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**New floristic records and species diversity in
North Sinai, Egypt: Monitoring changes
during last fifty years (1974-2024)**

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New floristic records and species diversity in North Sinai, Egypt: Monitoring changes during last fifty years (1974-2024)

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North Sinai is a location of ecological significance because of its physiographic changes and environmental gradients. The purpose of this study was to elucidate the recent alterations in the floristic structure and composition of North Sinai brought about by humanity and the current drought revealing new records with a comprehensive investigation of the life form and conservation status of each of the collected species. For three successive years (2022, 2023, and 2024), field trips were conducted seasonally from May to October. Ten localities were selected throughout North Sinai from El-Qantara to Rafah, in addition to El-Hassana and Nakhl areas to represent wild vegetation. This vegetation is characterized by the dominance of four large families: Asteraceae, Brassicaceae, Fabaceae and Poaceae revealing that therophyte is the most prevalent life form among plant species belonging to various families. The vegetation survey of these localities included a list on the life form of species and an evaluation of their conservation status. Five-hundred and twenty-two (522) species were recorded belonging to 307 genera and 66 families estimating that the number of weeds is in constant increase. The recorded species included seven endemic species belonging to families: Apiaceae, Asclepiadaceae, Brassicaceae, Caryophyllaceae and Lamiaceae. These endemic species comprised threatened and endangered species that must be conserved and deeply studied to prevent the risk of extinction including *Caralluma sinaica*, *Ferula sinaica* and *Spergula fallax*. Fifty-two species are new records conducted during this study in the different localities of North Sinai. Comparisons of the floristic composition and structure of North Sinai in the present study with earlier studies were also conducted. Improved knowledge of the indigenous flora can help North Sinai and other comparable desert locations make more informed decisions about conservation policies and sustainable land management practices.

Keywords: Endemic; Floristic composition; North Sinai; Plant communities; Vegetation

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INTRODUCTION

North Sinai is a part of the Saharo-Sindian desert. Its flora is made up of numerous rare species that have a restricted distribution in time and/or space, as well as a few common species that typically cover most of the area. The floristic composition of North Sinai has been the subject of numerous research (Täckholm, 1974; Gibali, 1988, 2000; Gazara *et al.*, 2000). The Sinai desert's distinctive flora faces numerous dangers, resulting in a fall in population size and diversity. Several of these threats to individual taxa affect functioning communities, ecosystems, and interactions with other species and the environment (Kamel *et al.*, 2008). However, only a small number of studies have detailed the diversity indices among various habitats. Numerous threats to the flora of the Sinai deserts result in a loss in the quantity and size of populations of its distinctive elements. Most of these threats impact the functional communities and ecosystems in which these populations eventually reside and interact with other species and the abiotic environment; some threats are specific to the populations of taxa (e.g. Zaghloul, 1997; Moustafa *et al.*, 2001; Zaghloul, 2003; and Abd El-Wahab *et al.*, 2004).

These dangers might be caused by humans or by the natural world. Drought, floods, and natural enemies (such as rodents, insects, and rotten fungi) are examples of the hazards posed by nature. The region has had cycles of drought and flood years (Zaghloul, 2003; Abd El-Wahab, 2003). Even though there may be a period of seven to ten years of drought and little precipitation, there may be a year or years of heavy precipitation that results in damaging flash floods that wipe out the vegetation in Wadis (dry valleys) and runnels (Fouad *et al.*, 2023). In addition to having an impact on the limited vegetation seen in dry to severely arid environments, the drought exacerbates additional threats, particularly those brought on by humans (Abd El-Wahab *et al.*, 2004).

North Sinai has seen numerous attempts at contemporary urbanization since 1981. These have included initiatives for Bedouin settlement and land reclamation in areas with fresh water supplies, school openings, road development, and the availability of public transportation (North Sinai Governorate, 2004). These endeavors brought the region and the rest of Egypt closer together and facilitated easier access to several locations and sites located in isolated deserts. There are positive and negative

aspects to this urbanization process. Stressing and destroying special natural habitats that support important and distinctive floristic characteristics of the region is one of the negative aspects. Overgrazing, over collecting, uprooting, overcutting for fuel wood, urbanization (building new settlements and infrastructure, such as the El-Salam irrigation canal), quarrying, solid waste disposal, and removing natural vegetation for cultivation projects are among the disturbances caused by human activity that have been documented in the area (Hany *et al.*, 2022; Bader and El-Shazly, 2024). These disturbances cause natural habitats to be destroyed and previously documented plant communities containing distinct floristic elements to vanish. As a result, the floristic composition and structure of the land alter, and diversity is lost (Kamel *et al.*, 2008). The main objectives of the present study are undertaken to evaluate the status of North Sinai floristic composition and tabulate and revise the species, their life form and conservation status in order to conduct a complete species checklist for the area in addition to reveal the new species recorded in North Sinai.

