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Floristic Studies in Suez Canal Region with Seventeen New Records to the Area

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Abstract

The present study provides a detailed flora composition and soil attributes of Suez Canal region. This region was represented in Ismailia-PortSaïd highway, Ismailia city and Ismailia-Suez highway which wasn't surveyed before as a whole region. The species collection was preformed seasonally from 2020 till 2022. The investigated area comprised of a wide range of habitats namely, waste land, cultivated land, irrigated areas, desert land, salt marshes, edge of cultivation and canal bank. A total of 190 species were recorded in the study area. They include 24 sub-species and 14 varieties belonging to 127 genera and 39 families. The most species-rich families were represented by Poaceae (36 species), Amarnthaceae (26 species), Asteraceae (18 species), Brassicaceae (12 species) and Fabaceae (10 species). Therophytes were the most dominate life-form in the study area represented by 58.5 percent, followed by chamaephytes (20.5%), hemicryptophytes (7.8%), cryptophytes (7.89%), then phanerophytes (4.7%) and parasites 0.5%. This study revealed seventeen species as new records to the flora of the study area. Out of these six species are added as new records to the flora of the Mediterranean region, Eastern desert and Isthmic desert.

***Keywords*: ** Flora composition, Soil attributes, Geographical distribution, New records, Suez Canal region

Introduction

Suez Canal is one of the most important waterways in the world due to its unique location as it connects north to south by joining Port Saïd on Mediterranean Sea with Suez on Gulf of Suez. At the same time, it is considered the shortest water way between Europe and India for the ships without navigating around Africa as well as from the west facing the Nile River and from the east facing Sinai Peninsula. **https://earth.esa.int/web/earth-watching/image-of-the-week/content/-/article/suez-canal-egypt/ accessed in (25/2/2022)**.

The current literature data revealed that the Flora of the Suez Canal not yet covered with sufficient research. But all the studies applied on this region were from the ecological point of view and targeted limited areas of the study region. Some studies were applied on areas near Ismailia - Port Saïd highway among them Zahran *et al.* (1989), El-Demerdash *et al.* (1990), Khedr & Zahran (1999), Mashaly *et al.* (2002), Shaltout & Galal (2007), Abd El–Hamid & Kamel (2010) and Serag *et al.* (2015). Moreover, the floristic composition of Ismailia city wasn't studied before in taxonomy point of view. But there were some ecological studies on and near this region e.g., Abd El-Hamid (1996), Abd El-Hamid (2005) Mohamed & Azer (2012) and El Bous & Abd El-Hamid (2018). Finally, the flora of Ismailia-Suez highway was analyzed by some authors but only in restricted localities e.g., Danin (1974) Mashaly *et al.* (1995), Abd El-Ghani (1998), Abd El-Ghani *et al.* (2013), El-Amier & Abdel-Kader (2015), Abd El-Hamid (2017), Hamdy *et al.* (2017), Azer (2018) and Radi *et al.* (2020).

There are many threats facing the wild flora of Suez Canal region. These are reconstruction and expansion of the highways. Both Ismailia - Port Saïd and Ismailia – Suez highways were reconstructed and expanded many times, Ismailia – Suez highway still reconstructed from 2020 till nowadays, so this led to the erosion of the natural habitats of the wild plants permanently. The construction of bridges in Ismailia city in some localities adjacent to Suez Canal e.g., Old University Street, in front of maritime navigation and guidance center. Renewing and repairing the roads in Ismailia city as in Old University area, Al -Ersal and Coca-Cola company area. Moreover, the establishing of new resorts along Ismailia - Port Saïd highway and Ismailia – Suez highway were the major thearts for the wild plants.

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Climate is the most affecting factor not only on determining the distribution of the plants but also on the growth, development, distribution, and densities of the vegetation of whole the earth, see also (Amer & Elshayeb, 2020). Therefore, the great variation in the climatic conditions that Egypt faces nowadays greatly harms the flora.

However, the excellent Egyptian flora given by Boulos (1999, 2000, 2002, 2005) was well studied but there are many gaps such as geographical distribution of many species still needed to be updated, the flora of some regions isn't well explored, some plant species need intensive collections and studies, the names of many families and taxa must be uptated.

So, this study aims to investigate the flora composition of the study area by collecting all wild plants from their natural habitats, updating all families, genera, and species names according to international reference database, giving the geographical distribution for all recorded taxa, studying some ecological data and showing the effect of the highway's reconstruction and construction of bridges on the wild plant habitats.

Study area

The present study was performed in Suez Canal Road which is adjacent and parallel to the Suez Canal from Port Saïd to Suez and its length is about 193Km long. The longest distance between the road and Suez Canal is approximately eight km. It is located between 30° 27' 17.99"N to 32° 20' 59.99" E.

The study area included three regions (Ismailia-PortSaïd highway, Ismailia city and Ismailia-Suez highway). Ismailia-Port Saïd highway which is about 75 km long, including several towns and villages (Al-Qantara West and Abu Khaleefa being the major towns), **Map (1)**. This sector includes mango plantations, crop farms, waste lands, salt marshes and muddy soil areas.

Ismailia city is about 210 km, located between 30°35'59.99" N to 32° 16' 60.00" E. It shows some variation in the habitats like waste land, sand plains, irrigated areas, canal bank. The plants collections include different regions which are parallel or near Suez Canal region like Al -Ersal, Old University Street, Al-Danvaa club and others, **Map (2)**.

Ismailia-Suez highway connects Ismailia with Suez (90 km long); most of the western side of the road is still desert. This sector is characterized by sand plains, undulating sand dunes, plateaus, salt marshes and scant irrigated areas. A large number of towns and villages are scattered along the way such as (Abu Sultan, Fayid, Fanara, Kasfareet and Geneifa), **Map (3)**.

The study area has a subtropical desert / low-latitude, arid hot climate. It is situated in or near the subtropical desert biome according to the Köppen-Geiger classification (BWh) and the Holdridge life zones system of bioclimatic classification. http://www.ismailia.climatemps.com (accessed in 4/9/202).

Map (1). Collection sites of Ismailia- Port Saïd highway. 1&2: Al Ferdan, 3: Abu Khaleefa, 4: Al-Qantara West, 5: Al-Balla, 6&7: Water treatment station Bahr Baqar, 8: After 30 June hospital, 9: Three July tunnels, 10: PortSaïd city

Map (2). Collection sites of Ismailia city. 1: Al Ersal, 2: The united nation monitoring the truce, 3: Old University Street, 4: Nemra 6 street, 5: Al Danvaa club, 6: Mercure Ismailia Forsan Island, 7&8: Mohamed Ali Lake, 9: Coca-Cola company road, 10: Al Allam.

Map (3). Collection sites of Ismailia-Suez highway. 1: Nefesha, 2, 3 & 4: Serapeum, 5: Abu Sultan, 6, 7: Fayid, 8: Fanara, 9&10: Kasfareet, 11: Geneifa.

Material and Methods

This study based is on freshly collected wild plants from their natural habitats in the period from 2020 to 2022 from the study area including four seasons. All voucher specimens were deposited in Suez Canal University Herbarium (SCU-I).

The studied specimens were identified according to Boulos (1999, 2000, 2002, 2005) and Täckholm (1974). In addition to using the of the plant flora of different neighboring countries were also used to achieve an accurate identification e.g., Zohary (1966, 1972) and Feinbrun-Dothan (1978, 1986) and Migahid (1978). The recent valid plant names of the recorded species were revised and verified with international reference databases. while family and species names were updated according to Hosni & Shamso (2022). The geographical distribution of the recorded species in Egypt was given according to Boulos (2009).

