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Weed communities of field crops at El-Tina Plain, Egypt

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ABSTRACT

The present study aims to analyze the weed communities associated with cultivated crops at El-Tina Plain area, which lies in the north-western Mediterranean coast of Sinai Peninsula, between longitudes 32^0 35′ and 32^0 45′ E and latitudes 31^0 00′ and 31^0 25′ N. Forty sampled stands cultivated by clover, wheat, broad bean, sugar beet and winter vegetables in winter season and maize, sesame, watermelon, citrus, olive and summer vegetables in summer season were randomly selected in the villages of El-Tina Plain area. These stands were seasonally surveyed during the period between autumn 2008 and summer 2009. Ten random (1x1m^2) quadrats were used in sampling of the weeds in each stand. The existing species were evaluated throughout; absolute and relative densities and frequencies. The relative values of density and frequency of each recorded species were summed up to give an estimate of its importance value, I.V (out of 200). Physical and chemical analyses of soil samples were carried out. A total of 55 associated species belonging to 20 families (3 Monocots and 17 Dicots) were recorded in the study area. The application of TWINSPAN classification led to the recognition of four vegetation groups in winter and three in summer crops. These groups were dominated by *Sarcocornia fruticosa*, *Spergularia marina, Polypogon monspeliensis* and *Lolium regidum* (in winter crops), whereas, *Digitaria sanguinalis, Portulaca oleracea* and *Echinocloa colona* (in summer crops). The ordination plan of stands given by Detrended Correspondence Analysis illustrated that the vegetation groups obtained by Two Way Indicator Species Analysis classification are distinguishable and have a clear pattern of segregation. The correlation between both stands and species with environmental variables is displayed on the ordination biplot produced by Canonical correspondence Analysis. This biplot showed that soil texture, chloride, sulfate, bicarbonate, sodium, potassium, calcium, magnesium, EC (salinity) and calcium carbonate are the most effective soil variables in weed vegetation composition in the study area.
Key words: El-Tina Plain, field crops, weeds, soil variables, multivariate analysis.

INTRODUCTION

The Egyptian cultivation has begun since thousands of years in the Nile Delta and its Valley. The growth of weeds in crops, vegetables and orchards attracted the attention of farmers, who developed various practices in getting rid of them. Despite the use of clean seeds, ploughing, burning, hoeing, hand weeding and crop rotation; weeds persisted because of the inability to cope with maximum production and massive recycling potentiality of weeds (Sen *et al*., 1980). Mechanical, chemical or biological weed control is unthinkable except through knowledge of weed species, their distribution and ecological behavior (Kosinova, 1975). Detailed studies of weed vegetation associated with the cultivated crops provide necessary information of understanding the nature of weeds. In Egypt, there are several recent studies that concentrate on the weed vegetation ecology: Shaltout *et al*.(1992); El-Demerdash *et al*.(1997); El-Hadidi *et al*. (1999); Sheded *et al*.(2000); El-Halawany (2000); El-Halawany *et al*. (2002); Turki (2000); Turki and Sheded (2002); Daie & El-Khanagry (2004); Abd El-Hamid (1996 , 2005); Omar (2006) and Mashaly *et al*. (2008).

El-Tina plain area lies east of the Suez Canal, which is a part of the reclamation area of El-Salam Canal Project, in which the reclamation area has been planned to cover about 620,000 feddans, of which about 220,000 feddans in the Hussinia on the south Portsaid area (western bank of the Suez Canal) and about 400,000 feddans in the El-Tina Plain and Mediterranean sea coastal area (eastern bank of the Suez Canal) (JICA, 1989). The studies on the variations of the weed vegetation composition with the changes in the microenvironment are still limited in this area. The information on such variations can serve as a guide in planning for weed management of this area. The present study aims to describe the seasonal changes in weed vegetation composition in relation to the cultivated crops and to provide a quantitative assessment of the main soil variables that governs the distribution of weeds in the study area.

STUDY AREA

The study area lies in the north-western Mediterranean coast of Sinai Peninsula, between longitudes 32^0 35′ and 32^0 45′ E and latitudes 31^0 00′ and 31^0 25′ N. Geologically; the area is a part of the ancient Nile Delta (Stanley, 1988). It has a triangular shape, surrounded by the Suez Canal to the west, the Mediterranean Sea to the north and the northern Sinai to the south (Fig.1). El-Tina plain can be divided into six geomorphic features including the sandy shore, coastal plain, marginal lagoon, Nile flood plain, sand dune belt and sabkhas (Deiab, 1998). The area is completely covered by Quaternary sediments of littoral, alluvial, and aeolian origin which shows variations in their texture and composition ranging from unconsolidated sands to salinized silt and clay of chemical and biochemical origins (Dewidar and Frihy, 2003). According to the map of the world distribution of the arid regions (UNESCO, 1977), the climatic conditions of the study area are typically arid Mediterranean climate with dry, warm summers (20 - 30°C) and mild winters (10 -