Study area

The study area is north of the Sinai Peninsula. The northern Sinai Governorate lies in the eastern part of Egypt, specifically between 34° E 32° W and 31° N 30° S. It is located along the Mediterranean Sea starting from Balloza village at the west to Rafah at the east. It is bounded by Port Said city and the Suez Canal from the West and El Arish city and Rafh from the East with a total area of 20310.4 km². Figure 1 shows the study area that is located between 31°19'44 and 30°30'08 north and between 34°29'44 and 34°29'53 east. The eastern border is the eastern international political border of Palastine starting with Taba in the south to Rafah at the north. The western border extends from Ras Masala at the south to Balloza village at the north (Figure 1). Its area is 27564 km² (≈ 2.8% of total Egyptian land). The study area includes El Tina Plain and the zone of El-Sheikh Gaber Al-Sabah Canal which is the back stone of El-Salam Canal project (one of the national major developing projects for the past two decades). The area includes the largest drainage basin in Sinai, Basin El Arish valley which extends from the middle of Sinai to the north and diverts its waters into the Mediterranean. The geographic elements of northern Sinai are distinguished into two main districts:

Coastal district: It includes a coastal plane, which extends 20 to 40 km southward from the

Mediterranean coast and is covered by different types of sand dunes.

Desert district: It dominates the central part of northern Sinai and includes plateaus and prominent but isolated mountain peaks such as Gebel El-Maghara (776 meters above sea level), Gebel El-Halal (881 meters above sea level), and Gebel Yi'allaq (1094 meters above sea level).

Climate of North Sinai

The climate of North Sinai (including the study area) is drier than South Sinai; therefore, the plant communities are quite different. Arish experienced a prolonged drought lasting for 9 months, from March to November. January is the wettest month in North Sinai. The mean annual rainfall 50-100 mm mainly distributed during the period from January to February. During the rest of the year, the area is particularly rainless. The mean annual temperature is in the range 16-20 °C with the highest temperature in June- July and the lowest in January – February. The average temperature rarely exceeds 30°C and rarely goes under 10°C (Gazara *et al.*, 2000).

Material and methods

During the different seasons of 2022, 2023 and 2024 ecological stands were distributed in ten main localities based on the occurrence of plant species and habitat variations sampled throughout North Sinai. For the duration of the research periods, monthly field trips were organized between October and May during the growing season. Furthermore, the trips encompassed neutralized and cultivated areas, farms, and villages with an abundance of annual plants and weeds invading the vast cultivated crop fields. The main locations under investigation are El-Qantara, Gilbana, Roman, Bir El-Abd, El-Mazar Bir Lehfan, El-Arish, Nakhl, El- Hassana, El-Sheikh Zwaied and Rafah (from Qantara to Rafah representing the Mediterranean coastal area, including the anticlines area (Gebel Halal, Gabel El-Maghara, Gabel Libni, and Gabel Yi'allaq). Table 1 elaborates on the GPS record for these 10 localities. Each area's selection of sites was primarily determined by the differences in physiognomy, habitat characteristics, prominent ecological factors, and soil surface nature. In each stand, the species list was recorded as presence/absence. Identification and nomenclature of the collected specimens were carried out according to Täckholm (1974), Zohary (1966 & 1972), Feinbrun-Dothan (1978 & 1986), and Boulos (1999, 2000, 2002 & 2005). In addition, the main electronic sources and