To study some ecological data, soil samples in triples was collected from each of the 10 studied sites in each three regions (31 sites) at depth of 15-20cm. The composite soil samples were passed through a 2 mm sieve to get rid of gravel and debris then the saturated soil paste extract were performed on the samples. Chemical soil analysis was applied to soil samples. Electrical conductivity (EC) of the saturated soil paste extract expressed as (dSm-1) was measured using the conductivity meter model Jenway 3310 according to Richards (1954). Soil pH was determined by bench-type Beckman glass electrode pH meter, in 1:2.5 soil water suspensions according to Page *et al.* (1982). Calcium and magnesium were extracted in the saturated soil and determined by volumetric titration with ethylene diamine tetra acetic acid (EDTA). Sodium and Potassium were determined by Flame photometer Chloride was determined by titration with silver nitrate, bicarbonate was determined by titration with sulphuric acid according to Page *et al.* (1982). Total carbonates were determined using Collin's calcimeter, (Piper, 1950).

Statistical analyses were performed for soil analysis results using SPSS statistical package (SPSS Inc., Version 11.5).

Results

This study revealed a total of 190 species including 24 sub-species and 14 varieties of flowering plants belonging to 127 genera and 39 families. The most species- rich families were Poaceae (36 species), Amaranthaceae (26 species), Asteraceae (18 species), Brassicaceae (12 species), and Fabaceae (10 species). Finally, twenty-three families represented the monogeneric families e.g., Lamiaceae, Commelinaceae, Euphorbiaceae and Nyctaginaceae, **Table (1).**

Some species were recorded in the study area showing great dominance having 64 species (33.6%) among them *Bassia indica*, *Zygophyllum album* and *Chenopodium murale.* While Ismailia - Port Saïd highway and Ismailia city flora showed the highest similarity by 27 species representing 14.2 % of the total number of species, among them *Mesembryanthemum forsskaolii* and *Veronica persica*. Moreover, Ismailia -Suez highway and Ismailia-Port Saïd highway shared 18 species representing 9.4% e.g, *Deverra tortuosa*, *Anabasis articulata*. Finally, Ismailia and Ismailia - Suez highway showed the lowest similarity by 9 species representing 4.7% e.g. *Calotropis procera* and *Erodium glaucophyllum*, **Table (1).**

This study included 109 annuals, 79 perennials and two biennials. The life forms spectrum of the Suez Canal region showed some variations. Therophytes came first with a percentage of 58.5%. Followed by Chamaephytes represented by 20.5%, then Hemicryptophytes and Cryptophytes which were nearly equal represented by 7.8% and 7.89%. Moreover, Phanerophytes represented by 4.7%, at last came parasites represented with lowest percentage of 0.5% **Table (1) and Fig. (1).**

Table (1). List of recorded species in the study area, life forms, habitats and geographical distribution of the recorded species. **Duration:** Ann=annual, Bi =biennial, Per = perennial. **Life form:** Th=Therophytes, H= Hemicryptophytes, N. Ph= Nanophanerophytes, Ch= chamaephytes, C= Cryptophytes, P=Parasites. **Habitats:** CL: cultivated lands, DL: desert land, EC: edge of cultivation, ES: edge of salt marshes IR: irrigated lands, SC: shore of canal, SM: salt marshes, WL: waste land. **Phytogeographical regions of Egypt according to Boulos (2009).**
N= Nile region, O= Oases of the Western Desert, M: The Mediterranean coastal strip, D=All the deserts of Egypt, De= Desert east to the Nile, Dw=Desert west of the Nile, GE=Gebel Elba, R= Red Sea coastal strip and S=Sinai Peninsula.
Asterisk (*) refers to new recorded species to the study regions, (+ = recorded, - = not recorded).

Family	Species	Duration	Life form	Habitat	Geographical distribution	Ismailia - Port Saïd highway	Ismailia city	Ismailia – Suez highway
Amaranthaceae (incl. Chenopodiaceae)	*Alternanthera sessilis* (L.) DC.	Per	H	WL	N, M, O, De	+	-	-
	Amaranthus hybridus L.subsp. *hybridus*	Ann	Th	CL, IR, WL	N, O, M, S	+	+	+
	A. blitum L. subsp. *oleraceus* (L.) Costea	Ann	Th	CL, IR	N, M, S	+	+	+
	A. viridis L.	Ann	Th	CL, IR, WL	N, O, M, De, S	+	+	+
	Anabasis articulata (Forssk.) Moq.	Per	Ch	DL, WL	O, M, D, S	+	-	+
	A. setifera Moq.	Per	Ch	DL	De, R, GE, S	-	-	+
	Arthrocaulon macrostachyum (Moric.) Piirainen & G. Kadereit	Per	Ch	SM, WL	N, O, M, De, R, S	+	-	+
	Atriplex lindlyi Moq. subsp. *inflata* (F. Muell.) P. G. Wilson	Ann	Th	DL, WL	N, M, D, S	+	+	+
	A. prostrata Boucher ex DC.	Ann	Th	CL, IR	N, M, S	+	+	-
	Bassia eriophora (Schrad.) Asch.	Ann	Th	DL	De, S	-	-	+
	B. indica (Wight) A.J. Scott.	Ann	Th	DL, WL	N, O, M, D, S	+	+	+
	B. muricata (L.) Asch.	Ann	Th	DL, EC, WL	O, M, D, S	+	+	+
	Chenopodium album L.	Ann	Th	CL,DL, WL	N, O, M, D, S	+	+	+
	**C. ficifolium* Sm.	Ann	Th	CL, WL	N, De	+	+	+
	C. glaucum L.	Bi	Th	DL	N,M	-	-	+
	C. murale L.	Ann	Th	CL,DL, ES, IR, WL	N, O, M, D, R, GE, S	+	+	+
	Cornulaca monocantha Delile	Per	Ch	DL, WL	O, M, D, S	+	+	+
	Dysphania ambrosioides (L.) Mosyakin& Clemants.	Ann	Th	CL, IR	N, M, O, S	+	+	-
	Halocnemum strobilaceum (Pall.) M.Bieb	Per	Ch	DL, ES	N (northern delta), M, D, R, S	+	-	+
	Halopeplis ameplexicaulis (Vahl) Ung. -Sternb.	Ann	Th	ES	N (northern delta). O, M, S	+	-	-
	H. perfoliata (Forssk.) Asch.	Per	Ch	SM	M, R, S	+	-	-
	Haloxylon salicornicum (Moq.) Bunge ex Boiss.	Per	Ch	DL,ES,SM, WL	O, M, D, R, S	+	+	+
	H. scoparium Pomel.	Per	Ch	DL,SM, WL,	M, D, S	+	-	+
	Salicornia europaea L.	Ann	Th	SM	N, O, M, S	+	-	-
	Salsola imbricata Forssk. subsp. *imbricata*	Per	Ph	DL	N, O, D, GE, S	-	-	+
	Suaeda vermiculata (Forssk.) Asch.	Per	Ph	ES	N, O, M, D, R, S	+	-	-
Apiaceae	*Ammi majus* L.	Ann	Th	CL, IR	N, O, M, S	+	+	+
	Deverra tortuosa (Desf.) DC.	Per	Ch	DL	O, M, D, R, S	+	-	+
	**Foeniculum vulgare* MilL.subsp. *vulgare*	Per	Ch	DL, IR	S	-	+	+
Apocynaceae (incl. Asclepiadaceae)	*Calotropis procera* (Aiton) W.T. Aiton	Per	Ph	DL, EC, WL	N, O, D, R, GE, S	-	+	+
	Cynanchum acutum L. subsp. *acutum*	Per	H	CL, IR, WL	N, O, M	+	+	+
	Bidens pilosa L.	Ann	Th	CL, IR, WL	N, M, De, S	+	+	+
	Brocchia cinerea (Delile) Vis.	Ann	Th	DL	M, D, R, S	-	-	+
	Dittrichia viscosa (L.) Greuter	Per	Ch	DL	N, M, S	-	+	-
	Eclipta prostrata L.	Ann	Th	EC	N, O, M	+	-	-
	Erigeron bonariensis L.	Ann	Th	CL, IR, WL	N, O, M, D, S	+	+	+
	**Eschenbachia stricta* (Willd.) Raizada	Per	Ch	DL	GE, S	-	-	+
	**Galinsoga parviflora* Cav.	Ann	Th	CL	N	+	-	-
	Launaea amal-aminea N. Kilion	Per	Ch	DL	De, S	-	-	+

