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Weed Flora of Orchards in the Nile Delta, Egypt: Floristic Features

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Abstract: The present study provides a description of the floristic features of the weed flora in major eight orchard types in the four Northern governorates of the Nile Delta region, namely: El-Behira, Kafr El-Sheikh, El-Dakahlia and Damietta. These orchards were cultivated with: *Citrus* spp., *Phoenix dactylifera*, *Musa sapientum*, *Prunus persica*, *Mangifera indica*, *Vitis vinifera*, *Psidium guajava* and *Pyrus malus*. The total number of weed species recorded in these orchards was 169 related to 126 genera and grouped under 35 families. Out of these weeds, 47 species were monocotyledoneae (27. 81%) and 122 species were dicotyledoneae (72.19%). *Gramineae* and *Compositae* were the main families representing collectively about 36.06% of the total recorded species. According to the life span, the recorded species were classified into three groups: 1) 50 perennial weed species (29.58%), 2) 4 biennial weed species (2.37%) and 3) 115 annual weed species (68.05%). Furthermore, the annual weeds can be subdivided into three categories as follows: a) all year active annuals (31 species), b) winter-spring annuals (57 species) and c) summer-autumn annuals (27 species). According to the life-form spectrum, the weed flora of the study orchards may be grouped under six groups; these were: therophytes (119 species), cryptophytes (27 species), hemicryptophytes (12 species), chamaephytes (7 species), nanophanerophytes (3 species) and parasites (one species). Phytogeographically, 84 species (49.7%) were Mediterranean taxa. These were either pluriregional (23.07%), biregional (20.11%) or monoregional (6.52%). It has been also found that 68 species (about 40.24%) representing the following chorotypes: 23 cosmopolitan (13.61%), 21 palaeotropical (12.43%), 19 pantropical (11.24%) and 5 neotropical (2.96). Saharo-Sindian element comprises 8 species (4.73%). The other floristic categories were either poorly represented by few number of species or absent.

Key words: Nile Delta, orchards, weed flora, life form, chorotypes

Introduction

In Egypt as well as in other parts of the world, the floristic studies on the orchards attracted the attention of many scientists. E.g. Kosinova (1974), Al-Saadawi and Ahlam (1985), Sidhu and Bir (1987), Solymosi and Kostyal (1989), Vasconcelos and Nazar (1989), Cho *et al.* (1989), Boira and Carretero (1992), Nalini *et al.* (1993), Abd El-Ghani (1994, 1998), Sridhara *et al.* (1995), Das and Singh (1995), El-Ashri (1996), Jung *et al.* (1997), Bensellam *et al.* (1997), El-Kady *et al.* (1999), El-Fahar (2000), El-Halawany (2000), Sheded and Turki (2000), Omar (2001) and Shaheen (2002). Most studies on weeds of orchards in Egypt were oriented on date palm orchards. However El-Kady *et al.* (1999) presented a report on the diversity of weed communities in the common orchards in El-Gharbia Governorate which was not included in the study area of the present work. Outside Egypt, studies focused on the weeds of their native orchards, for instance, Sidhu and Bir (1987) studied the weed flora in loquat, mango, guava and per orchards in Patiala District, Punjab (India). Vasconcelos and Nazar (1989) studied the weed flora in apple, pear, peach and cherry orchards in Beira Interior (Portugal). Sridhara *et al.* (1995) studied the weed flora in mulberry orchards in Bangalore (India). The weed occurrence in apple orchards in Korea was conducted by Jung *et al.* (1997). The phytosociological surveys in citrus orchards of the Gharb region of Morocco were carried out by Bensellam *et al.* (1997).

This study was conducted by the following objectives

a) Study of the floristic composition, distributional pattern and life-form spectra of the weed flora of the selected major orchards in the northern sector of the Nile Delta in Egypt.

b) Detection of the taxonomic and phytogeographical significance of the floristic components and find out the floristic relationship between the study area and the rest of Egypt as well as the adjacent countries.

Study area: The study area was located in the northern part of the Nile Delta region. It includes four governorates, namely: El-Behira, Kafr El-Sheikh, El-Dakahlia and Damietta (Fig. 1). The Nile Delta comprises two main geomorphological components: coastal and deltaic (Sestini, 1976). Soils of the study area were man-made variants of gley and fluvi soils that belong to the Pliocene and Pleistocene (El-Gabaly *et al.*, 1969). Deposits covering the Delta reach about 10.9 m in thickness. These deposits were considered as the basis of Egypt's fertility

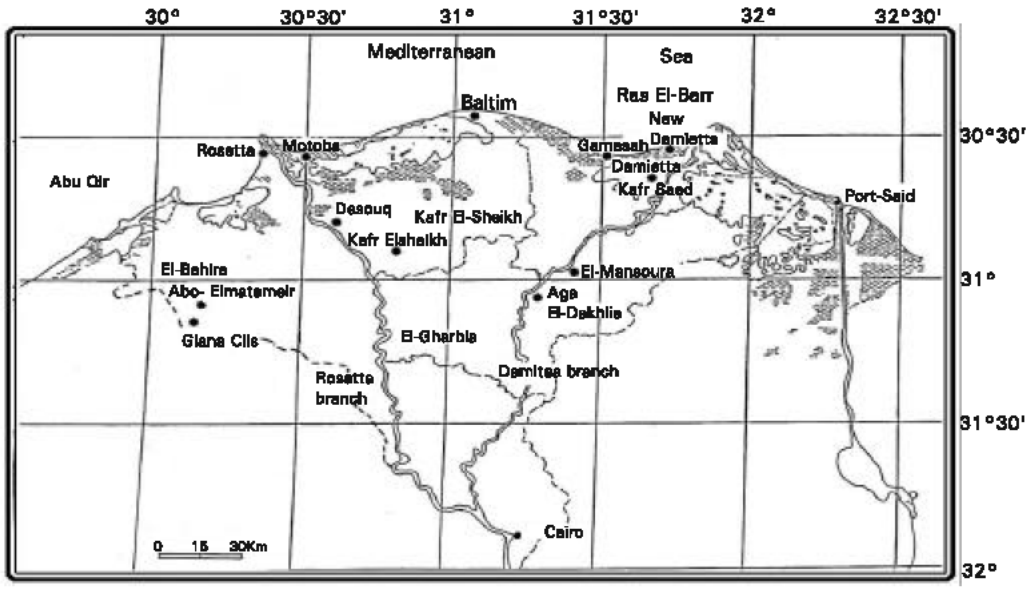

Fig. 1: Map of the Nile Delta region showing the different localities in the study area (●).

