance levels (2.0 mg/g dw) reported by Boudet (1975) and lower than the maximum tolerable level (20.0 mg/g dw) reported by (NRC, 1984).Thus the forage Ca value of the studied plant was adequate for the optimum performance of ruminants.

In the present study, Mg value (20.1 mg/g dw) is similar to that reported by Heneidy and Helmy (2009) (22.3 mg/g dw) in western Mediterranean coastal rangelands (El- Omayed), slightly higher than the maintenance levels of Boudet (1975) and lower than the maximum tolerable level (NRC, 1984). Thus the forage Mg value found in the present study was adequate for the optimum performance of ruminants' diet

Periguad (1970) recommend that forages should contain at least 0.05 mg/g dw Fe, the investigated species had higher level of Fe (0.6 mg/g dw) than this value. (McDowell and Arthington, 2005) reported that maximum tolerable level of Fe in forages is about 1.0 mg/g dw, the investigated species had lower level of Fe than this level. Thus Fe value of the investigated species was adequate for the optimum performance of ruminants' diet.

Copper concentration of shoots of *S. irio* in the present study (0.04 mg/gm dw) was much lower than the demand of animals which is 0.08 mg/g DW as recommended by (NRC, 1985). In the present results soil pH in the study area ranged 6.75 - 8.33, this high pH may be the cause of Cu deficiency in the studied plant according to (Aubert and Pinta, 1977). Thus the forage Cu value found in the present study was not adequate for the optimum performance of ruminants

Ni is classified as toxic element, although it is widely distributed but in low concentration in air, feed, water and soil. Mineral toxicities are more difficult to control than deficiency especially under grazing conditions (Kafeel *et al.*, 2009). The present investigation reported that the Ni level in the studied species (0.01 mg/g dw) were below the toxic level suggested by (NRC, 1996). Ni concentration of shoots of *S, irio* was lower than these limits; however, Ni value found in the present study was not adequate for the optimum performance of ruminants.

In the present study, manganese concentration was lower than the critical level (0.4 mg/g dw) (McDowell *et al.*, 1984), but in the present investigation, the level of Mn (0.2 mg/g dw) was below this tolerable range. Georgievskii (1982) reported that increase in soil pH above 6.0 causes to decrease the availability of Mn. Low level of Mn contents in forages generally occur only on neutral or alkaline soils (Minson,1990). The present results indicated that, soil pH in the study area ranged 6.75 - 8.33; this high pH may be the cause of Mn deficiency in the studied plant. Thus, Mn value found in the present study was not adequate for the optimum performance of ruminants.

The value of Zn in the present study was (0.3 mg/gm dw) which is higher than the least recommended level for Zn in forages which is 0.1 mg/g dw (Danbara *et al.*, 1985) and it is similar to the highest recommended level for Zn 0.3 mg/g dw (NRC, 1996). Zn value found in the present study was adequate for the optimum performance of ruminants.

In the present study, phosphorous has the value 2.0 mg/g DW, which is similar to the maintenance levels reported by Boudet (1975). The recommended range of P for all classes of ruminants as suggested by NRC (1984) was 1.2 to 4.8 mg/g dw. P value of the studied plant was between these two levels, thus P value in the present study was adequate for the optimum performance of ruminants.

Lead is a very toxic metal. It is a non essential element. In the present study, Pb values were below the toxic level reported by NRC (1996), so the ruminants feeding on the studied forage species had no chance of Pb toxicity.

Nehring and Haenlein (1973) stated that gross energy (GE), digestible energy (DE), metabolized energy (ME) and net energy (NE) are the most important categories used in determination of energy value of animal feed. In the present study, *S. irio* showed high-energy value represented by high amounts of GE, DE, ME, and NE.

Based on the value of DCP and net energy, using the scale suggested by Boudet and Riviere (1968), *S. irio* is considered as good forage.

CONCLUSION:

The present study indicated that, S. *irio* has a high importance value and also offers good potential as a fodder species because it is relatively rich in carbohydrates and crude protein and it has at least adequate levels of most of the important minerals except copper, manganese and nickel, so these trace minerals are needed for supplementation. Therefore, *S. irio* can be considered an underexploited natural feed resource plant.