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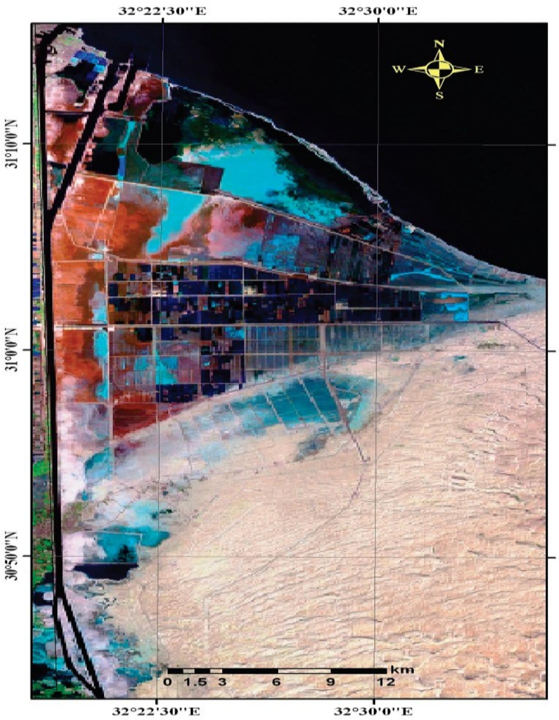
20°C). Most of the rains (70 % or more) occur during winter months.

(a)



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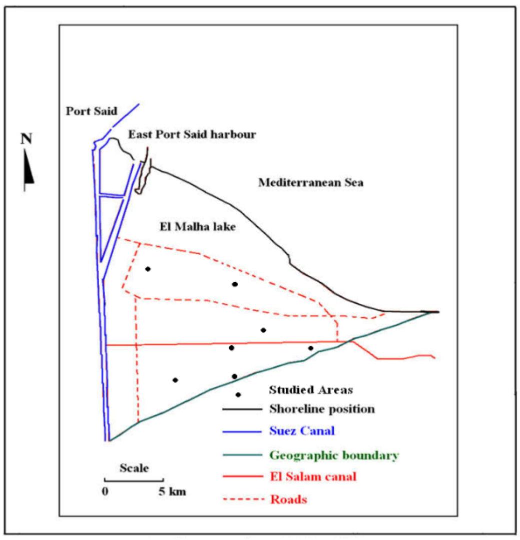

Figure (1): (a) Satellite image, (b) map of El-Tina Plain Area.

Materials and Methods

Weeds associated with eleven cultivated crops were studied in El-Tina plain villages. These crops were clover, wheat, broad bean, sugar beet and winter vegetables representing winter crops; maize, sesame, watermelon, citrus, olive and summer vegetables representing summer crops. Forty stands were used for sampling the weed flora in the selected crops. Ten random quadrats each of (1m^2) were used in the weeds sampling in each stand. The number of individuals of each species was counted and used to estimate its absolute and relative densities. The number of occurrence of a weed species in quadrats of each stand was used to calculate its absolute and relative frequencies. The relative values of density and frequency for each weed species were summed up to give an estimate of its importance value (IV out of 200). The taxonomic nomenclature of the weed species in the study area was given according to Täckholm (1974) and Boulos (1995, 1999, 2000, 2002, 2005). Phytogeographical regions of the study area were assessed following Good (1974) and Wickens (1976).

Three soil samples were collected from each stand at depth 0-50 cm, mixed, air-dried and passed through 2-mm sieve for physical and chemical analyses. Soil texture was determined by Bouyoucos hydrometer method, by which percentage of sand, silt and clay were calculated. Organic matter content was determined by Walkely and Black rapid titration method. Calcium carbonate content was estimated in the dry soil samples using Collins Calcimeter. Soil-water extracts (1:5) were used for the estimation of soil salinity (EC) using a digital conductivity meter (Model 76, ES & D, Inc. USA, soil reaction (pH) using a digital pH-meter (Model 201, Orion research, USA), soluble carbonates (CO_3^{--}) and bicarbonates (HCO_3^-) were measured volumetrically by titration of the soil extract against standard H_2SO_4 using methyl orange and phenol-phthalein as indicators, chlorides (Cl^-) were estimated by titrating the soil extract against standard $AgNO_3$ solution using K_2CrO_4 as an indicator, calcium and magnesium were estimated by versene (EDTA) method and sulphates were determined by the gravimetric method in which sulphates were precipitated as barium sulphate by using barium chloride. Sodium and potassium was determined using flame photometer (Model 410, Corning, England). All these procedures were according to Chapman and Pratt (1961), Jackson (1973), Allen *et al*. (1974), and Baruah and Barthakur (1997).

Two techniques of multivariate analysis (numerical classification and ordination) were applied in the present study. The classification technique was carried out by TWINSPAN (Two Way-INdicator SPecies ANalysis) program. This is a Fortran computer program written by Hill (1979a) and used in windows version (Henderson and Seaby, 1999). Two ordination programs were applied, DECORANA (DEtrended CORrespondence ANAlysis) written by Hill (1979b) and used in windows version (Henderson and Seaby, 1999) and CCA (Canonical Correspondence Analysis) using CANOCO- Fortran program (ter Braak, 1986, 1994).