(Abu Al-Izz, 1971). Ayyad *et al*. (1983) recognized that the Mediterranean coastal region lies in the attenuated arid province characterized by short dry period, warm summer and mild winter. Accordingly, the studied governorates a part of the Deltaic Mediterranean coast belongs to the arid or semi-arid climatic belts of the northern coastal region of Egypt.

Materials and Methods

The sampling sites were selected to represent the major orchards in four governorates of the Nile Delta of Egypt, namely from west to east as follows: El-Behira, Kafr El-Sheikh, El-Dakahlia and Damietta. Eight orchard types were selected for this study. These include the orchards of *Citrus* spp., *Phoenix dactylifera*, *Musa sapientum*, *Prunus persica*, *Mangifera indica*, *Vitis vinifera*, *Psidium guajava* and *Pyrus malus*.

Two seasonal records (winter-spring season and summer-autumn season) of the weed species were carried out during regular visits to the study orchards in different sites through January 2000 - April 2001. During each visit the species of weed flora were recorded and plant specimens were collected for identification. All voucher samples were kept in the Herbarium of Botany Department, Faculty of Science, Mansoura University.

The description and classification of life-form spectra were according to Raunkiaer (1934). The classification, identification, nomenclature and floristic categories were according to Tutin *et al*. (1964-1980), Davis (1965-1985), Zohary (1966, 1972), Townsend and Guest (1966-1985), Täckholm (1974), Wickens (1976), Meikle (1977, 1985), Feinbrun (1978, 1986) and Boulos (1995, 1999, 2000).

Results

Distribution of weed flora: The total number of weed species in the study orchards was 169 (Table 1) . The orchards of *Citrus* spp. had the highest number of weeds (115 species), i.e. about 68% of the total number of the recorded species. In the orchards of *Psidium guajava* the recorded weeds attained 99 taxa i.e about 58.6% of the total recorded species. The number of weeds in the other orchards and their presence percentages were as follows: *Phoenix dactylifera* 96 species (56.8%), *Prunus persica* 76 species (38.8%), *Vitis vinifera* 74 species (37.8%), *Musa sapientum* 58 species (34.3%), *Mangifera indica* 39 species (23%) and *Pyrus malus* 34 species (20.1%).

Table 1: Floristic composition of the weed flora in the study orchards

Species	Life form	Floristic category	Orchard types								Presence percentage (P%)
			Cs.	Pd.	Ms.	Pp.	Mi.	Vv.	Pg.	Pm.	
Perennials											
Cynodon dactylon	G	PAN, COSM	+	+	+	+	+	+	+	+	100
Cyperus rotundus	G	PAN	+	+	+	+	+	+	+	+	100
Aster squamatus	Ch	NEO	+	+	+	+	-	+	+	+	87.5
Imperata cylindrica	H	PAL + M	+	+	+	-	+	+	+	+	87.5
Convolvulus arvensis	H	COSM	+	+	+	+	-	+	+	-	75
Oxalis corniculata	H	COSM	+	+	+	+	-	+	+	-	75
Paspalum distichum	G	PAL	+	+	-	+	+	+	+	-	75