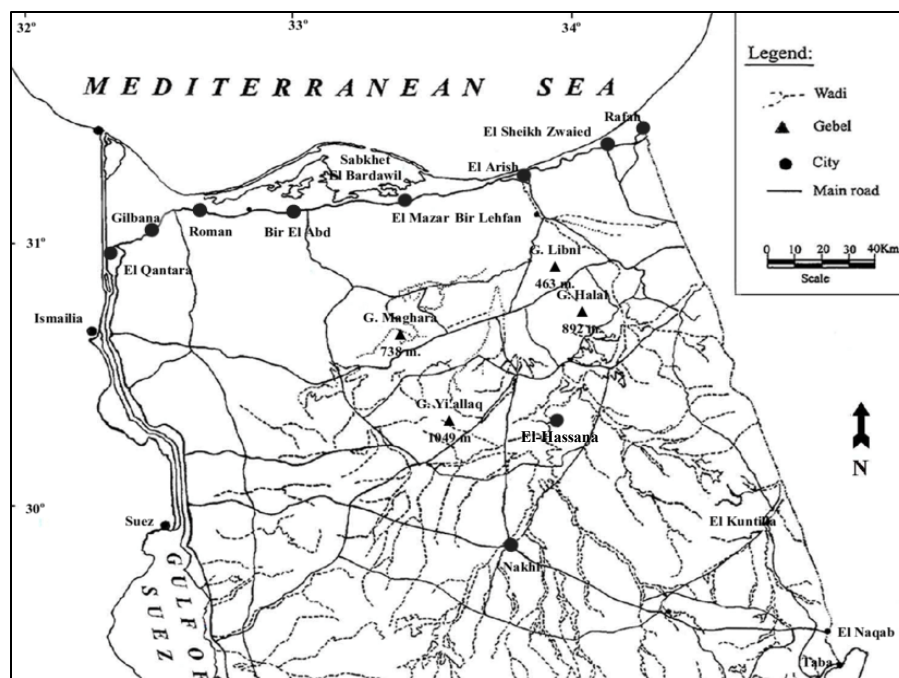


Figure 1. Map of North Sinai showing the main localities of the vegetation survey during the last three years (2022 – 2024).

Table 1. GPS record for each of the ten localities.

Locality	GPS record	
	Latitude	Longitude
Bir El-Abd	31° 00' 00" N	33° 01' 00" E
El-Arish	31. 1155° N	33. 7795° E
El-Hassana	30° 27' 25" N	33° 47' 01" E
El-Mazar Bir Lehfan	31° 02' 32" N	33° 22' 52" E
El-Sheikh Zwaied	31° 12' 43" N	34° 06' 38" E
El-Qantara	30° 51' 00" N	30° 19' 00" E
Gilbana	30° 56' 00" N	32° 45' 00" E
Nekhel	29° 45' 00" N	33° 45' 00" E
Rafah	31.2833° N	34. 2500° E
Romanah	31° 00' 00" N	32° 41' 00" E

online global databases were used such as: Global Biodiversity Information Facility (GBIF; <http://www.gbif.org/occurrence>), and Plants of the World Online (POWO; <http://www.plantsoftheworldonline.org>). All specimens cited are deposited in the Suez Canal University Herbarium. The life form was assigned following The Raunkiaer system (1934).

RESULTS

Floristic diversity in the present survey

In the present study, 522 species were collected from 10 localities in North Sinai. The identified species belong to 307 genera and 66 families. The most represented five families were: Poaceae (77 species, 14.75%), Asteraceae (72 species, 13.79%), Fabaceae

(45 species, 8.62%), Brassicaceae (36 species, 6.89%) and Amaranthaceae (24 species, 4.59%). On the contrary, 19 mono-specific families (consisting of a single species) were: Araceae, Ceratophyllaceae, Cupressaceae, Juncaceae, Moraceae, Neuradaceae, Nitrariaceae, Nyctaginaceae, Passifloraceae, Pontederiaceae, Portulacaceae, Potamogetonaceae, Primulaceae, Rhamnaceae, Rhizophoraceae, Rutaceae, Salvadoraceae, Thymelaeaceae and Typhaceae. Table 3 shows the plant species belonging to the various families in North Sinai conveying the life form and conservation status of each plant species. The collected plant species from the various localities in North Sinai showed a high difference in the life forms even the species of the same family. Table 2 shows the number and percentage of these different life forms. Table 2 concludes that the most dominating life forms are Therophyte with 46%, Chamaephyte with 20% and Hemicryptophyte with 19% indicating that herbaceous plants and low growing shrubs are dominating the life forms of plant species in North Sinai. Table 3 confirms the fact that North Sinai is distinguished by the substantial number of families. Seven endemic species are found in North Sinai belonging to several families. The endemic species recorded in North Sinai: are *Ferula sinaica* belonging to family Apiaceae, *Caralluma sinaica* belonging to family Asclepiadaceae, *Brassica deserti* belonging to family Brassicaceae, *Spergula fallax* and *Spergularia*