Results

A total of 55 weed species were recorded in 11 crops of the cultivated lands in El-Tina Plain. These weed species belong to 20 families (3 Monocots and 17 Dicots). The most represented families were Gramineae (39.9%), Chenopodiaceae (16.4%), Compositae (9.9%) and Leguminoseae (7.2 %). Chorological analysis of the weed flora associated with the field crops in this area indicated that the Mediterranean elements (with monoregional, biregional and pluriregional) attained the maximum representation (about 36.4 % of the total species), followed by Cosmopolitan (23.6 %), Palaeotropical (10.9%) and Pantropical (10.9 %) (Table1).

Weed vegetation of winter crops was classified into four vegetation groups (Fig. 2). The first group comprises 3 stands and 8 species; the most dominant of them are *Spergularia marina* (IV=47.2) and *Sarcocornia fruticosa* (IV=43.6). The second group includes 5 stands and 16 species; the most dominant are *Spergularia marina* (IV=53.3) and *Polypogon monspeliensis* (IV=29.6). The third group comprises 5 stands and 21 species; the most dominant is *Polypogon monspeliensis* (IV=82.6). The fourth group comprises 7 stands and 18 species; the dominants are *Lolium rigidum* (IV=46.5) and *Melilotus indicus* (IV=37.2) Table 2. Weed vegetation of summer crops were classified into three vegetation groups (Fig. 3). The first group comprises 3 stands codominated by *Digitaria sanguinalis* (IV=24.5) and *Cynodon dactylon* (IV=23.4), the second contains 8 stands dominated by *Portulaca oleracea* (IV=64.5) and the third comprises 9 stands dominated by *Echinochloa colona* (IV=50.3) and *Portulaca oleracea* (IV=38.0) Table 3. The vegetation groups derived from the application of TWINSPAN classification technique are clearly separated on the ordination planes of winter and summer seasons (Figs 4 and 5).

The soil variables vary considerably from one group to the other of stands of winter field crops (Table 4). Electric conductivity, Cl-, HCO3-, SO4--, Na+, K+, Ca++ and silt fraction are higher in group I than in the other groups. The percentage of calcium carbonate and clay attained the highest values in group II. The percentage of organic matter attained its maximum value in group III. While, the percentage of sand fraction and pH value are higher in group IV than in the other groups. On the other hand, most of the soil variables show little variations between the three groups representing the stands of summer field crops (Table 5). Electric conductivity, Cl-, HCO3-, SO4--, Na+, K+, Ca++, Mg++, organic matter, silt, clay and calcium carbonate are higher in group III than in the other groups; while, the percentage of sand and pH attained the highest values in group I.

The application of CCA indicated the strong relationships between some soil factors (sand, silt, clay, SO_4^{--}, Mg^{++}, Na^+, K^+, HCO_3^-, salinity and pH) and distribution of winter weed species. For example, *Tamarix nilotica, Cynanchum acutum* and *Typha domingensis* are highly related to the silt fraction, SO_4^{--}, Mg^{++}, Na^+, and salinity. *Gastridium pheloides, Chenopodium glaucum* and *Spergularia marina* are associated with clay fraction. *Convolvulus arvensis, Malva parviflora* and *Conyza bonariensis* showed close relationships with pH variations. *Lolium rigidum* and *Avena fatua* indicate high affinity with sand fraction (Fig. 6). Similarly, sand, clay, SO_4^{--}, Mg^{++}, Na^+, Ca^{++}, K^+, Cl^-, HCO_3^-, salinity, $CaCO_3$ and pH showed strong relationships with the distribution of summer weed species. For example, *Cyperus rotundus*, *Dactyloctenium aegyptium* and *Cenchrus biflorus* are closely associated with pH variations. *Amaranthus lividus, Portulaca oleracea, Chenopodium glaucum* and *Malva parviflora* showed close relationships with clay fraction. *Tamarix nilotica, Phragmites australis*, *Leptochloa panecia and Sonchus oleraceus* are highly related to SO_4^{--}, Mg^{++}, Na^+, Ca^{++}, K^+, Cl^-, HCO_3^- and salinity. *Stipa scoparia, Zygophyllum album*, *Bassia muricata, Setaria verticillata and Digitaria sanguinalis* showed close relationships with sand fraction (Fig. 7).

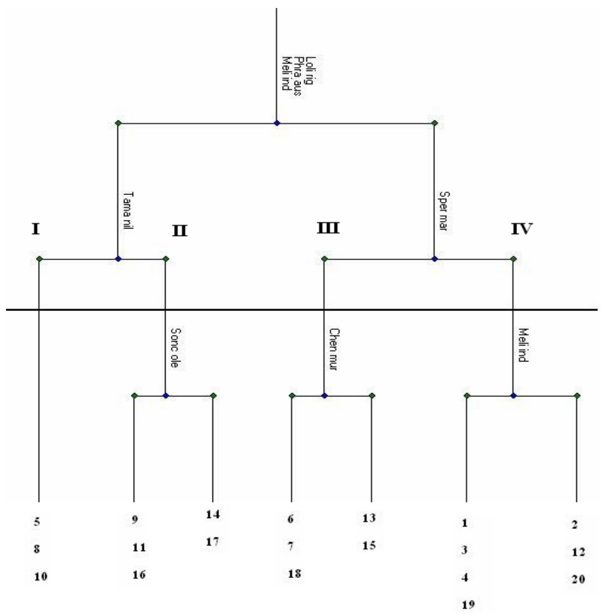

Figure (2): Classification of stands of winter crops. The indicator species are abbreviated to the first four letters of the genus and the first three letters of the species name.