Asteraceae	*L. mucronata* (Forssk.) Muschl. subsp *mucronata*	Per	Ch	DL, EC, WL	N, O, D, R, GE, S	-	+	+
	Limbarda crithmoides (L.) Dumort.	Per	Ch	SM	N, O, M	+	-	-
	Pulicaria incisia (Lam.) DC. subsp. *candolleana* E. Gamal.Eldin.	Ann	Th	DL	De, S	-	-	+
	P. undulata (L.) C. A. Mey.subsp. *undulata*	Per	Ch	DL	N, O, M, D, R, GE, S	-	-	+
	Pluchea dioscoridis (L.) DC.	Per	Ph	CL, DL, ES, SM WL	N, O, M, De, S	+	+	+
	Reichardia tingitana (L.) Roth.	Ann	Th	DL, EC, WL	N, M, D, R, GE, S	+	+	+
	Senecio glaucus L. subsp *coronopifolius* (Maire.) C. Alexander.	Ann	Th	DL, EC, WL	N, O, M, D, R, S	+	+	+
	Silybum marianum (L.) Gaertn. Var. *marianum.*	Ann	Th	IR	N, O, M, S	-	+	-
	Sonchus oleraceus L.	Ann	Th	CL, DL, EC, IR, SC, SM, WL	N, O, M, D, R, S	+	+	+
	Urospermum picroides (L.) F.W. Schmidt.	Ann	Th	EC, WL	N, O, M, D, GE, S	+	+	+
Aizoaceae	*Mesembryanthemum crystallinum* L.	Ann	Th	EM, WL	M, N, De, S	+	+	-
	M. cryptanthum Hook.f.	Ann	Th	CL, WL	M, D, O (Wadi Natrun), S	+	+	-
	M. nodiflorum L.	Ann	Th	CL, WL	M, N, S	+	+	-
	Trianthema portulacastrum L.	Ann	Th	WL	GE	-	+	-
Boragoniaceae	*Gastrocotyle hispida* (Forssk.) Bunge	Ann	Th	CL, IR	N, M, D, S	+	+	-
	Heliotropium aegyptiacum Lehm.	Ann	Th	DL	N, GE	-	+	-
	H. bacciferum Forssk.var *bacciferum*	Per	Ch	DL	N, D, R, GE, S	-	-	+
	H. digynum (Forssk.) Asch.	Per	Ch	DL	N, M, D, R. S	-	-	+
Brassicaceae	*Brassica nigra* (L.) Koch.	Ann	Th	CL	N, O, M, S	+	-	+
	**Cakile maritima* Scop. subsp. *aegyptiaca* (Willd.)Nyman	Ann	Th	DL	N, M. S	+	-	+
	Capsella bursa-pastoris (L.) Medik.	Ann	Th	CL, IR	N	+	+	+
	Coincya tournefortii (Gouan) Alcaraz.*et al.*	Ann	Th	EC, WL	N, O, M, D, S	+	+	+
	Eremobium aegyptiacum (Spreng.) Asch. var *aegyptiacum.*	Bi	Th	DL	N, O, M, D, R, S	-	-	+
	Eruca vesicaria (L.) Cav.	Ann	Th	CL, WL	N, O, M, De, S	+	+	+
	Lepidium didymium L.	Ann	Th	CL, IR, WL	N	+	+	+
	**Matthiola longipetala* (Vent.) DC.subsp. *bicornis* (Sm.) P.W. Ball.	Ann	Th	DL	M, S	-	-	+
	Matthiola longipetala (Vent.) DC. subsp. *livida* (Delile) Maire	Ann	Th	DL	N, M, R, S	-	-	+
	Raphanus raphanistrum L. subsp *raphanistrum*	Ann	Th	CL, WL	N, M	+	+	+
	Sisymbrium irio L.	Ann	Th	CL, EC, WL	N, M, De, R, GE, S	+	+	+
	Zilla spinosa (L.) Prantl	Per	Ch	DL	N, D, R, GE, S	-	-	+
Caryophyllaceae	*Paronychia arabica* (L.) DC. subsp *arabica*	Ann	Th	DL	M, D, S	-	-	+
	P. sinaica Fresen.	Per	H	DL	De, S	-	-	+
	Silene gallica L.	Ann	Th	CL	O, M	+	-	-
	S. rubella L. var. *rubella*	Ann	Th	CL, IR	O, N, M, S	+	+	-
	Spergularia marina L.	Ann	Th	EC	N, M, S	+	+	-
	S. media (L.) C. Presl	Ann	Th	WL	N, O, M, S	+	+	-
	S. rubra (L.) J. Presl & C. Presl	Per	H	EC, WL	N, M, S	+	+	-
	Stellaria media (L.) Vill.	Ann	Th	CL	M	+	-	+
	S. pallida (Dumort.) Murb.	Ann	Th	DL, IR	N, O, M, S	+	-	-
Ceratophyllaceae	*Ceratophyllum demersum* L.	Per	C	SC	N, M, De	-	+	-
	**C. muricatum* Cham.	Per	C	SC	N	-	+	-
Commelinaceae	*Commelina bengnalensis* L.	Per	H	CL	N, GE	+	-	-
Convolvulaceae	*Convolvulus arvensis* L.	Per	H	CL, IR, WL	N, O, M, D, S	+	+	+
	C. lanatus Vahl.	Per	Ch	WL	M, D, S	+	-	-
	Cuscuta pedicellate Ledeb.	Ann	P	WL	N, O, M, D, GE, S	-	+	-
Cucurbitaceae	*Citrullus colocynthis* (L.) Schrad.	Per	H	SC	N, O, M, D, R, GE, S	+	+	-
Cyperaceae	*Cyperus articulatus* L.	Per	C	EC, WL	N, M, De, S	+	-	+
	C. laevigatus L. var *laevigatus*	Per	C	EC, SM, WL	N, O, M, D, R, GE, S	+	+	+
	C. rotundus L.	Per	C	EC, ES, WL	N, O, M. O, R, GE, S	+	+	+