Pluchea dioscoridis	Nph	S – Z + SA – SI	+	+	+	+	-	+	+	-	75
Polypogon viridis	He	M + IR – TR + ER – SR	+	+	+	+	-	+	+	-	75
Arundo donax	He	CULT & NAT	+	+	-	-	-	+	+	+	62.5
Leptochloa fusca	G,He	PAL	+	+	+	+	-	-	+	-	62.5
Mentha longifolia	He	PAL	+	+	-	+	-	+	+	-	62.5
Phyla nodiflora	Ch	PAN	+	+	-	+	-	+	+	-	62.5
Centaurea calcitrapa	Ch	M + ER – SR	-	-	-	-	+	+	+	+	50
Persicaria salicifolia	G	PAL	+	+	-	-	-	+	+	-	50
Plantago major	H	COSM	+	+	+	-	-	-	+	-	50
Polygonum equisetiforme	G	M + IR – TR	+	+	-	-	+	-	+	-	50
Cynachum acutum	Nph	M + IR – TR	+	+	-	-	-	-	+	-	37.5
Desmostachya bipinnata	G	S – Z + SA – SI + IR – TR	-	-	-	+	+	+	-	-	37.5
Hemarthria altissima	G	M + SA – SI	+	+	-	-	-	-	+	-	37.5
Leersia hexandra	He	PAN	+	+	-	-	-	-	+	-	37.5
Phragmites australis	G,He	COSM	-	+	-	+	-	-	-	+	37.5
Alternanthera sessilis	Nph	PAN	-	-	-	-	-	+	+	-	25
Atriplex halimus	Nph	M + SA – SI	-	-	-	-	-	+	-	+	25
Atriplex portulacoides	Ch	ER – SR + M + IR – TR	-	-	-	-	-	+	-	+	25
Cyperus laevigatus	G,He	PAN	+	+	-	-	-	-	-	-	25
Dichanthium annulatum	H	PAN	-	-	-	-	+	-	-	+	25
Eclipta alba	He	NEO & NAT	-	-	-	+	-	-	+	-	25
Limonium narbonense	H	M	+	-	-	-	-	-	+	-	25
Paspalidium geminatum	He	PAL	-	-	-	+	-	-	+	-	25
Silybum marianum	H	M + IR – TR + ER – SR	+	-	-	-	-	+	-	-	25
Spergularia marina	G	M	-	+	-	-	-	-	+	-	25
Suaeda pruinosa	Ch	M	+	+	-	-	-	-	-	-	25
Alhagi graecorum	H	PAL	-	-	+	-	-	-	-	-	12.5
Allium roseum var. *tourneuxii*	G	SA – SI	+	-	-	-	-	-	-	-	12.5
Brachiaria reptans	Th	M + IR – TR	-	-	-	+	-	-	-	-	12.5
Carex extensa	G	M + ER – SR	-	-	-	-	-	-	+	-	12.5
Cressa cretica	H	M + PAL	-	+	-	-	-	-	-	-	12.5
Cyperus alopecuroides	He	PAN	-	+	-	-	-	-	-	-	12.5
Euphorbia terracina	H	M	-	+	-	-	-	-	-	-	12.5
Inula crithmoides	Ch	M + ER – SR + SA – SI	-	+	-	-	-	-	-	-	12.5
Ipomoea eriocarpa	G	PAN	+	-	-	-	-	-	-	-	12.5
Launcea angustifolia	H	M + SA – SI	-	-	-	-	-	+	-	-	12.5
Nicotiana glauca	Ch	NAT	+	-	-	-	-	-	-	-	12.5
Orobanche crenata	P	M + SA – SI + IR – TR	+	-	-	-	-	-	-	-	12.5
Panicum coloratum	G	M + PAL	-	-	-	-	-	+	-	-	12.5
Panicum repens	G	PAN	-	-	-	-	-	-	+	-	12.5
Persicaria senegalensis	G	PAL	-	-	-	-	-	-	+	-	12.5
Persicaria lapathifolia	G	PAL	-	-	-	-	-	-	+	-	12.5
Veronica anagallis-aquatica	He	COSM	+	-	-	-	-	-	-	-	12.5
Biennials											
Rorippa palustris	Th	M + ER – SR	+	+	+	+	-	-	+	-	62.5
Chenopodium ambrosioides	Th	COSM	-	+	-	-	-	+	+	-	37.5
Apium graveolens	Th	ER – SR + M + IR – TR	+	-	-	-	-	-	-	-	12.5
Brassica rapa	Th	CULT & NAT	+	-	-	-	-	-	-	-	12.5
Annuals											
All year annuals											
Chenopodium album	Th	COMS	+	+	+	+	+	+	+	+	100
Chenopodium murale	Th	COMS	+	+	+	+	+	+	+	+	100
Rumex dentatus	Th	M + IR - TR + ER - SR	+	+	+	+	+	+	+	+	100
Solanum nigrum	Th	COSM	+	+	+	+	+	+	+	+	100
Sonchus oleraceus	Th	COSM	+	+	+	+	+	+	+	+	100
Amaranthus lividus	Th	M + IR – TR	+	+	+	+	+	+	+	-	87.5
Bidens pilosa	Th	PAN	+	+	+	+	+	+	+	-	87.5
Cenchrus biflorus	Th	NEO	+	+	-	+	+	+	+	+	87.5