DISCUSSION

Fifty weed species belonging to 20 families were recorded in the crops of the study area. The flora of the surveyed area belongs to Sinai Peninsula, which stands in a middle position between three well-defined phytogeographical regions of the world Saharo-Sindian, Irano Turanian and the Mediterranean regions (Good,

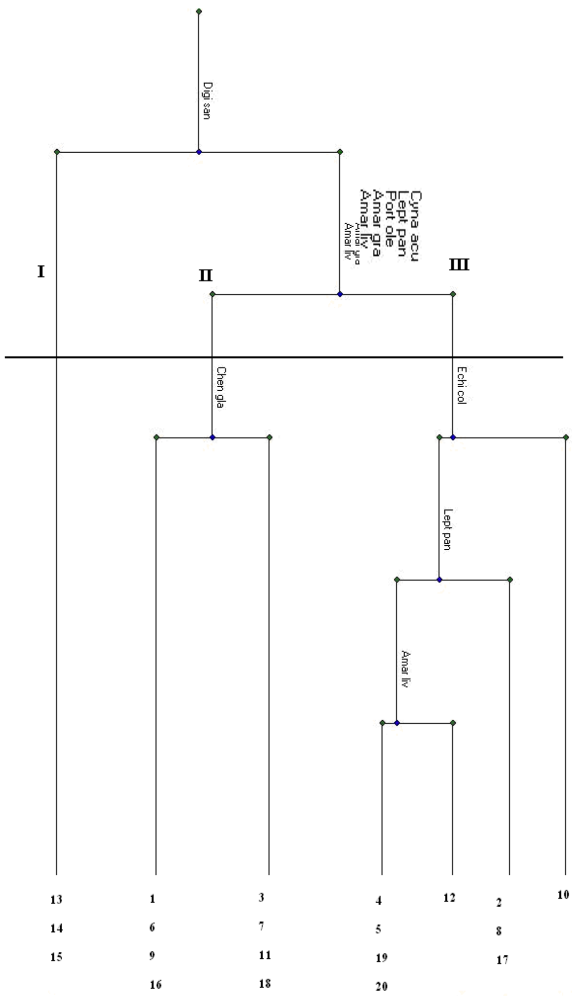

Figure (3): Classification of stands of summer crops. The indicator species are abbreviated to the first four letters of the genus and the first three letters of the species name.

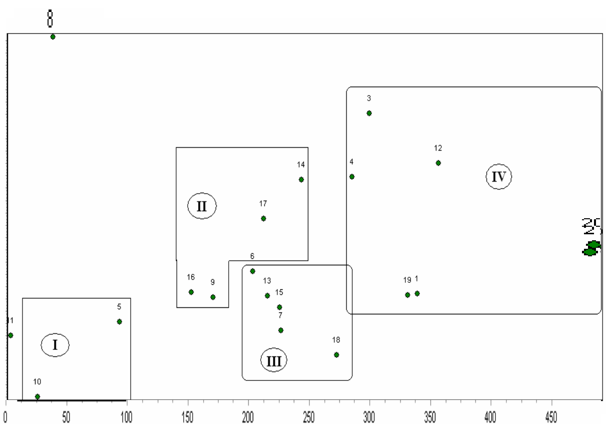

Figure (4): Distribution of stands in relation to the first two axes of stand ordination diagram. Lines encircle stands belonging to the weed vegetation groups obtained after application of TWINSPAN classification program of winter crops.

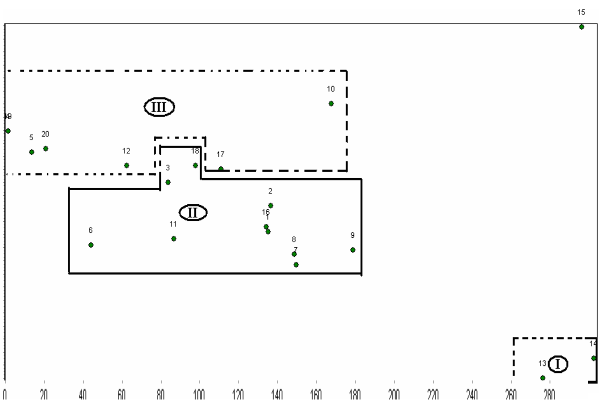

Figure (5): Distribution of stands in relation to the first two axes of stand ordination diagram. Lines encircle stands belonging to the weed vegetation groups obtained after application of TWINSPAN classification program of summer crops.