Euphorbiaceae	*Euphorbia helioscopia* L.	Ann	Th	CL, IR	N, M	+	+	+
	E. heterophylla L.	Ann	Th	CL	N, O, M	+	-	-
	**E. indica* Lam.	Ann	Th	IR	N	-	+	-
	E. prostrata Aiton	Ann	Th	IR	N, M, S	-	+	-
	E. peplis L.	Ann	Th	CL, IR, WL	M, S	+	+	-
	E. peplus L.	Ann	Th	CL, IR	N, O, M, D, S	+	+	+
Fabaceae	*Alhagi graecorum* Boiss.	Per	Ch	EC, DL, SM, WL	N, O, M, D, R, S	+	+	+
	Lotus polyphyllos E.D. Clarke	Per	H	CL, IR	M	+	+	-
	Medicago polymorpha L.var *polymorpha*	Ann	Th	CL, IR	N, O, M, D, S	+	+	-
	M. sativa L. subsp. *sativa*	Ann	Th	CL, IR	N, O, M, S	+	+	-
	Melilotus albus Medik.	Ann	Th	IR	N, S	-	+	-
	M. indicus (L.) All.	Ann	Th	CL, EC, IR, SC, WL	N, O, M, D, S	+	+	+
	Trifolium resupinatum L.var *resupinatum*	Ann	Th	CL, IR	N, O, M, D	+	+	-
	Trigonella glabra Thunb. subsp. *glabra*	Ann	Th	CL, IR	N, O, M, S	+	+	+
	Vachellia tortilis (Forssk.) Galasso & Banfi subsp. *raddiana* (Savi) Kyal. & Boatwr.	Per	Ph	DL	De. R, GE, S	-	-	+
	Vicia sativa L. subsp *sativa*	Ann	Th	CL, IR	N, M	+	+	+
Papaveraceae (incl. Fumariaceae)	*Fumaria parviflora* Lam.	Ann	Th	CL, IR	N, M, De, S	+	+	+
Geraniaceae	*Erodium glaucophyllum* (L.) L'Hér.	Per	H	DL	M, D, S	-	+	+
	E. malacoides (L.) L'Hér.	Ann	Th	IR	N, O, M, De, S	-	+	-
	**E. oxyrhynchum* M. Bieb. subsp. *bryoniifolium* (Boiss.) Schönb.-Tem.	Ann	Th	DL	N, O, M, D, S	-	-	+
Juncaceae	*Juncus acutus* L.subsp. acutus	Per	C	WL	M, N, O, De, S	+	-	+
	J. rigidus Desf.	Per	C	DL, EC, WL	M. N, O, Dw, De, S, R	+	+	+
Lamiaceae	*Lamium amplexicaule* L. subsp. *amplexicaule*	Ann	Th	CL, IR	N, O, M, S	+	+	+
Malvaceae	*Malva parviflora* L.	Ann	Th	CL, DL, IR, SM, WL	N, O, M, D, R, GE, S	+	+	+
	Sida alba L.	Per	Ch	CL	N, O, M	+	-	-
Nyctaginaceae	**Boerhavia diffusa* L.	Per	H	WL	N	+	-	-
Onagraceae	*Ludwigia adscendens* (L.) H. Hara	Per	C	SC	N, O, M, S	-	+	-
Oxalidaceae	*Oxalis corniculata* L.	Per	H	CL, IR, WL	N, O, M, De	+	+	+
Plantaginaceae	*Misopates orontium* (L.) Rafin.subsp. *orontium*	Ann	Th	IR	N, M, De, GE, S	-	+	-
	Plantago lanceolata L.	Per	H	IR	N	-	+	-
	P. major L.	Per	H	CL, IR	N, O, M, S	-	+	+
	Veronica anagaIlis-aquatica L.	Per	Ch	WL	N, O	+	-	-
	V. persica Poir.	Ann	Th	CL, IR	M	+	+	-
	V. polita Fr.	Ann	Th	IR	N, M, O	-	+	-
Poaceae	*Avena fatua* L.	Ann	Th	CL, IR	N, O, M, D, S	+	+	+
	A. sativa L.	Ann	Th	CL, IR	N, O, M, D, S	+	+	+
	Bromus catharticus Vahl	Per	Ch	CL, IR	N, O, M, De	+	+	+
	Cenchrus biflorus Roxb.	Ann	Th	CL, DL, IR, WL	N, D, S	+	+	+
	C. divisus (J.F.Gmel.) Verloove, Govaerts & Butler	Per	Ch	CL	N, O, D, R, S	+	-	-
	Centropodia forskaolii (Vahl.) Cope	Ann	Th	DL	N, O, M, D, R, GE, S	-	-	+
	Chloris virgata Sw.	Ann	Th	IR	N, O, GE	-	+	-
	Cynodon dactylon (L.) Pers.	Per	C	CL, DL, EC, IR, WL,	N, O, M, D, R, GE, S	+	+	+
	Dactyloctenium aegypticum (L.) Wild.	Ann	Th	CL, EC, IR	N, O, M, D, S	+	+	-
	Dichanthium annulatum (Forssk.) Stapf.	Per	Ch	IR	N, O, M, De, S	-	+	-
	Diplachne fusca (L.) P. Beauv. ex Roem. & Schult	Per	Ch	ES, SM	N, O, M, D, R, GE	+	-	+
	Digitaria ciliaris (Retz.) Koeler	Per	Ch	CL, IR, WL	N, O, R, GE, S	+	+	+
	**D. nodosa* Parl.	Per	Ch	CL	GE	+	-	-
	Echinochloa colona (L.) Link.	Ann	Th	CL, DL, IR	N, O, M, D, R, GE, S	+	+	+
	Eleusine africana Kenn.	Ann	Th	CL, IR	N, O, M, R, S	+	+	+
	Eragrostis cilianensis (All.) Vignolo ex Janch.	Ann	Th	IR, WL	N, O, M, D, R, GE, S	+	+	-
	E. pilosa (L.) P. Beauv.	Ann	Th	IR	N, O, M, D, GE, S	-	+	-
	E. tef (Zucc.) Trotter.	Ann	Th	IR	N, O	-	+	-
	Imperata cylindrica (L.) Raeusch.	Per	C	CL, EC, WL	N, O, M, D, R, S	+	+	+