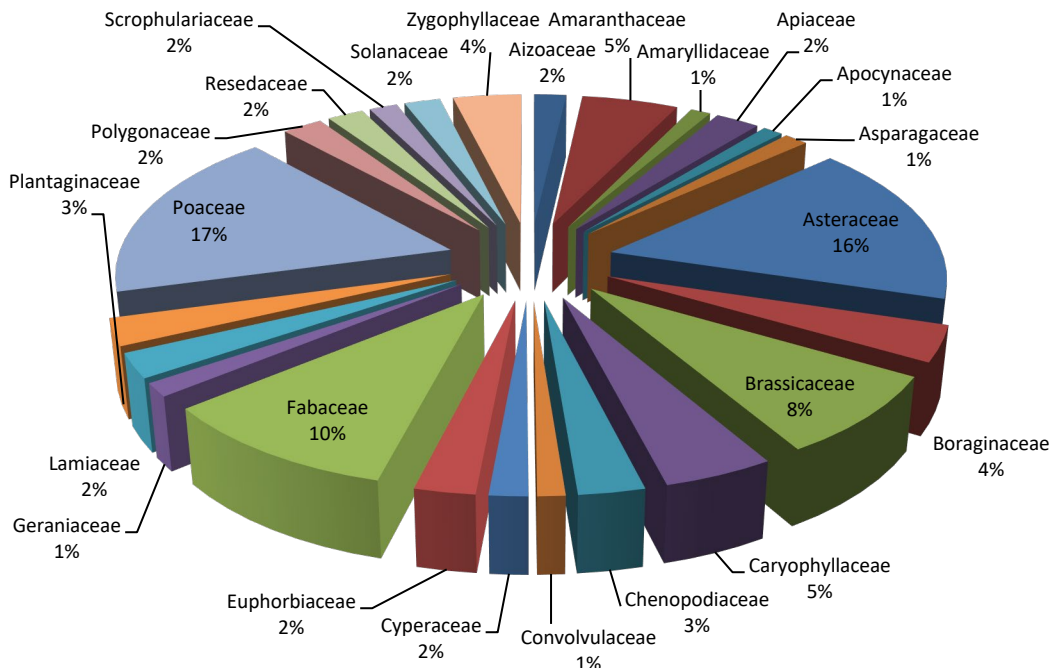


Figure 2. Pie chart showing the floristic composition of North Sinai (Families with less than five species are neglected).

Table 2. Comparison of the number and percentage of the different life forms in North Sinai according to The Raunkiaer system (1934).

Life form	No. of life form	Percentage%
Chamaephyte	111	20
Hemicryptophyte	107	19
Therophyte	259	46
Halophyte	5	1
Phanerophyte	42	7
Geophyte	34	6
Helophyte	2	0
Hydrophyte	5	1

marina belonging to family Caryophyllaceae and *Origanum isthmicum* and *Satureja sinaica* belonging to family Lamiaceae.

In terms of the conservation status, International Union for Conservation of Nature (IUCN) is the most prominent tool used for extinction risk assessment. A key component for effectively preventing the extinction of a certain species is the accurate assessment of its conservation status. North Sinai comprises numerous plants that are threatened and need to be conserved. North Sinai is characterized by the presence of 15 (2.87%) critically endangered species that are found in 10 different families. The main families containing these endangered species are Asteraceae, Brassicaceae, Poaceae and Zygophyllaceae. Thirty-seven (7.08%) species are considered endangered mostly belonging to families

Asteraceae, Brassicaceae and Caryophyllaceae. Of all the collected species during this survey, 16 (3.06%) species are marked as vulnerable. Eight (1.53%) of these vulnerable species belong to family Amaranthaceae solely. Nine (1.72%) species are classified as near threatened which are distributed in 8 families including Aizoaceae, Asphodelaceae, Cupressaceae and Rubiaceae. Nearly all the families present in North Sinai contain threatened species. Fifty-eight (11.11%) plant species are regarded as threatened. One-hundred and twenty-one (23.18%) plant species are categorized as least concern. Plants that need more study are represented by tree categories; 39 (7.47%) not applicable species, 131 (25.09%) not evaluated species and 3 (0.57%) data deficient species. Examples of the floristic composition found in North Sinai are shown in Figures 3–14.

Table 3. Plant species collected from 10 localities in North Sinai regarding the life form according to The Raunkiær system (1934) and the conservation status according to the IUCN red list category (2024) for each species. *= an endemic species (<https://www.iucnredlist.org/>).