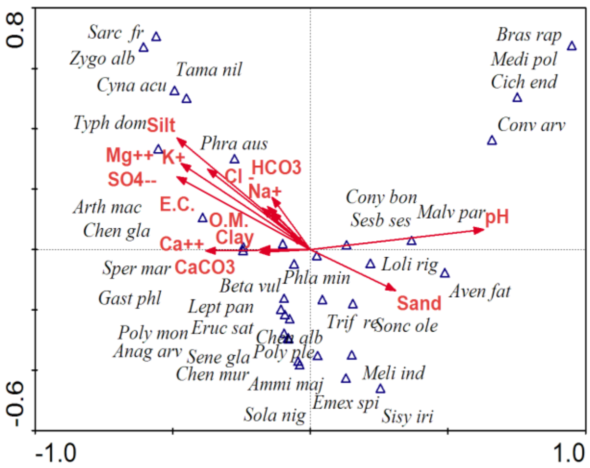

Figure (6): Biplot of Canonical Correspondence Analysis (CCA) showing the relationships between the winter weed species and correlated soil variables. These species are abbreviated to the first four letters of the genus and the first three letters of the species name.

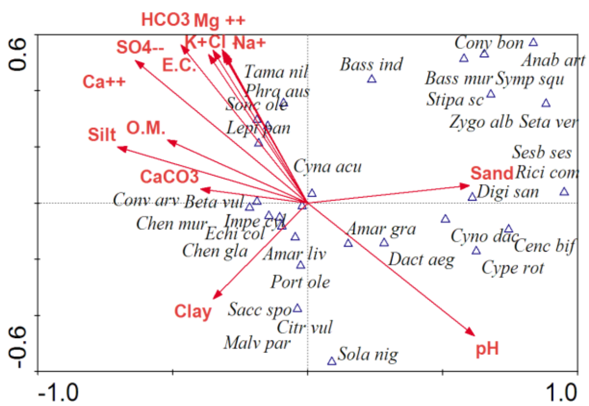

Figure (7): Biplot of Canonical Correspondence Analysis (CCA) showing the relationships between the summer weed species and correlated soil variables. These species are abbreviated to the first four letters of the genus and the first three letters of the species name.

Table 1: Chorological analysis of the recorded species. (EU-SB = EURO- SIBERIAN, IR-TR = IRANO-TURANIAN, SA-SI = SAHARO-SINDIAN, S-Z= SUDANO-ZAMBEZIAN, Cul & Nat = Cultivated & Naturalized, M = Mediterranean).

Phytochoria	Number of species	Percentage (%) of the total species recorded
I- Monoregional		
Mediterranean	2	3.6
Pantropical	6	10.9
Paleotropical	6	10.9
SA – SI	1	1.8
S – Z	1	1.8
II- Biregional		
M + EU-SB	2	3.6
M + IR-TR	4	7.3
M+ SA –SI	1	1.8
M+ S- Z	1	1.8
SA - SI + S – Z	1	1.8
SA - SI + IR-TR	2	1.8
S - Z + IR-TR	1	1.8
III- Pluriregional		
M + IR-TR + Eu-SB	7	12.7
M + IR-TR + SA-SI	2	3.6
M + SA-SI + S-Z	1	1.8
Cosmopolitan	13	23.6
Cul & Nat	4	7.3
Total species	55	100
Total M elements	20	36.4

1974). Chorological analysis of the weed flora in the study area indicated that the Mediterranean elements (mono-, bi- and pluri- regionals) attained the maximum representation, this agree in principal with Kosinova (1974) and EL-Hadidi (1993).

The recorded weed species in the study area contained 67.3% of annual species and 32.7% of the perennial one. The short life cycle of annuals as well as prevailing climatic conditions and water availability lead to their frequent occurrence (Shaltout and El- Fahar, 1991). The dominance of annuals could be attributed to the fact that they have higher reproductive capacity and ecological, morphological and genetic plasticity under high levels of disturbance such as agricultural practices (Frenkel, 1970; Harper, 1977; Grime, 1979).

The environment of weed plant communities is extremely variable and the relationships between individual factors are complicated, this is not only due to variable natural conditions but still more to the human activity. This is why weed communities were not helped to be real communities at one time. Therefore, their classification into abstract community types according to rules of Zurich- Montpellier School has always been difficult (Holzner, 1978; Shaltout *et al*., 1992).

The weed communities of the winter crops in the present study included a high number of species as compared to those of summer crops. This may be due to differences in the weeding process of the two groups of crops. Weeds are mainly controlled by hand pulling and manual hoeing in winter crops. Moreover, the clover and broad beans are leguminous crops that enrich the soil with nitrogen. This stimulates the seed germination of the weeds and hence enriches the associated weed flora (Fawcett and Slife, 1978). On the other hand, the associated weeds of summer crops controlled by regular weeding, either mechanically or through the use of herbicides. This reduces the weed biomass and leads to a decrease in the number of weed species (Shaltout and El-Fahar, 1991).