	Leptochloa panicea (Retz.) Ohwi.	Ann	Th	ES	N	+	-	-
	Lolium multiflorum Lam.	Ann	Th	CL	N, M, O, D, R, S	+	-	+
	L. perenne L.	Ann	Th	CL, IR	N, O, M, D, S	+	+	+
	L. rigidum Gaudin	Ann	Th	CL, IR	N, O, M, D, S	+	+	+
	Panicum coloratum L.	Per	Ch	IR	N, O, M, De	-	+	-
	P. repens L.	Per	Ch	CL, IR, WL	N, O, M, De	+	+	-
	Paspalum dilatatum Poir.	Per	Ch	CL, IR	N, S	+	+	-
	Phragmites australis (Cav.) Trin.ex. Steud.	Per	C	DL, EC, ES, SC, SM, WL	N, O, M, D, R, S	+	+	+
	Polypogon monospeliensis (L.) Desf.	Ann	Th	CL, IR, WL	N, O, M, D, R, S	+	+	+
	Schismus barbatus (L.) Thell.	Ann	Th	DL, WL	N, O, M, D, R, GE, S	+	+	+
	Setaria geminate (Forssk.) Veldkamp	Per	Ch	CL, ES, IR, WL	N, O, M, De	+	+	+
	**S. pumila* (Poir.) Roem. & Schult.	Ann	Th	CL	N, O, GE, S	+	-	-
	S. verticillata (L.) P. Beauv.	Ann	Th	CL, WL	N, O, M, D, R, GE, S	+	+	-
	S. viridis (L.) P. Beauv.	Ann	Th	CL, IR	N, O, De, S	+	+	-
	Sporobolus spicatus (Vahl) Kunth.	Per	C	DL, WL	N, O, M, D, R, GE, S	-	+	+
	Stipagrostis plumosa (L.) Munro ex T. Anderson	Per	H	DL	N, O, M, D, R, GE, S	-	+	+
	Triticum aestivum L.	Ann	Th	EC	N	+	-	-
Polygonaceae	*Calligonum comosum* L.'Her.	Per	Ph	DL	O, M, D, R, GE, S	-	-	+
	**Persicaria decipiens* (R.Br.) K.L. Wilson	Per	Ch	CL, EC, SC, WL	N, M	+	+	+
	Rumex cyprius Murb.	Ann	Th	DL	M, De, S	-	-	+
	R. dentatus L. subsp. *dentatus*	Ann	Th	CL, WL	N, M	+	+	-
	R. spinosus L.	Ann	Th	DL, WL	N, O, M, D, S	+	+	+
	R. vesicarius L.	Ann	Th	DL	M, D, R, GE, S	-	+	+
Pontederiaceae	*Pontederia crassipes* Mart.	Per	C	SC	N, O, M	-	+	-
Portulaceae	*Portulaca oleracea* L. subsp *nitida* Danin & H.G. Baker	Ann	Th	CL, DL, IR, WL	N, O, M, D, S	+	+	+
Potamogetonaceae	*Potamogeton crispus* L.	Per	C	SC	N, O, M, D, S	-	+	-
	P. nodosus Poir.	Per	C	SC	N, M, De (Ismailia Canal), S	-	+	-
Primulaceae	*Lysimachia arvensis* (L.) U. Manns & Anderb. var. *arvensis*	Ann	Th	IR, CL	N. O, M, D, R. GE, S	+	+	+
Resedaceae	*Oligomeris linifolia* (Vahl ex Hornem.) J. F. Macbr.	Ann	Th	DL	N, M, D, R, S	-	+	+
Salicaceae	*Salix mucronata* Thurb.	Per	Ph	SC	N, O, M, De, S	-	+	-
Santalaceae	*Thesium humile* Vahl var. *humile*	Ann	Th	WL	N, O, M, S	-	+	-
Solanaceae	*Datura innoxia* Mill.	Ann	Th	WL	N	+	+	-
	D. stramonium L.	Ann	Th	WL	N	+	+	+
	Hyoscyamus boveanus (Dunal.) Asch. & Schweinf.	Per	Ch	DL	N, O, De, R, S	-	-	+
	H. muticus L.	Per	Ch	DL, WL	N, O, M, D, R, GE, S	-	+	+
	Solanum nigrum L.var *nigrum*	Ann	Th	CL, WL	N, O, M, D, S	+	+	+
Tamaricaceae	*Tamarix aphylla* (L.) H. Karst.	Per	Ph	SM, WL	N, O, M, D, R, GE, S	+	-	-
	T. nilotica (Ehrenb.) Bunge.	Per	Ph	DL, ES, SM, WL	N, O, M, D, R, GE, S	+	+	+
Typhaceae	*Typha domingensis* (Pers.) Poir. ex Steud.	Per	H	ES, WL	N, O, M, D, R, S	+	-	+
Urticaceae	*Utrica urens* L.	Ann	Th	CL, IR, WL	N. O, M. De	+	+	+
Verbenaceae	*Phyla nodiflora* (L.) Greene	Per	H	IR	N, O, M, D, S	-	+	-
Zygophyllaceae	*Fagonia arabica* L.var *visidissama* Maire	Per	Ch	DL, WL	O, D	-	+	+
	Zygophyllum album L.	Per	Ch	DL, EC, ES, SM, WL	O, M, D, R, S	+	+	+
	**Z. coccineum* L.	Per	Ch	DL, WL	O, D, R, S	+	-	+
	**Z. simplex* L.	Ann	Th	DL, SM, WL	D, R, GE, S	+	+	+
	Tribulus bimucronatus var *bispinulosus (*Kralik) Hosni	Ann	Th	WL	De, R, GE	-	-	+
	T. bimucronatus var *inermis* (Kralik) Hosni	Ann	Th	WL	De, R, GE	-	-	+
	**T. parvispinus* Presl var. *parvispinus*	Ann	Th	IR	R, GE	-	+	-
	T. terrestris L.	Ann	Th	DL, WL	N, M, D, R, GE, S	+	+	+

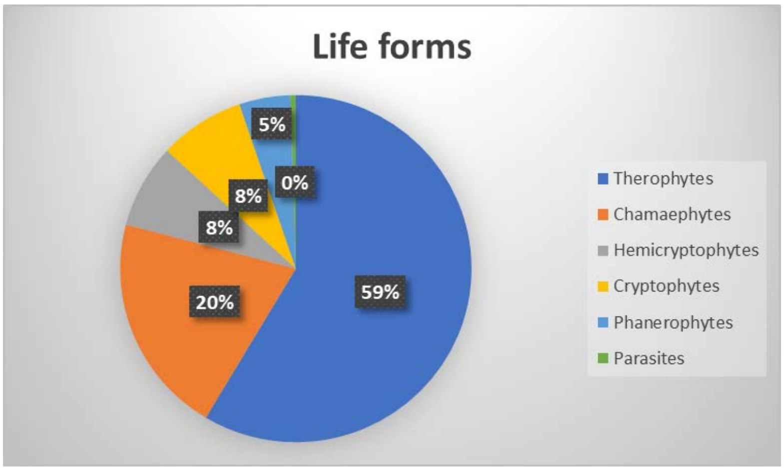

Fig. (1). Showed the percentage of the different life forms in the study area

Some habitats showed a high number of species and considered as a center of diversity, while some others showed lower species diversity e.g. waste lands included the highest number of species represented by 22.9% then the cultivated lands (19.9%) and sandy deserts (19.3%) However, canal bank recorded the lowest number (3.3%) **Table (1) and Fig. (2).**

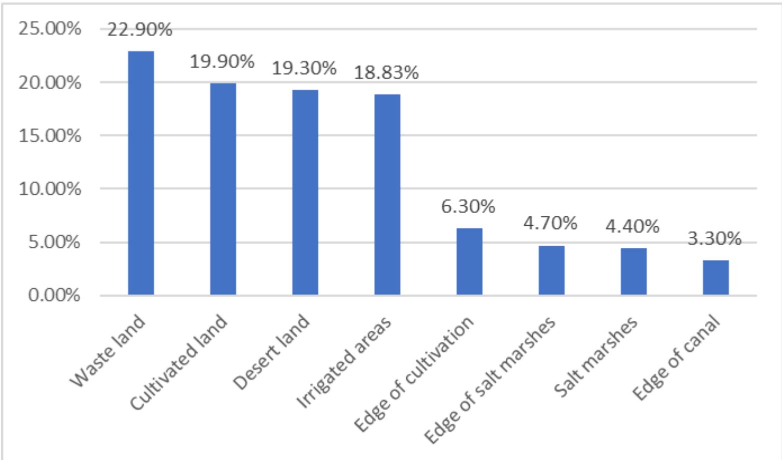

Fig. (2). The variations in the species percentage among the different habitats of the study area

The present study added 17 species as new records to Suez Canal region according to the geographical distribution of Boulos (2009), **Table (1).** Six species were added as new records out of the 17 species in Ismailia - Port Saïd highway which are *Boerhavia diffusa*, *Setaria pumila* and *Digitaria nodosa*, *Galinsoga parviflora*, *Zygophyllum simplex*, *Z. coccineum*.