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الخصائص البيئية والقيمة الرعوية لنبات فجل الجمل *Sisymbrium irio* بدلتا النيل بمصر

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استهدف هذا البحث دراسة الخصائص البيئية والقيمة الرعوية لنبات فجل الجبل (*Sisymbrium irio*) الذى ينمو بمنطقة الدراسة بدلتا نهر النيل من أجل تحقيق هذه الأهداف فقد تم اختيار 50 موقعا لدراسة السمات الفلورية والمظاهر الفصلية (Life–span) والطرز الحياتية (Life–form) والعناصر الفلورية (Floristic-elements) فى منطقة الدراسة فى المحافظات التالية الشرقية، الغربية، البحيرة، كفر الشيخ والدقهلية وأظهرت النتائج تسجيل 104 نوعاً من النباتات الزهرية والتى تتبع 87 جنساً وتنتمى إلى 31 عائلة نباتية حيث وجد أن الفصيلة النجيلية تمثل الفصيلة السائدة والتى حققت نسبة (21.15%) من العدد الكلى للنباتات الزهرية المسجلة بمنطقة الدراسة.ووفقا لفترة النمو (Life-span) يمكن تقسيم النباتات التى سجلت فى منطقة الدراسة إلى 72 نوع حولى (69.23%) ، وثلاث أنواع ثناية الحول (2.88%)، 29 نوع معمر (27.88%) وقد تم أيضاً الطرز الحياتية (Life-form) للأنواع النباتية المسجلة بمنطقة الدراسة وتبين أن طرز الحوليات (Therophytes) يمثل الطراز الأول السائد بمنطقة الدراسة وذلك بنسبة 72.13%، يليه طراز السطحيات (Chamaephytes) بنسبة 7.69%، يليه طراز شبه المختفيات (Hemicryptophytes) فقد سجلت بنسبة 6.73، يليه طراز أرضيات البيئة الرطبة (Geophytes-Helophytes) بنسبة 4.81% ثم طراز النباتات الظاهرة الصغيرة (Nanophanerophytes) فقد سجلت بنسبة 3.84% ثم طراز النباتات الأرضيه (Geophytes) فقد سجلت بنسبة 2.88%، ثم طراز المتسلقات وطراز النباتات المتطفلة فقد سجلت بنسبة 0.96% لكل نوع. ولدراسة العلاقة بين العوامل البيئية والتركيب النوعى للعشائر النباتية محل الدراسة امكن باستخدام برامج التصنيف ثنائى الإتجاه والتسلسل التعرف على سبع مجموعات نباتية تم فصلها احصائيا إلى مجموعة A وتتميز بسيادة نبات شبيط القدماء (*Xanthium strumarium*)؛ مجموعة B وتتميز بسيادة مشتركة بين نبات فجل الجمل (*Sisymbrium irio*) ونبات الودينه (*Euphorbia peplus*) ؛ مجموعة C تتميز بسيادة نبات الشلطام (*tourenfortti* ؛ مجموعة D وتتميز بسيادة نبات ديل القط *Brassica*) (*Polypogon monospeliensis*) ؛ مجموعة E وتتميز بسيادة نبات الخبيزة (*Malva parviflora*) ؛ مجموعة F وتتميز بسيادة نبات فجل الجمل (*Sisymbrium irio*) ؛ مجموعة G وتتميز ايضا بسيادة مشتركة بين نبات فجل الجمل *Sisymbrium irio*) (ونبات الخبيزة *Malva parviflora*) . وقد أوضح التحليل الفلورى لمنطقه الدراسه أن هناك 60 نوعاً (57.69%) من النباتات المسجلة تتبع عنصر البحر المتوسط، كما وجد أن العنصر العالمى يشتمل على 17 نوعاً,(16.34%)، العنصر الأستوائى القديم على 8 أنوع (7.69%)، حيث وجد أن هذه العناصر الفلورية الثلاثة تعتبر هى العناصر الرئيسية بمنطقة الدراسة.أما بقية المجموعات الفلورية الأخرى فهى ممثلة تمثيلاً ضعيفاً. ومما سبق يتضح أن منطقة الدراسة تتبع أساسا أقليم البحر المتوسط. وأظهرت النتا ئج أن أهم عوامل التربة التى تؤثر فى توزيع وتركيب ووفرة الكساء الخضرى لتلك المجموعات النباتية هى: الرمل، السلت، الطمى، درجة تركيز ايون الهيدروجين، كربونات الكالسيوم، الكربون العضوي والسعة المائية القصوى. تم جمع المجموع الخضرى لنبات فجل الجمل (*Sisymbrium irio*) من المناطق المنزرعة حول منطقة الزقازيق، وأظهرت التحاليل أن النبات يحتوى على قيماً جيدة كعلف للحيوان إذا قدرت كصافى طاقة (3.88 ميجا چولز / كجم) وذلك بالمقارنة بالمقاييس العالميه وأعطى هذا النبات قيما جيده من حيث محتواه من الرطوبه، الرماد، المادة الجافة، الألياف، الدهون، البروتين والكربوهيدرات الكلية. كما أظهر التحليل الكيميائى أن محتوى النبات من عناصر الصوديوم، البوتاسيوم، الكالسيوم، المغنسيوم، الحديد، الزنك والفوسفور كان جيداً بينما محتواه من النحاس، النيكل والمنجنيز كان منخفضاً وبذلك يعتبر نبات فجل الجمل (*Sisymbrium irio*) مصدراً جيداً كعلف للحيوانات.

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