The weed vegetation of the study area was numerically classified into a number of vegetational groups belonging to winter and summer cultivated crops. Weed vegetation of the winter crops was classified into four vegetation groups named after their dominants as follows: *Spergularia marina – Sarcocornia fruticosa, Spergularia marina - Polypogon monspeliensis*, *Polypogon monspeliensis* and *Lolium rigium* - *Melilotus indicus*. The vegetational groups of the winter field crops of the present study are more or less related to the Melilotion indicae alliance recognized by Kosinova (1975) in the description of weed communities of winter crops in Egypt. This alliance is dominated by *Melilotus indicus*. The characteristic associated weed species grouped under this alliance are: *Convolvulus arvensis, Rumex dentatus, Cynodon dactylon, Sonchus oleraceus, Polypogon monspeliensis, Trifolium reuspinatum, Chenopodium murale, Avena fatua, Beta vulgaris, Malva parviflora, Chenopodium album, Ammi majus, Spergularia marina, Euphorbia peplus, Vicia sativa* and *Cichorium endivia*. This alliance does not include *Sarcocornia fruticosa*, as a characteristic weed species, which is recorded as dominant weed species in the present study. The association of Kosinova (1975) may be abstracted on the basis of analyzing stands of cultivated lands less saline soils than those of the study area. Also the dominant and characteristic weed species resulting from the vegetation analysis of winter crops may be rather similar to those described by EL-Halawany *et al*. (2002) in Damietta and Abd El-Hamid (1996 , 2005) in Ismailia. On the other hand, the weed vegetation of summer crops were classified into three groups named after their dominants as follows: *Digitaria sanguinalis* - *Cynodon dactylon, Portulaca oleracea* and *Echinochloa colona- Portulaca oleracea.* The weed vegetational groups of the summer field crops in the present study may be related to the *Digitarietalia sanguinalis*

Table 2. Importance values of the weed species in the four vegetation groups resulting after the TWINSPAN classification of the stands of winter crops. The chorological affinities of each weed species are indicated in the last column. Maximum values of the mean IV of the dominant species in each vegetation groups are in bold face.

Species	**Vegetational groups**				**Chorology**
	I	**II**	**III**	**IV**	
Ammi majus L.			1.7		M
Anagalis arvensis L.			1.9		COSM
Arthrocnemum macrostachyum (Moric.) Koch.		2.6	1.3		SA_- SI+ M
Avena fatua L.				4.9	COSM
Beta vulgaris L.		1.7			EU-SB+IR-TR+M
Brassica rapa L.				17.5	CUL+ NAT
Chenopodium album L.		1.7	3.4		COSM
Chenopodium glaucum L.	9.7	6.5	2.2		EU-SB+ M
Chenopodium murale L.			6.9	2.9	COSM
Cichorium endivia L.		2.0	3.4	19.7	IR- TR+M
Convolvulus arvensis L.				7.9	PAL
Conyza bonariensis (L.) Cronquist.				1.7	M
Cynanchum acutum L.	9.8		2.1		EU-SB+IR-TR+M
Emex spinesus (L.) Campd.			2.9	3.3	IR- TR+ SA-SI+ M
Eruca sativa Mill.			1.7		IR- TR+ M
Gastridium phleoides (Nees & Meyen) Hubb.		11.2			COSM.
Leptochloa panicea (Retz.) Ohwi.		1.7	5.1		PAL
Lolium rigidum Gaudin.		23.2	15.6	46.5	IR- TR+M
Malva parviflora L.			1.3	7.5	IR- TR+M
Medicago polymorpha L.				3.3	COSM
Melilotus indica (L.) All.			15.4	37.2	IR- TR+M
Phalaris minor Retz.		2.7		1.7	EU-SB+ IR-TR+ M
Phragmites australis (Cav.) Trin.	38.3	22.9		12.8	PAL
Polypogon monspeliensis (L.) Desf.	6.0	29.6	82.6		COSM
Polygonum plebejum Br.		2.0	5.2		EU-SB+ IR-TR+ M
Sarcocornia fruticosa (L.) Scott.	43.6				EU-SB+ M
Senecio glaucus L.			9.2		IR- TR +SA-SI+M
Sesbania sesban (L.) Merr.				1.7	S- Z
Sisymbrium irio L.				1.8	EU-SB+IR-TR+M
Solanum nigrum L.			19.2		COSM
Sonchus oleraceus L.		12.5	26.4	15.8	COSM
Spergularia marina	47.2	53.3	34.0		EU-SB+IR-TR+ M
Tamarix nilotica (L.) Bessler.	32.4	2.6	1.7	1.7	SA- SI+ S- Z+ M
Trifolium resupinatum L.				13.6	EU-SB+IR-TR+M
Typha domingensis (Pers.) Poir.		22.9			PAN
Zygophyllum album L.	18.1				SA- SI
Total species (36)	8	16	21	18	

Table 3. Importance values of the weed species in the three vegetation groups resulting after the TWINSPAN classification of the stands of summer crops. The chorological affinities of each weed species are indicated in the last column. Maximum values of the mean IV of the dominant species in each vegetation groups are in bold face.