Four species were recorded on Ismailia city which are: *Tribulus parvispinus*, *Chenopodium ficifolium*, *Ceratophyllum muricatum* and *Euphorbia indica*. While seven species were recorded in Ismailia – Suez highway which are: *Cakile maritima*, *Eschenbachia stricta*, *Persicaria decipiens* , *Matthiola longipetala* subsp. *bicornis*, *Foeniculum vulgare* subsp. *vulgare*, *Sterallia media* and *Erodium oxyrhynchum*. Moreover, *Boerhavia diffusa*, *Digitaria nodosa* and *Setaria pumila* are new records to the Mediterranean region. While, *Cakile maritima*, *Eschenbachia stricta* are recorded in the Eastern desert. *Ceratophyllum muricatum* is recorded to the Isthmic desert. *Hyoscyamus boveanus* is the only endemic plant recorded in Ismailia – Suez highway.

Soil samples were analyzed to measure the chemical properties which corresponding to pH, electric conductivity, cations, anions and calcium carbonate There was a significant difference between the different sites of the three regions (**Table 3 a, b and c)**.The pH value was nearly alkaline ranging from 7-9. While, electrical conductivity ranged from 0.56 to 86 dsm^{-1}. Cations included a wide range from 0.47 to 650 $meql^{-1}$. In addition, anions ranged from 1.45 to 660 $meql^{-1}$and Calcium carbonate level ranged from 1.37 to 20%.

Table (3a). Chemical results of soil samples in 10 sites of Ismailia-Port Saïd highway. Each value is the Mean, ± SD Mean of 3 replicates. Within the same column, means carrying different superscripts are significantly different from each other (a refer to the highest value, while k refers to the lowest one).

Region	Site no.	PH	E.C dsm^{-1}	Cations ($meql^{-1}$)				Anions ($meql^{-1}$)			$\%CaCO_3$
				Ca2+	Mg2+	Na+	K+	HCO3-	Cl-	SO42-	
Ismailia-Port Saïd highway	1	8.22^{c} ±0.1	5.10^{b} ±0.2	17.8^{d} ±0.2	14.5^{e} ±0.2	20^{c} ±0.3	3.20^{b} ±0.2	6.65^{a} ±0.2	26.7^{c} ±0.3	22.6^{d} ±0.3	4.00^{c} ±0.2
	2	7.83^{ab} ±0.1	3.30^{a} ±0.3	10.0^{a} ±0.2	5.50^{a} ±0.2	18.0^{a} ±0.3	2.40^{a} ±0.2	7.90^{c} ±0.2	15.0^{a} ±0.2	14.0^{a} ±0.2	5.00^{d} ±0.2
	3	8.46^{cd} ±0.23	5.35^{b} ±0.9	20.0^{e} ±0.2	15.0^{f} ±0.1	21.5^{d} ±0.2	3.40^{b} ±0.2	6.50^{a} ±0.2	30.0^{d} ±0.3	23.4^{e} ±0.2	3.50^{b} ±0.3
	4	9.00^{c} ±0.2	86.0^{f} ±0.3	245^{j} ±0.3	415^{j} ±0.2	650^{i} ±0.3	28^{e} ±0.2	183^{h} ±0.3	470^{i} ±0.2	685^{i} ±0.2	7.50^{f} ±0.3
	5	7.50^{a} ±0.3	3.65^{a} ±0.2	11.5^{c} ±0.2	6.90^{c} ±0.2	19.0^{b} ±0.2	2.60^{a} ±0.3	9.90^{d} ±0.14	15.2^{a} ±0.2	14.9^{b} ±0.08	4.70^{d} ±0.2
	6	8.28^{c} ±0.3	32.2^{d} ±0.3	120^{h} ±0.2	160^{h} ±0.2	115^{g} ±0.1	40^{f} ±0.2	20.7^{e} ±0.2	260^{g} ±0.2	154^{f} ±0.2	6.00^{e} ±0.07
	7	8.50^{cd} ±0.2	84.0^{e} ±0.2	210^{i} ±0.2	400^{i} ±0.3	625^{h} ±0.2	25.0^{d} ±0.1	150^{g} ±0.2	450^{h} ±0.2	660^{h} ±0.2	7.20^{f} ±0.2
	8	7.85^{b} ±0.05	3.50^{a} ±0.2	11.1^{b} ±0.2	6.14^{b} ±0.2	18.3^{a} ±0.3	2.46^{a} ±0.2	8.00^{c} ±0.2	16.0^{b} ±0.2	14.0^{a} ±0.2	6.10^{e} ±0.2
	9	8.83^{de} ±0.3	20.4^{c} ±0.2	63.0^{g} ±0.1	123^{g} ±0.2	55.2^{f} ±0.2	20.8^{c} ±0.2	31.5^{f} ±0.1	65.0^{f} ±0.2	166^{g} ±0.2	2.50^{a} ±0.2
	10	8.50^{e} ±0.1	5.30^{b} ±0.3	20.5^{f} ±0.1	14.0^{d} ±0.1	22.3^{e} ±0.2	3.20^{b} ±0.2	7.00^{b} ±0.1	31.0^{e} ±0.1	22.0^{c} ±0.2	3.59^{b} ±0.2
	F-ratio	17	59 E+3	66 E+4	26 E+5	45 E+5	15 E+3	49 E+4	28 E+5	68 E+5	21 E+1
	p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table (3b). Chemical results of soil samples in 10 sites of Ismailia city.