Table 1: Continuous

Species	Life form	Floristic category	Orchard types Cs.	Pd.	Ms.	Pp.	Mi.	Vv.	Pg.	Pm.	Presence percentage (P%)
Chenopodium ficifolium	Th	COSM	+	+	+	+	-	+	+	+	87.5
Conyza aegyptiaca	Th	NEO	+	+	+	+	+	+	+	-	87.5
Conyza bonariensis	Th	NEO	+	+	-	+	+	+	+	+	87.5
Emex spinosa	Th	M + SA – SI	+	+	+	+	+	+	+	-	87.5
Beta vulgaris	Th	M + IR - TR + ER - SR	+	-	+	+	+	+	+	-	75
Gnaphalium luteo album	Th	COSM	+	+	+	+	-	+	+	-	75
Malva parviflora	Th	M + IR – TR	+	-	+	+	+	+	+	-	75
Xanthium strumarium	Th	COSM	+	-	-	+	+	+	+	+	75
Apium leptophyllum	Th	COSM	+	+	+	+	-	-	+	-	62.5
Bassia indica	Th	S – Z + IR – TR	-	+	+	-	-	+	+	+	62.5
Poa annua	Th	COSM	+	+	+	+	-	-	+	-	62.5
Cakile maritima	Th	M + ER – SR	+	-	+	+	-	-	+	-	50
Euphorbia heterophylla	Th	PAN	+	-	+	+	-	+	-	-	50
Euphorbia prostrata	Th	COSM	+	+	-	+	-	+	-	-	50
Lactuca serriola	Th	M + IR –TR + ER – SR	-	+	-	+	-	+	+	-	50
Sorghum virgatum	Th	PAL	-	-	+	+	-	+	+	-	50
Urtica urens	Th	M + IR – TR – ER – SR	+	-	+	+	-	-	+	-	50
Ethulia conyzoides	Th	PAL	+	-	-	-	-	-	+	-	25
Lotus glaber	Th,H	ER – SR + M + IR – TR	-	+	-	-	-	-	+	-	25
Chenopodium glaucum	Th	M + ER – SR	-	+	-	-	-	-	-	-	12.5
Mesembryanthmum crystallinum	Th	M + ER – SR	-	-	-	-	-	-	+	-	12.5
Parietaria alsinifolia	Th	SA – SI	-	-	-	-	-	-	+	-	12.5
Torilis bracteosa	Th	M +ER – SR	+	-	-	-	-	-	-	-	12.5
Winter-spring annuals											
Euphorbia peplis	Th	ER – SR + M + IR – TR	+	+	+	+	+	+	+	+	100
Sisymbrium irio	Th	M + ER – SR + IR – TR	+	+	+	+	+	+	+	+	100
Anagallis arvensis	Th	COSM	+	+	+	-	+	+	+	+	87
Lolium perenne	Th	ER – SR + M + IR – TR	+	+	+	-	+	+	+	-	75
Medicago polymorpha	Th	COSM	+	+	+	+	-	+	+	-	75
Melilotus indicus	Th	M + IR – TR + SA – SI	+	+	+	+	+	-	+	-	75
Polypogon monospeliensis	Th	COSM	+	+	-	+	-	+	+	+	75
Stellaria pallida	Th	M + ER – SR	+	+	-	+	+	+	+	-	75
Trifolium resupinatum	Th	M + ER – SR + IR – TR	+	+	+	+	-	+	+	-	75
Vicia sativa	Th	M + ER – SR + IR – TR	+	+	+	+	-	+	+	-	75
Bromus diandrus	Th	M	+	-	+	-	+	-	+	+	62.5
Avena fatua	Th	PAL	-	+	-	+	-	+	+	-	50
Bromus catharticus	Th	ER – SR + M + IR – TR	+	-	+	-	-	+	+	-	50
Cichorium endivia var. *pumilum*	Th	M + IR – TR	+	+	-	+	-	-	+	-	50
Euphorbia helioscopia	Th	M + SA – SI + IR – TR	+	+	+	+	-	-	-	-	50
Hordeum marinum	Th	M + ER – SR + IR – TR	-	-	-	+	-	+	+	+	50
Phalaris minor	Th	M + IR – TR	+	+	-	+	-	-	+	-	50
Senecio vulgaris	Th	M + IR – TR + ER – SR	+	-	+	-	-	+	+	-	50
Silene rubella	Th	PAL	+	-	-	+	-	+	+	-	50
Aegilops bicornis	Th	M + SA – SI	-	+	-	-	-	+	+	-	37.5
Ammi majus	Th	M + IR – TR + ER – SR	+	-	-	+	-	+	-	-	37.5
Brassica tounefortii	Th	M + IR – TR + SA – SI	+	+	-	-	-	-	+	-	37.5
Capsella bursa pastoris	Th	COSM	+	-	+	+	-	-	-	-	37.5
Coronopus didymus	Th	COSM	+	-	+	-	-	-	+	-	37.5
Erodium crassifolium	Th	SA – SI	+	+	-	-	-	-	+	-	37.5
Fumaria densiflora	Th	M + ER – SR + IR - TR	+	+	-	-	-	-	+	-	37.5
Hordeum murinum	Th	M + IR – TR	+	+	-	+	-	-	-	-	37.5
Plantago lagoups	Th	M + IR – TR	-	-	-	-	+	+	-	+	37.5
Polycarpon tetraphyllum	Th	M	+	+	-	-	-	-	+	-	37.5
Raphanus raphanistrum	Th	M + ER – SR	-	-	-	-	+	+	-	+	37.5
Urospermum picroides	Th	M + IR – TR	-	-	-	+	+	+	-	-	37.5
Vicia monantha	Th	M + IR – TR	-	+	+	+	-	-	-	-	37.5
Ammi visnaga	Th	M + IR – TR	+	-	-	+	-	-	-	-	25
Anthemis retusa	Th	M	+	-	-	+	-	-	-	-	25
Euphorbia hirta	Th	S – Z	-	+	+	-	-	-	-	-	25
Lamium amplexicaule	Th	M + IR – TR + ER – SR	+	-	-	+	-	-	-	-	25
Neurada procumbens	Th	SA – SI + S – Z	-	-	-	-	-	+	-	+	25
Parapholis incurva	Th	M + IR – TR + ER – SR	+	-	-	-	-	-	-	+	25
Amaranthus hybridus	Th	PAL	-	+	-	-	-	-	-	-	12.5
Coronopus squamatus	Th	M + ER – SR + IR – TR	-	-	-	-	-	-	-	+	12.5
Cutandia memphitica	Th	M + IR – TR + SA – SI	-	+	-	-	-	-	-	-	12.5
Daucus bicolor	Th	M	-	-	-	-	-	-	+	-	12.5
Erodium oxyrhynchum var. *bryoniifolium*	Th	SA – SI	+	-	-	-	-	-	-	-	12.5
Eruca sativa	Th	CULT & NAT	+	-	-	-	-	-	-	-	12.5
Galium aparine	Th	ER – SR + M + IR – TR	+	-	-	-	-	-	-	-	12.5