Species	Vegetational groups			Chorology
	I	II	III	
Amaranthus graceizans L.	22.0	14.1	3.0	COSM
Amaranthus lividus L.	2.5	12.6	0.8	COSM
Anabasis articulata (Forssk.) Moq.	3.0			IR- TR+ SA- SI
Bassia indica (Wight) Scott.			2.9	IR- TR+ S- Z
Bassia muricata (L.) Asch.	3.0			SA-SI+ S-z
Beta vulgaris L.			0.8	EU-SB+IR-TR+ M
Cenchrus biflorus Roxb.	8.1			PAL
Chenopodium glaucum L.		13.7	11.8	EU-SB+ M
Chenopodium murale L.		4.0		COSM
Citrullus vulgaris (Thunb.) Matsum. & Nakai		0.9		CUL& NAT
Convolvulus arvensis L.		1.3		PAL
Conyza bonariensis (L.) Cronquist.	3.9		1.0	M
Cynanchum acutum L.	3.0	6.4		EU-SB+IR-TR+ M
Cynodon dactylon (L.) Pers.	23.4		3.8	PAN
Cyperus rotundus L.	18.4			PAN
Dactyloctenium aegyptium (L.) Willd.	3.6	2.5		PAL
Digitaria sanguinalis (L.) Scop.	24.5	1.2		PAL
Echinochloa colonum (L.) Link.	6.6	21.1	50.3	PAN
Imperata cylindrica (L.) Raeusch.		4.2		S-Z+ M
Leptochloa panecia (Retz.) Ohwi.	3.0	18.0	30.7	PAL
Malva parviflora L.		3.7		M+ IR-TR
Phragmites australis (Cav.) Trin.		11.1	27.6	PAL
Portulaca oleracea L.	23.5	64.5	38.0	COSM
Ricinus communis L.	2.5			CULv& NAT
Saccharum spontaneum L.		3.5		PAL
Sesbania sesban (L.) Merr.	2.5			S-Z
Setaria verticillata (L.) P.Beauv.	17.7			COSM
Solanum nigrum L.		2.9		COSM
Sonchus oleraceus L.	2.8	5.3	21.3	COSM
Symphyotrichum squamatum (Spreng. Nesom)	6.4		1.0	PAN
Stipagrostis scoparia (Trin. & Rupr.) de Winter	3.0			SA-SI+ S-z
Tamarix nilotica (Ehrenb.) Bunge.			6.2	SA-SI+ S-z+ M
Zygophyllum album L.	13.5		2.0	SA-SI
Total species (33)	21	18	15	

Table 4. Mean ± standard deviation of soil variables representing the four vegetational groups that obtained after TWINSPAN classification in winter crops.

Soil variable	Vegetation group			
	I	II	III	IV
pH	7.2 ± 0.2	7.3 ± 0.04	7.4 ± 0.2	7.6 ± 0.3
$CaCO_3$ %	0.6 ± 0.1	3.7 ± 1.2	1.8 ± 0.8	1.2 ± 0.4
O.M. %	0.6 ± 0.3	0.4 ± 0.1	0.8 ± 1.2	0.6 ± 0.5
E.C. ms/cm	30.8 ± 21.3	3.5 ± 1.3	10.9 ± 18.7	16.9 ± 41.8
HCO_3^- meq/L	4.0 ± 2.2	0.4 ± 0.1	1.7 ± 2.7	2.3 ± 4.6
Cl^- meq/L	196.8 ± 163.1	12.1 ± 16.4	65.0 ± 128.2	121.1 ± 308.7
SO_4^{--} meq/L	100.1 ± 47.6	22.6 ± 5.9	41.5 ± 54.9	14.6 ± 26.9
Ca^{++} meq/L	23.5 ± 15.0	21.5 ± 5.2	19.4 ± 13.0	12.0 ± 26.0
Mg^{++} meq/L	50.0 ± 19.0	7.8 ± 3.3	20.2 ± 35.0	4.3 ± 6.6
Na^+ meq/L	223.4 ± 177.8	5.0 ± 4.3	66.7 ± 136.2	120.2 ± 304.9
K^+ meq/L	4.0 ± 1.2	1.1 ± 0.5	1.7 ± 2.6	1.4 ± 2.4
Sand %	52.2 ± 23.0	43.0 ± 2.6	61.1 ± 35.9	65.9 ± 33.0
Silt %	25.9 ± 5.3	24.0 ± 4.5	15.3 ± 6.4	14.1 ± 10.0
Clay %	22.0 ± 18.3	33.0 ± 3.7	25.4 ± 37.0	20.0 ± 30.8

Table 5. Mean ± standard deviation of soil variables representing the three vegetational groups after TWINSPAN classification in summer field crops.

Soil variable	Vegetation group		
	I	II	III
pH	7.8 ± 0.1	7.6 ± 3.5	7.4 ± 0.3
$CaCO_3$ %	0.8 ± 0.1	1.5 ± 1.6	1.9 ± 1.1
O.M. %	0.3 ± 0.2	0.6 ± 1.7	0.7 ± 0.5
E.C ms/cm	1.0± 0.9	2.5 ± 1.7	13.4 ± 21.4
HCO_3^- meq/L	0.3± 0.3	0.8 ± 4.5	4.3 ± 6.9
Cl^- meq/L	0.5 ± 0.0	0.5 ± 14.1	1.3 ± 2.7
SO_4^{--} meq/L	4.5 ± 2.1	10.0 ± 10.6	89.6 ± 167.3
Ca^{++} meq/L	5.1 ± 7.3	14.6 ± 11.9	41.0 ± 41.5
Mg^{++} meq/L	0.7 ± 0.4	11.3 ± 11.8	23.4 ± 14.0
Na^+ meq/L	6.1 ± 0.6	7.4 ± 2.9	26.2 ± 42.3
K^+ meq/L	3.1 ± 2.1	5.8 ± 36.4	81.1 ± 154.3
Sand %	0.3 ± 0.1	0.6 ± 32.6	1.6 ± 2.4
Silt %	93.4 ± 0.8	70.6 ± 29.5	59.0 ± 15.4
Clay %	4.1 ± 1.0	17.5 ± 13.7	26.8 ± 8.2