Region	Site no.	pH	E.C dsm^{-1}	Cations ($meql^{-1}$)				Anions ($meql^{-1}$)			%$CaCO_3$
				Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	HCO^{3-}	Cl^{-}	SO_4^{2-}	
Ismailia city	1	8.22^{d} ±0.2	13.5^{f} ±0.2	35.0^{g} ±0.2	45.0^{g} ±0.2	77.0^{i} ±0.2	9.00^{h} ±0.2	50.0^{h} ±0.2	70.0^{g} ±0.2	46.0^{f} ±0.2	8.23^{a} ±0.2
	2	9^{e} ±0.2	12.2^{e} ±0.2	39^{h} ±0.2	50.0^{h} ±0.2	53^{h} ±0.2	8.00^{g} ±0.2	43.0^{g} ±0.2	60.0^{f} ±0.2	47.0^{g} ±0.2	8.00^{a} ±0.2
	3	7.40^{b} ±0.2	0.74^{b} ±0.07	3.50^{d} ±0.3	2.20^{b} ±0.2	1.20^{b} ±0.1	0.47^{a} ±0.3	3.00^{3} ±0.2	2.50^{a} ±0.1	1.87^{b} ±0.07	1.50^{a} ±0.09
	4	7.20^{ab} ±0.3	1.2^{c} ±0.1	4.00^{e} ±0.1	2.7^{cd} ±0.1	3.50^{f} ±0.11	0.80^{c} ±0.05	6.00^{e} ±0.1	3.60^{c} ±0.1	2.40^{c} ±0.2	3.0^{b} ±0.2
	5	7.82^{c} ±0.12	0.56^{a} ±0.05	1.20^{a} ±0.04	2.76^{d} ±0.05	0.69^{a} ±0.07	0.95^{cd} ±0.04	1.50^{a} ±0.09	2.50^{a} ±0.09	2.60^{d} ±0.09	2.72^{b} ±0.08
	6	7.95^{cd} ±0.14	8.33^{d} ±0.09	25.0^{f} ±0.2	35.0^{f} ±0.2	32.0^{g} ±0.1	4.00^{f} ±0.09	20.0^{f} ±0.2	40.0^{e} ±0.2	36.0^{e} ±0.1	2.00^{b} ±0.2
	7	8.00^{cd} ±0.2	0.77^{b} ±0.04	2.50^{b} ±0.1	3.32^{e} ±0.06	1.33^{b} ±0.85	0.55^{b} ±0.04	2.47^{b} ±0.13	2.78^{b} ±0.09	1.45^{a} ±0.04	1.37^{a} ±0.3
	8	7.00^{a} ±0.1	0.91^{b} ±0.04	3.00^{c} ±0.2	1.89^{a} ±0.09	2.86^{e} ±0.07	1.35^{e} ±0.03	2.85^{c} ±0.05	3.75^{cd} ±0.07	2.50^{cd} ±0.1	5.5^{d} ±0.1
	9	7.90^{c} ±0.1	0.87^{b} ±0.05	2.75^{b} ±0.07	2.50^{c} ±0.09	2.44^{d} ±0.1	1.1^{d} ±0.13	2.20^{b} ±0.32	3.90^{d} ±0.07	2.60^{d} ±0.09	1.65^{a} ±0.03
	10	7.2^{ab} ±0.1	0.90^{b} ±0.3	3.40^{d} ±0.04	2.6^{cd} ±0.04	2.10^{c} ±0.1	0.86^{cd} ±0.01	3.50^{d} ±0.06	3.60^{c} ±0.04	1.9^{b} ±0.04	2.22^{b} ±0.05
	F-ratio	39	82 E+2	26 E+3	82 E+3	19 E+4	19 E+2	42 E+3	15 E+4	10 E+4	97 E+1
	p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table (3c). Chemical results of soil samples in 10 sites of Ismailia-Suez highway

Region	Site no.	pH	E.C dsm^{-1}	Cations ($meql^{-1}$)				Anions ($meql^{-1}$)			%$CaCO_3$
				Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	HCO^{3-}	Cl^{-}	SO_4^{2-}	
Ismailia-Suez highway	1	8.4 ^{d} ±0.1	12.7 ^{e} ±0.1	25.0 ^{f} ±0.4	40.0 ^{f} ±0.1	86.0 ^{e} ±0.1	5.21 ^{f} ±0.1	32.5 ^{f} ±0.2	62.5 ^{i} ±0.2	61.21 ^{f} ±0.7	15.0 ^{e} ±0.2
	2	7.0 ^{a} ±0.8	3.11 ^{a} ±0.1	10.0 ^{a} ±0.1	15.3 ^{a} ±0.2	6.00 ^{b} ±0.13	2.59 ^{c} ±0.07	10.0 ^{b} ±0.1	15.0 ^{b} ±0.1	8.89 ^{c} ±0.09	8.00 ^{c} ±0.2
	3	7.10 ^{ab} ±0.1	3.20 ^{a} ±0.05	11.3 ^{b} ±0.1	15.0 ^{a} ±0.2	5.55 ^{a} ±0.2	3.20 ^{d} ±0.1	10.5 ^{c} ±0.7	15.4 ^{c} ±0.2	9.14 ^{cd} ±0.1	7.60 ^{b} ±0.2
	4	7.0 ^{a} ±0.2	3.00 ^{a} ±0.2	10.0 ^{a} ±0.2	15.1 ^{a} ±0.2	5.60 ^{a} ±0.2	2.50 ^{c} ±0.2	9.70 ^{ab} ±0.06	14.5 ^{a} ±0.2	9.00 ^{cd} ±0.1	8.20 ^{cd} ±0.2
	5	7.21 ^{ab} ±0.2	5.15 ^{c} ±0.2	22.5 ^{d} ±0.2	25.0 ^{c} ±0.2	8.18 ^{c} ±0.2	2.00 ^{a} ±0.2	10.0 ^{b} ±0.2	43.5 ^{g} ±0.7	4.18 ^{a} ±0.2	20.0 ^{i} ±0.2
	6	7.00 ^{a} ±0.2	3.55 ^{b} ±0.06	12.0 ^{c} ±0.2	16.6 ^{b} ±0.2	6.20 ^{b} ±0.2	3.20 ^{d} ±0.1	12.2 ^{d} ±0.3	17.5 ^{d} ±0.2	9.30 ^{d} ±0.11	16.0 ^{f} ±0.2
	7	8.25 ^{cd} ±0.2	21.3 ^{f} ±0.2	50.0 ^{h} ±0.2	80.0 ^{g} ±0.4	100 ^{f} ±0.3	4.3 ^{c} ±0.2	50.3 ^{h} ±0.2	99.0 ^{j} ±0.3	85.0 ^{i} ±0.2	4.50 ^{a} ±0.1
	8	8.00 ^{c} ±0.2	12.3 ^{d} ±0.2	26.10 ^{g} ±0.2	38.4 ^{c} ±0.2	65.0 ^{d} ±0.2	5.51 ^{g} ±0.1	36.6 ^{g} ±0.1	53.4 ^{h} ±0.2	45.00 ^{e} ±0.2	14.90 ^{e} ±0.1
	9	8.05 ^{c} ±0.13	63.0 ^{g} ±0.2	200 ^{a} ±0.3	260 ^{h} ±0.3	446 ^{g} ±0.2	7.50 ^{h} ±0.2	175 ^{i} ±0.2	325 ^{k} ±0.2	413.5 ^{j} ±0.1	17.0 ^{g} ±0.14
	10	7.30 ^{b} ±0.2	5.16 ^{c} ±0.1	22.8 ^{dc} ±0.1	25.1 ^{c} ±0.2	8.23 ^{c} ±0.2	2.10 ^{ab} ±0.2	9.50 ^{a} ±0.1	40.6 ^{e} ±0.2	8.13 ^{b} ±0.11	8.30 ^{d} ±0.2
	11	7.23 ^{ab} ±0.1	5.20 ^{c} ±0.2	23 ^{c} ±0.2	25.5 ^{d} ±0.2	8.26 ^{c} ±0.08	2.24 ^{b} ±0.1	11.1 ^{c} ±0.2	43.2 ^{f} ±0.2	4.42 ^{a} ±0.2	19.0 ^{h} ±0.2
	F-ratio	51	56 E+3	23 E+3	40 E+4	21 E+5	59 E+1	11 E+4	82 E+4	70 E+4	36 E+2
	p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Discussion

Although, the present study revealed the presence of 190 species. This given number could be larger, due to the destruction of the natural habitats of the wild flora by reestablishment and widening of the roads. The extreme variation in climatic conditions (extreme cold, hot and strong wind) which affect the growth and development of some species.