Table 1: Continuous

Species	Life form	Floristic category	Orchard types: Cs.	Pd.	Ms.	Pp.	Mi.	Vv.	Pg.	Pm.	Presence percentage (P%)
Geranium dissectum	Th	ER – SR + M + IR – TR	-	-	-	+	-	-	-	-	12.5
Heliotropium lasiocarpum	Th	M + ER – SR + IR – TR	+	-	-	-	-	-	-	-	12.5
Lepidium sativum	Th	M	+	-	-	-	-	-	-	-	12.5
Malva sylvestris	Th	M + ER – SR + IR – TR	+	-	-	-	-	-	-	-	12.5
Medicago intertexta	Th	M + ER – SR	+	-	-	-	-	-	-	-	12.5
Medicago sativa	Th	COSM	-	+	-	-	-	-	-	-	12.5
Mesembryanthmum nodiflorum	Th	M + SA – SI + ER –SR	-	-	-	-	-	-	+	-	12.5
Nicotiana plumbaginifolia	Th	NAT	+	-	-	-	-	-	-	-	12.5
Plantago squarrosa	Th	M	+	-	-	-	-	-	-	-	12.5
Ranunculus marginatus	Th	M + IR – TR + ER – SR	-	-	-	-	-	-	+	-	12.5
Ranunculus sceleratus	Th	M + IR – TR + ER – SR	-	+	-	-	-	-	-	-	12.5
Reichardia tingitana	Th	M + SA – SI + IR – TR		-	+	-	-	-	-	-	12.5
Summer-autumn annuals											
Portulaca oleracea	Th	COSM	+	+	+	+	+	+	+	+	100
Digitaria sanguinalis	Th	PAN	+	+	+	+	+	+	+	-	87.5
Dinebra retroflexa	Th	S – Z + SA – SI	+	+	+	+	+	+	+	-	87.5
Echinochloa colona	Th	PAN	+	+	+	+	+	+	+	-	87.5
Setaria verticillata	Th	PAL	+	+	+	+	+	+	+	-	87.5
Dactyloctenium aegyptium	Th	PAL	+	+	+	+	+	-	+	-	75
Pennisetum glaucum	Th	PAN	+	+	+	+	-	+	+	-	75
Amaranthus tricolor	Th	PAL	+	+	+	+	-	+	-	-	62.5
Corchorus olitorius	Th	PAN	+	+	+	-	-	+	+	-	62.5
Eleusine indica	Th	PAL	+	+	-	+	-	-	+	+	62.5
Amaranthus graecizans	Th	M + IR – TR	+	+	-	+	-	-	+	-	50
Echinochloa-crus galli	Th	PAN	+	+	-	-	-	+	+	-	50
Setaria viridis	Th	PAL	+	+	-	+	-	-	+	-	50
Sida alba	Th	PAL	+	+	-	-	-	+	+	-	50
Hibiscus trionum	Th	PAL	+	+	-	-	-	+	-	-	37.5
Abutilon theophrasti	Th	M + IR – TR + ER – SR	+	+	-	-	-	-	-	-	25
Poa infirma	Th	M	+	+	-	-	-	-	-	-	25
Sesbania sericea	Th	PAL	-	+	-	-	-	-	+	-	25
Trianthema portulacastrum	Th	PAN	+	+	-	-	-	-	-	-	25
Tribulus terrestris	Th	ER–SR + M + IR–TR + S–Z	-	-	-	-	-	+	-	+	25
Acrachne racemosa	Th	PAN	+	-	-	-	-	-	-	-	12.5
Anchusa aegyptica	Th	SA – SI + S – Z	+	-	-	-	-	-	-	-	12.5
Anchusa humilis	Th	M + SA – SI	-	+	-	-	-	-	-	-	12.5
Brachiaria eruciformis	Th	M + IR – TR	-	-	-	+	-	-	-	-	12.5
Cyperus difformis	Th	PAL	+	-	-	-	-	-	-	-	12.5
Rumex pictus	Th	M + SA – SI	-	+	-	-	-	-	-	-	12.5
Verbena supina	Th	M + IR – TR + ER – SR	+	-	-	-	-	-	-	-	12.5
Total number of species			115	96	58	76	39	74	99	34	

Th: Therophytes, G: Geophytes, He: Helophytes, H: Hemicryptophytes, Ch: Chamaephytes, Nph: Nanophanerophytes, P: Parasites, COSM: Cosmopolitan, PAN: Pantropical, PAL: Paleotropical, NEO: Neotropical, M: Mediterranean, ER-SR: Euro-Siberian, SA-SI: Saharo-Sindian IR-TR: Irano-Turanian, S-Z: Sudano-Zambezian, NAT: Naturalized, CULT: Cultivated, Cs: *Cirus* spp., Pd: *Phoenix dactylira*, Ms: *Musa sepientum*, Pp: *Prunus persica*, Mi: *Mangfera indica*, Vv; *Vitis vinifeta*, Pg: *Psidium guajava*, Pm: *Pyrus malus*

Table 2: Life span spectrum of the weed flora in the orchard types of the study area

Life span	Total area No.	%	Cs. No.	%	Pd. No.	%	Ms. No.	%	Pp. No.	%	Mi. No.	%	Vv. No.	%	Pg. No.	%	Pm. No.	%
Perennials	50	29.58	29	25.22	27	28.12	11	18.96	15	19.74	8	20.51	21	28.38	29	29.3	10	29.41
Biennials	4	2.37	3	2.61	2	2.1	1	1.72	1	1.31	-	-	1	1.35	2	2.02	-	
Annuals (115 species):																		
All year annuals	31		24		20		20		24		14		21		27		10	
Winter-spring annuals	57	68.05	38	72.17	26	69.8	17	79.32	23	78.96	11	79.49	19	70.27	27	68.69	11	70.59
Summer- autumn annuals	27		21		21		9		13		6		12		14		3	
Total	169	100	115	100	96	100	58	100	76	100	39	100	74	100	99	100	34	100

Cs: *Citrus* spp. (*Citrus sinensis* & *Citrus reticulata*), Pd : *Phoenix dactylifera*, Ms : *Musa sapientum*, Pp : *Prunus persica*, Mi : *Mangifera indica*, Vv: *Vitis vinifera*, Pg : *Psidium guajava*, Pm : *Pyrus malus*

Table 3: Life form spectrum of the weed flora in orchard types of the study area

			Orchard type															
	Total area		Cs.		Pd.		Ms.		Pp.		Mi.		Vv.		Pg.		Pm.	
Life span	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Therophytes (Th)	119	70.41	88	76.52	70	71.87	47	81.03	61	80.26	31	79.49	53	71.62	71	71.72	23	67.65
Cryptophytes (G & He)	27	15.98	13	11.3	14	15.63	4	6.91	10	13.16	5	12.82	10	13.51	18	18.18	5	14.7
Hemicryptophytes (H)	12	7.1	7	6.08	6	6.25	5	8.62	2	2.63	2	5.13	5	6.76	5	5.05	2	5.88
Chamaephytes (Ch)	7	4.11	4	3.48	4	4.17	1	1.72	2	2.63	1	2.56	4	5.41	3	3.03	3	8.83
Nanophanerophytes (Nph)	3	1.8	2	1.74	2	2.08	1	1.72	1	1.32	-	-	2	2.7	2	2.02	1	2.94
Parasites (P)	1	0.59	1	0.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	169	100	115	100	96	100	58	100	76	100	39	100	74	100	99	100	34	100

* Legends of the orchard types: see Table 2.