alliance recognized by Zohary (1973). The characteristic associated species grouped under this alliance are *Portulaca oleracea, Cyperus rotundus, Echinochloa colona, Dactyloctinum aergyptium, Corchorus olitorius, Hibiscus trionum, Echinochloa crus-galli* and *Dinebra retroflexa*. The dominant and characteristic weed species resulting from the vegetation analysis of summer crops of the present study are similar to those described by El-Demerdash *et al*. (1997), Abd El-Hamid (1996, 2005), Omar (2006) and Mashaly *et al.* (2008).

The most important environmental factors correlating with the distribution of weed vegetation in field crops of the study area are related to soil properties such as sand, silt, clay, SO_4^{--}, Mg^{++}, Na^+, Ca^{++}, K^+, Cl^-, HCO_3^-, EC, $CaCO_3$, pH and organic matter. These results agreed with that of Shaltout and El-Sheikh (1991) in aspects of electric conductivity, calcium carbonates, organic matter and pH. EL-Halawany (2000), EL-Halawany *et al*. (2002) and Abd El-Hamid (2005) determined the environmental factors which mostly affect species distribution as electric conductivity, sodium, clay fraction, chloride, sulphate, calcium and potassium. The application of multivariate techniques (CCA) revealed that the principal environmental factor that control the weed distribution in the crops of the study area are salinity and texture, this agrees with the results of El-Kharbotly (2009). The dominance of halophytic species such as *Spergularia marina* and *Sarcocornia fruticosa* reflects the magnitude of the high salinity problem within this area.

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مجتمعات الحشائش المصاحبة للمحاصيل الزراعية في منطقة سهل الطينة- مصر

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الملخـــص العربــــي

تهدف هذه الدراسة إلى تحليل الكساء الخضري للحشائش والتعرف على المجموعات المميزة للمحاصيل الزراعية وكذلك تحليل التغيرات فى عوامل التربة وتحديد العوامل المؤثرة منها فى توزيع الغطاء النباتى لعشائر الحشائش فى منطقة سهل الطينة - مصر. ولتحقيق أهداف الدراسة الحالية تم اختيار أربعون موقعا نباتياً وزعت توزيعاً عشوائياً على آحد عشر محصولاً زراعياً هى: البرسيم والقمح والفول وبنجر السكر والخضروات الشتوية (شتاءاً) والذرة والسمسم والبطيخ والخضروات الصيفية (صيفاً). كما شملت الدراسة بعض حدائق الفاكهة مثل الموالح والزيتون. تم حصر ٥٥ نوعاً من الحشائش بمنطقة الدراسة تنتمي إلى عشرين فصيلة (ثلاث فصائل منها من ذوات الفلقة الواحدة والباقي تتبع فصائل ذوات الفلقتين). وجد أن اكثر الفصائل تمثيلاً هى النجيلية والرمرامية والمركبة والقرنية.وقد أظهر التوزيع الجغرافي للحشائش أن عدد أنواع النباتات التي تتبع منطقة حوض البحر المتوسط و/أو امتداداته في منطقة جغرافية واحدة أو منطقتين أو ثلاثة مناطق جغرافية أخرى كانت بصفة إجمالية تمثل ٢٠ نوعاً أى حوالي ٣٦.٤ % من العدد الكلى المسجل للحشائش. قسم الكساء الخضري للحشائش المصاحبة للمحاصيل الشتوية، بإستخدام برامج التقسيم العددى، الى أربعة مجموعات نباتية: سُميت تبعاً للأنواع السائدة فيها الى: ابوغلام- ابوساق (مجموعة١) ، ابوغلام - ذيل القط (مجموعة٢)، ذيل القط (مجموعة٣)، والصحلح - الحندقوق (مجموعة٤) .كما ًقسم الكساء الخضري للحشائش المصاحبة للمحاصيل الصيفية إلى ثلاثة مجموعات نباتية مميزة هى الدفيرة-الرجلة (مجموعة١)، الرجلة (مجموعة٢) والرجلة-ابوركبة (مجموعة٣). أوضح إستخدام التحليل التسلسلى متعدد الأبعاد ان أهم عوامل التربة ارتباطا بتوزيع العشائر النباتية هى ملوحة وقوام التربة، الانيونات الذائبة (الكلور- البيكربونات- الكبريتات)، الكاتيونات الذائبة (الصوديوم- البوتاسيوم- الكالسيوم والمغنسيوم) والأس الهيدروجينى.