Some habitats in Ismailia city were destructed completely due to the city roads reconstruction and the construction of bridges as in the case of site 2 which exposed to complete erosion and even pulling all the wild plants after one year of species collection.

The recorded species in the 11th site was destroyed after two seasons of species collection in 2020 and some other sites were partially destroyed due to the human activities of road reconstruction that continued till today. Therefore, Ismailia- Suez highway included the lowest number of the recorded taxa.

The highest families of species number in the Suez Canal region were Poaceae (18.9 %), Amaranthaceae (13.6%), Asteraceae (9.4 %,), Brassicaceae (6.3 %) and Fabaceae (5.2%). The sequence of these families agreed with Abd El–Hamid and Kamel (2010) and disagreed with Mashaly *et al*. (2008) and Abd El-Ghani *et al.* (2014).

According to Boulos (1995) and Quézel (1978), these families are from the largest ones in the Egyptian flora and the most common plant families in the Mediterranean North African flora.

The recorded species in the study area were represented by 57.8% annuals, 41.5% perennials and 0.5% biennial. The dominance of annuals referred to their higher capacity of reproduction and ecological, morphological and genetic adaptability under the maximum levels of disturbance (Abd El-Hamid, 2005).

The life forms spectrum of study area dominated by therophytes (58.5%), followed by chamaephytes (20.5%), hemicryptophytes (7.8%), cryptophytes (7.89%), then phanerophytes (4.3%). This result agreed with Abd El-Hamid (2017) and Mashaly *et al*. (2019).

The dominance of therophytes may be due to the response to Mediterranean climate, topography variation and biological influence (Mashaly *et al*. 2013), while the highest percentages of chamaephytes and hemicryptophytes seems to be a tool of adaption against drought, salinity, sand accumulation and grazing via Danin & Orshan (1990) and Danin (1996).

The soil analysis results of Ismailia-Port Saïd highway were more or less convenient with those of Abd El–Hamid & Kamel (2010), who analyzed the weed communities associated with cultivated crops only and the study area was very limited. While Ismailia city results were relatively convenient with those of Abd El-Hamid (2005). Finally, Ismailia-Suez highway results almost convenient with those of Hamdy *et al.* (2017) and Abd El-Hamid (2017).

In this work, the highest species number were recorded in the waste land habitat (22.9%), followed by cultivated land (19.9%), then sandy deserts (19.3%). Finally, the lowest number were recorded in canal bank represented by 3.3%. The results agreed with that given by Abd El-Ghani *et al.* (2015). They stated that soil nutrient content, soil moisture and soil pH play an effective role in wild plants growth in the waste land, cultivated land and desert land habitats. Therefore, waste land habitat may include the best soil parameters for the flora of Suez Canal region.

Seventeen species were added to the flora of Suez Canal region which weren't recorded before by Boulos (2009). Moreover, they weren't recorded by the previous studies on the study area namely; Danin (1974), Zahran *et al.* (1990), El-Demerdash *et al.* (1990), Mashaly *et al.* (1995), Abd El-Hamid (1996), Abd El-Ghani (1998), Khedr and Zahran (1999), Mashaly *et al.* (2002), Abd El-Hamid (2005), Shaltout & Galal (2007), Abd El–Hamid and Kamel (2010), Mohamed & Azer (2012), Abd El-Ghani *et al.* (2013), Serag *et al.* (2015), El-Amier *et al.* (2015), Abd El-Hamid (2017), Hamdy *et al.* (2017), Azer (2018), El Bous & Abd El-Hamid (2018) and Radi *et al*. (2020).

Six species are newly recorded in the flora of Mediterranean region, Eastern desert and Isthmic desert. These results weren't given in many works namely; Hassan (1987), Dahmash (2001), Heneidy (2002, 2003), Heneidy & Bidak (2004), Boulos (2008), Bidak *et al.* (2013), Abd El-Ghani *et al.* (2014a), Abd El-Ghani *et al.* (2014b), Shaltout *et al*. (2015), Abd El-Ghani *et al.* (2017), Salama *et al*. (2018), Abdelaal *et al*. (2019), Mashaly *et al.* (2019), Amer *et al*. (2020), Amer & ELshayeb (2020), Hamed *et al.* (2021) and Fouad *et al.* (2022).

Boerhavia diffusa, *Setaria pumila* and *Digitaria nodosa* were mentioned as a new record to Ismailia-Port Saïd highway and the Mediterranean region according to the previously mentioned studies. *Boerhavia diffusa* belongs to Nile region according to Boulos (2009), while *Setaria pumila* belongs to the Nile region, Oasis, Gabel Elba, Sinai and *Digitaria nodosa* related to Gabel Elba. The presence of *Boerhavia diffusa* and *Setaria pumila* in the Mediterranean region may be due to the laying of Port Saïd at the east of the middle sector of deltaic Mediterranean coast as stated by Zahran *et al.* (1990). *Digitaria nodosa* may be present there because of the human activities as agriculture, recreation, global trade and transportation that promoted both the intentional and accidental spread of species across their natural dispersal barriers (Kolar & Lodge, 2001).

Tribulus parvispinus, *Ceratophyllum muricatum* and *Euphorbia indica* are new record to Ismailia city. In addition, *Ceratophyllum muricatum* is a new record to Isthmic deserts. According to Boulos (2009) *Ceratophyllum muricatum* and *Euphorbia indica* belong to Nile region, while *Tribulus parvispinus* belongs to Red Sea and Gabel Elba. The occurrence of these species there is due to the belonging of Ismailia city to Isthmic desert which seems to be extended from many neighboring regions as; Nile Delta, Eastern desert, Mediterranean coastal regions, Sinai and Nile valley (Taeckholm, 1974).

Cakile maritima, *Eschenbachia stricta*, *Persicaria decipiens* , *Matthiola longipetala* ssp. *bicornis*, *Digitaria ciliaris*, *Stellaria media* and *Erodium oxyrhynchum* are new records to Ismailia-Suez highway. In addition, *Cakile maritima* and *Eschenbachia stricta* are new records to the eastern desert. *Cakile maritima* relates to Mediterranean region, Nile region and Sinai, whereas *Eschenbachia stricta* relates to Gabel Elba and Sinai. The existence of *Cakile maritima* in the Eastern desert may be due to the presence of study area near Mediterranean/Sahara regional transition zone which includes mixed flora of both Mediterranean and Saharo-Sindian regions as mentioned by White (1993). In addition, the presence of *Eschenbachia stricta* may be due to the laying of Gabel Elba in the south east corner of Eastern desert.

Conclusion and Recommendation

The flora in Egypt is still in need of further intensive collections from all regions and accurate taxonomical studies. In addition, the geographical distributions of some species are updated according to this study. The road reconstruction and expansion are a bad impact on the wild flora, leading to habitats loss, hence the disappearance of many wild plants, e.g. *Erodium oxyrhynchum*, *Eschenbachia stricta*, *Hyoscyamus boveanus* and *Cakile maritima* in Ismailia-Suez highway. Moreover, this study could be the last one to record the flora of Ismailia-Suez highway before and after the road reconstruction. The establishment of new resorts along Ismailia - Port Saïd highway and Ismailia – Suez highway were the major threarts for the wild species.

This study could be the last one to record the flora of Ismailia-Suez highway before and after the road reconstruction

Therefore, the plant species must be protected in order to conserve the natural resources (ecosystems and habitats) and our flora must be updated and well studied.

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