Table 4: Floristic categories of the families in the study area

Family	Genera	Species	COSM	PAN	PAL	NEO	Pluri-regional	Bi-regional	M- PAL	M	SA–SI	S–Z	Nat	Nat & Cult
Monocotyledoneae														
Cyperaceae	2	5	-	3	1	-	-	1	-	-	-	-	-	-
Gramineae	32	41	3	9	8	1	8	7	2	2	-	-	-	1
Liliaceae	1	1	-	-	-	-	-	1	-	-	-	-	-	-
Dicotyledoneae														
Archichlamydeae														
Urticaceae	2	2	-	-	-	-	1	-	-	-	1	-	-	-
Polygonaceae	4	7	-	-	3	-	1	3	-	-	-	-	-	-
Aizoaceae	2	3		1			1	1					-	
Portulacaceae	1	1	1	-	-	-	-	-	-	-	-	-	-	-
Caryophyllaceae	4	4	-	-	1	-	-	1	-	2	-	-	-	-
Chenopodiaceae	5	10	4	-	-	-	2	3		1	-	-	-	-
Amaranthaceae	2	5		1	2	-	-	2	-	-	-	-	-	-
Ranunculaceae	1	2	-	-	-	-	2	-	-	-	-	-	-	-
Fumariaceae	1	1	-	-	-	-		1	-	-	-	-	-	-
Cruciferae	9	11	2	-	-	-	3	3	-	1	-	-	-	2
Neuradaceae	1	1	-	-	-	-		1	-	-	-	-	-	-
Leguminosae	7	10	2		2		4	2	-	-	-	-	-	-
Oxalidaceae	1	1	1	-	-	-	-	-	-	-	-	-	-	-
Geraniaceae	2	3	-	-	-	-	1	-	-	-	2	-	-	-
Zygophyllaceae	1	1	-	-		-	1	-	-	-	-	-	-	-
Euphorbiaceae	1	6	1	1	-	-	2	-	-	1	-	1	-	-
Tiliaceae	1	1	-	1	-	-	-	-	-	-	-	-	-	-
Malvaceae	4	5			2		2	1	-	-	-	-	-	-
Umbelliferae	4	6	1	-	-	-	2	2		1	-	-	-	-
Sympetalae														
Primulaceae	1	1	1	-	-	-	-	-	-	-	-	-	-	-
Plumbaginaceae	1	1	-	-	-	-	-	-	-	1	-	-	-	-
Asclepiadaceae	1	1	-	-	-	-	-	1	-	-	-	-	-	-
Rubiaceae	1	1	-	-	-	-	1	-	-	-	-	-	-	-
Convolvulaceae	3	3	1	1	-	-	-	-	1	-	-	-	-	-
Boraginaceae	3	3	-	-	-	-	1	2	-	-	-	-	-	-
Verbenaceae	2	2	-	1	-	-	1	-	-	-	-	-	-	-
Labiatae	2	2	-	-	1		1	-	-	-	-	-	-	-
Solonaceae	2	3	1	-	-	-	-	-	-	-	-	-	2	-
Scrophulariaceae	1	1	1	-	-	-	-	-	-	-	-	-	-	-
Orobanchaceae	1	1	-	-	-	-	1	-	-	-	-	-	-	-
Plantaginaceae	1	3	1	-	-	-	-	1	-	1	-	-	-	-
Compositae	19	20	3	1	1	4	5	5		1			-	
Total number	126	169	23	19	21	5	40	38	3	11	3	1	2	3

Abbrevations of the floristic categories are listed in Table1.

Table 5: Number of species and percentage of various floristic categories of the orchard types in the study area

	Total area		Orchard type															
			Cs.		Pd.		Ms.		Pp.		Mi.		Vv.		Pg.		Pm.	
Floristic category	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
COSM	23	13.62	20	17.39	18	18.75	16	27.58	17	22.37	7	17.96	15	20.27	18	18.18	10	28.42
PAN	19	11.24	15	13.04	13	13.54	8	13.79	8	10.53	6	15.39	11	14.85	12	12.12	3	8.82
PAL	22	13.01	14	12.17	14	14.58	7	12.08	12	15.78	3	7.69	10	13.51	17	17.17	1	2.94
NEO	5	2.96	4	3.48	4	4.17	2	3.45	5	6.58	3	7.69	4	5.39	5	5.05	4	8.82
M + IR – TR + ER – SR	30	17.75	22	19.13	12	12.5	11	18.98	13	17.1	6	15.39	14	18.98	17	17.17	6	17.66
M + IR – TR + SA – SI	6	3.55	4	3.48	5	5.2	2	3.45	2	2.63	1	2.56	-	-	2	2.02	-	-
M + ER – SR + SA – SI	2	1.18	-	-	1	1.04	-	-	-	-	-	-	-	-	1	1.01	-	-
SA – SI + S – Z + IR – TR	1	0.59	-	-	-	-	-	-	1	1.32	1	2.56	1	1.35	-	-	-	-
M + IR – TR	14	8.28	10	8.7	8	8.34	3	5.17	11	14.47	5	12.83	4	5.4	7	7.07	1	2.94
M + ER – SR	10	5.92	4	3.48	3	3.12	2	3.45	3	3.95	3	7.69	3	4.05	6	6.06	3	8.82
M + PAL	3	1.77	1	0.87	2	2.1	1	1.72	-	-	1	2.56	2	2.7	1	1.01	1	2.94
M + SA – SI	7	4.14	2	1.74	5	5.2	1	1.72	1	1.32	1	2.56	4	5.4	3	3.03	1	2.94
SA – SI + S – Z	4	2.37	3	2.61	2	2.1	2	3.45	2	2.63	1	2.56	3	4.05	2	2.02	1	2.94
S – Z + IR – TR	1	0.59	-	-	1	1.04	1	1.72	-	-	-	-	1	1.35	1	1.01	1	2.94
M	11	6.52	8	6.95	5	5.2	1	1.72	1	1.32	1	2.56	-	-	5	5.05	1	2.94
SA – SI	4	2.37	3	2.61	1	1.04	-	-	-	-	-	-	-	-	1	1.01	-	-
S – Z	1	0.59	-	-	1	1.04	1	1.72	-	-	-	-	-	-	-	-	-	-
CULT & NAT	3	1.78	3	2.61	1	1.04	-	-	-	-	-	-	1	1.35	1	1.01	1	2.94
NAT	2	1.18	2	1.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M+ IR– TR+ ER– SR+ S - Z	1	0.59	-	-	-	-	-	-	-	-	-	-	1	1.35	-	-	1	2.94
Total number	169	100	115	100	96	100	58	100	76	100	39	100	74	100	99	100	34	100

Cs: *Citrus* spp., Pd: *Phoenix dactylifera*, Ms: *Musa sapientum*, Pp: *Prunus persica*,
Mi: *Mangifera indica*, Vv: *Vitis vinifera*, Pg: *Psidium guajava*, Pm: *Pyrus malus*,

It was obvious that, out of the recorded species, ten weeds had very wide ecological amplitude attaining the highest presence value (P = 100%), they had been recorded in the eight orchard types. These ten weeds may be grouped as follows:

a) Two perennials: *Cynodon dactylon* and *Cyperus rotundus*.
b) Five all year active annuals: *Chenopodium album*, *Chenopodium murale*, *Rumex dentatus*, *Solanum nigrum* and *Sonchus oleraceus*.
c) Two winter-spring active annuals: *Euphorbia peplis* and *Sisymbrium irio*.
d) One summer-autumn active annual: *Portulaca oleracea*.

Fourteen weed species were of relatively high ecological amplitude being recorded in 7 orchard types (P = 87.5%). These may be classified as follows:

a) Two perennials: *Aster squamatus* and *Imperata cylindrica*.
b) Seven all year annuals: *Amaranthus lividus*, *Bidens pilosa*, *Cenchrus biflorus*, *Chenopodium ficifolium*, *Conyza aegyptiaca*, *Conyza bonariensis* and *Emex spinosa*.
c) One winter-spring annual: *Anagallis arvensis*.
d) Four summer-autumn annuals: *Digitaria sanguinalis*, *Dinebra retroflexa*, *Echinochloa colona* and *Setaria verticillata*.

Eighteen weed species were recorded in 6 orchard types (P=75%), these weeds were distributed as follows:

a) Five perennials: *Paspalum distichum*, *Pluchea dioscoridis*, *Polypogon viridis*, *Convolvulus arvensis* and *Oxalis corniculata*.
b) Four all year annuals: *Beta vulgaris*, *Gnaphalium luteo album*, *Malva parviflora* and *Xanthium strumarium*.
c) Seven winter-spring annuals, among of them are: *Lolium perenne*, *Trifolium resupinatum*, *Vicia sativa*, etc.
d) Two summer-autumn annuals: *Dactyloctenium aegyptium* and *Pennisetum glaucum*.

Twelve weed species were recorded in 5 orchard types (P=62.5%), these include the following:

a) Four perennials: *Arundo donax*, *Leptochloa fusca*, *Mentha longifolia* and *Phyla nodiflora*.
b) One biennial weed, namely: *Rorippa palustris*.
c) Three all year annuals: *Apium leptophyllum*, *Bassia indica* and *Poa annua*.
d) One winter-spring annual, namely: *Bromus diandrus*.
e) Three summer-autumn annuals: *Amaranthus tricolor*, *Corchorus olitorius* and *Eleusine indica*.

Twenty two weed species had a moderate representation (P=50%), these may be classified as follows:

a) Four perennials: *Centaurea calcitrapa*, *Persicaria salicifolia*, *Plantago major* and *Polygonum equisetiforme*.
b) Six all year annuals, among of these weeds: *Cakile maritima*, *Euphorbia heterophylla*, etc.
c) Eight winter-spring annuals, some of these are: *Bromus catharticus*, *Phalaris minor*, *Senecio vulgaris*, *Silene rubella*, etc.
d) Four summer-autumn annuals, these are: *Amaranthus graecizans*, *Echinochloa crus galli*, *Setaria viridis* and *Sida alba*.

Also, 19 weed species were recorded in three orchard types (P=37.5%), 24 weed species in two orchard types (P = 25%) and 49 rare weed species which were represented in a single orchard type (P = 12.5%).

Plant life-span: The plant life-span spectrum varies from one orchard type to the other (Table 2). The highest number of perennial weeds had been recorded in *Pyrus malus* orchards (29.41%), followed by *Psidium guajava* (29.30%), *Vitis vinifera* (28.38%), *Phoenix dactylifera* (28.12%), *Citrus* spp (25.22%), *Mangifera indica* (20.51%) and *Prunus persica* orchards (19.74%). The lowest presentation of perennials was attained in *Musa sapientum* orchards (18.96%).
The highest presence value of the biennial weeds was attained in *Citrus* spp. orchards while the lowest value was attained in the orchards of *Prunus persica* (1.31%).
The annual weeds were represented by relatively high presence percentages in the study eight orchard types, ranged from 68.69% (*Psidium guajava*) to 79.49% (*Mangifera indica*).

Plant life-form: The recorded weed species (169) were grouped under six types of life-forms. The majority of these plants were therophytes (70.41%) and cryptophytes (15.98%). Hemicryptophytes attained value of 7.1%, chamaephytes 4.11% and nanophanerophytes 1.8%. Parasites attained the lowest value of 0.59% (Table 3). The life-form spectra varied from one orchard type to the other. The orchards of *Musa sapientum* had the highest presence percentage of therophytes (81.03%), followed by the orchards of *Prunus persica* (80.26%). While the lowest presence value of therophytes was recorded in orchards of *Pyrus malus* (67.65%). The other five orchards had almost comparable representations of therophytes with presence values ranged between 71.65-79.49%. Cryptophytes showed the highest contribution in *Psidium guajava* orchard (18.18%) and attained the lowest value (6.91%) in *Musa sapientum* orchard.
Hemicryptophytes attained the highest value (8.62%) in *Musa sapientum* orchard and the lowest value (2.63%) in orchard of *Prunus persica*. The highest representation of chamaephytes was attained in *Pyrus malus* orchard (8.8%) and the lowest value in orchard of *Musa sapientum* (1.72%).
Nanophanerophytes were missed in orchard of *Mangifera indica*, but they attained the highest value (2.9%) in *Pyrus malus* orchard and the lowest value (1.32%) in *Prunus persica* orchard. The parasites were represented by one species only in the orchard of *Citrus* spp.

Floristic analysis: The weed flora of the study orchards comprises 169 species related to 126 genera and belonging to 35 families. The number of monocot species recorded in the study area (Table 4) was 47 taxa (27.81%), while the number of dicots was 122 species (72.19%). Gramineae comprises 41 species or about 24.26% of the total recorded species, followed by Compositae which includes 20 species (11.8%), then Cruciferae 11 species (6.5%), Chenopodiaceae and Leguminosae 10 species each (5.9%). Polygonaceae was represented by 7 species (4.1%), Euphorbiaceae and Umbelliferae were represented by 6 species each (3.6%). Amaranthaceae and Malvaceae were represented by 5 species each (3%) while Caryophyllaceae by 4 species (2.4%). The other remaining families (23) were either represented by 3,2 or one species. It has been found that 84 species (49.7%) of the total recorded weeds were Mediterranean taxa. These taxa were either pluriregional (23.07%), biregional (20.11%) or monoregional (6.52%). Floristic analysis also reveals that another 69 species or about 40.83% of the total number of recorded species were either cosmopolitan (13.61%), palaeotropical (12.43%), pantropical (11.24%) or neotropical (2.96%). Saharo-Sindian element comprises 8 species (4.73%) including 4 species monoregional and 4 biregional Saharo-Sindian and Sudano-Zambezian taxa. The other floristic categories were poorly represented by few number of species (Table 4).
The floristic categories of the weed flora (Table 5) vary from one orchard type to the other. The orchards of *Citrus* spp. showed the highest number (51 species) of the Mediterranean taxa including 26 pluriregional, 17 biregional and 8 monoregional species. While *Pyrus malus* orchards attained the lowest number (13 species) of Mediterranean taxa comprising 6 pluriregional, 6 biregional and one monoregional taxa. The number of Mediterranean taxa in the orchards of *Phoenix dactylifera* was 41 species classified into 18 pluriregional, 18 biregional and 5 monoregional taxa. The orchards of *Psidium guajava* attained 42 Mediterranean taxa which constitute 20 pluriregional, 17 biregional and 5

monoregional. The orchards of *Prunus persica*, *Vitis vinifera*, *Musa sapientum* and *Mangifera indica* attained 31, 27, 21 and 18 Mediterranean taxa respectively.

It has also been found that the Cosmopolitan element was represented by 20 species in the orchards of *Citrus* spp., 17 species in *Prunus persica*, 16 species in *Musa sapientum*, 15 species in *Vitis vinifera*, 10 species in *Pyrus malus* and 7 species in *Mangifera indica*. The pantropical and palaeotropical categories were important chorotypes showed a relatively moderate representation in different orchard types. While the neotropical element was represented by a relatively low comparable number of species ranged between 2-5 taxa in the study orchards. The other floristic categories were either poorly represented by a few number of species in some orchard type or missed in other (Table 5).

Discussion

The present research showed that the weed flora of the study orchards comprises 169 species belonging to 126 genera and

related to 35 families. Out of these families, Gramineae, Compositae, Cruciferae, Chenopodiaceae and Leguminosae were the major families contributing collectively about 54.44% of the total recorded species. This indicates that, these five families were the common taxa and constitute the main bulk of the flora in the study area. This agrees with the findings of the Quezel (1978) concerning the floristic structure of the Mediterranean Africa, El-Fahar (1989) on the weed flora of the main crops in the Nile Delta, El-Sheikh (1989) on the canal banks of middle Nile Delta region, El-Kady *et al*. (1999) on the weed flora of the common orchards in El-Gharbia Province, El-Halawany (2000) on the weed flora of date palm orchards in the Nile Delta and Omar (2001) on the weed flora of Damietta area.

The highest number of weed species (115) was recorded in the orchards of *Citrus* spp., while the lowest number (34) was recorded in *Pyrus malus* orchards. This may be attributed to the fact that, the soil type of *Citrus* plantation was heavy textured and the water-holding capacity as well as organic carbon contents were relatively high and enough to the establishment and domination of these weeds (Mashaly and Awad, 2002). On the other hand, the orchards of *Pyrus malus* were generally located in areas of sandy soils where water-holding capacity and organic carbon contents were low. Such soil type enable few number of weed species to grow.

Regarding the life-span of species (duration), the recorded weeds were categorised into three main groups: perennial species (50), biennials (4) and annual species (115). According to Raunkiaer (1934), therophytes were thus the most common representing about 70.41% of the total number of recorded species followed by cryptophytes of about 15.98%. The dominance of therophytes among the weed vegetation was probably attributed to their short life cycle that enable them to resist the instability of the cultivation system. They had also the ability to set seeds without the need of pollinator visit (Baker, 1974). The life-form spectra of the weed flora in the present study was similar to that reported by Hassib (1951), El-Sheikh (1989), Shalaby (1995), El-Kady *et al*. (1999), El-Halawany (2000), Mashaly (2001) and Omar (2001).

The Mediterranean taxa were relatively high represented (49.7%), followed by cosmopolitan (13.61%), palaeotropical (12.43%) and pantropical (11.24%). This confirms the findings of Serag (1986), Mashaly (1987), Shalaby (1995) and Omar (2001). 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.

The monoregional Mediterranean element was poorly represented in the study area if compared with the biregional and pluriregional Mediterranean elements. Also, it may be noticed that the number of Mediterranean taxa extending into Euro-Siberian Territory were apparently higher than the Mediterranean species with Saharo-Sindian extension. This result supports the suggestion for the presence of a transitional Mediterranean Territory in Egypt between the Mediterranean and Saharo-Arabian Territories. Similar investigations had been reported by El-Bakry (1982), Shaltout and El-Fahar (1991), Zaki and Mashaly (1992), Shalaby (1995) and El-Ashri (1996). In conclusion, the flora of the study area belongs mainly to the Mediterranean Territory and partly to the Irano-Turanian, Euro-Siberian and Saharo-Sindian Territories.

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