Family	Plant species	No. of species	Life cycle	Life form	Conservation status
Acanthaceae	<i>Barleria acanthoides</i> Vahl	2	Per.	Chamaephyte	Not Evaluated
	<i>Blepharis edulis</i> (Forssk.) Pers.		Per.	Hemicryptophyte	Not Evaluated
Aizoaceae	<i>Aizoon canariense</i> L.	8	Per.	Hemicryptophyte	Near Threatened
	<i>Aizoon hispanicum</i> L.		Ann.	Therophyte	Not Evaluated
	<i>Mesembryanthemum crystallinum</i> L.		Ann.	Halophyte	Least Concern
	<i>Mesembryanthemum forskahlii</i> Hochst. ex Boiss.		Ann.	Therophyte	Not Evaluated
	<i>Mesembryanthemum nodiflorum</i> L.		Ann.	Therophyte	Least Concern
	<i>Sesuvium sesuvioides</i> (Fenzl) Verdc.		Ann.	Therophyte	Not Evaluated
	<i>Sesuvium verrucosum</i> Raf.		Per.	Halophyte	Not Evaluated
	<i>Trianthema portulacastrum</i> L.		Ann.	Therophyte	Threatened
Amaranthaceae	<i>Aerva javanica</i> (Burm.f.) Juss. ex Schult.	24	Per.	Chamaephyte	Not Evaluated
	<i>Amaranthus lividus</i> L.		Ann.	Therophyte	Not Evaluated
	<i>Anabasis articulata</i> (Forssk.) Moq.		Per.	Chamaephyte	Vulnerable
	<i>Anabasis setifera</i> Moq.		Per.	Chamaephyte	Vulnerable
	<i>Alternanthera pungens</i> Kunth		Per.	Hemicryptophyte	Not Evaluated
	<i>Alternanthera sessilis</i> (L.) DC.		Per.	Therophyte	Least Concern
	<i>Arthrocaulon macrostachyum</i> (Moric.) Piirainen & G.Kadereit		Per.	Chamaephyte	Least Concern
	<i>Bassia eriophora</i> (Schrad.) Asch.		Ann.	Therophyte	Vulnerable
	<i>Bassia indica</i> (Wight) A.J.Scott		Per.	Therophyte	Vulnerable
	<i>Bassia muricata</i> (L.) Asch.		Ann.	Therophyte	Vulnerable
	<i>Cornulaca monacantha</i> Delile		Per.	Chamaephyte	Not Threatened
	<i>Enchylaena tomentosa</i> R.Br.		Per.	Chamaephyte	Not Threatened
	<i>Halocnemum strobilaceum</i> (Pall.) M.Bieb.		Per.	Chamaephyte	Not Evaluated
	<i>Haloxylon salicornicum</i> (Moq.) Bunge ex Boiss.		Per.	Chamaephyte	Vulnerable
	<i>Haloxylon scoparium</i> Pomel		Per.	Chamaephyte	Vulnerable
	<i>Noaea mucronata</i> (Forssk.) Asch. & Schweinf		Per.	Chamaephyte	Not Evaluated
	<i>Salsola dendroides</i> Pall.		Per.	Phanerophyte	Threatened
	<i>Salsola kali</i> L.		Ann.	Therophyte	Endangered
	<i>Salsola kali subsp. tragus</i> DC		Ann.	Therophyte	Not Evaluated
	<i>Salsola longifolia</i> Lam.		Per.	Halophyte	Vulnerable
	<i>Salsola villosa</i> Schult		Per.	Chamaephyte	Threatened
	<i>Suaeda fruticosa</i> Forssk. ex J.F.Gmel.		Per.	Phanerophyte, Chamaephyte	Threatened
	<i>Suaeda pruinosa</i> Lange		Per.	Chamaephyte	Not Threatened
	<i>Suaeda salsa</i> (L.) Pall.		Ann.	Therophyte	Threatened
Amaryllidaceae	<i>Allium curtum</i> Boiss. & Gaill.	5	Per.	Geophyte	Not Threatened
	<i>Allium desertorum</i> Forssk.		Per.	Geophyte	Not Threatened
	<i>Allium triquetrum</i> L.		Per.	Geophyte	Least Concern
	<i>Pancratium maritimum</i> L.		Per.	Geophyte	Threatened
	<i>Pancratium sickenbergeri</i> Asch. & Schweinf		Per.	Geophyte	Threatened
Apiaceae	<i>Ammi majus</i> L.	11	Ann.	Therophyte	Least Concern
	<i>Ammi visnaga</i> (L.) Lam.		Ann.	Hemicryptophyte, Therophyte	Least Concern
	<i>Apium leptophyllum</i> (Pers.) F.Muell.		Ann.	Therophyte	Endangered
	<i>Chaetosciadium trichospermum</i> (L.) Boiss.		Ann.	Therophyte	Threatened
	<i>Deverra tortuosa</i> (Desf.) DC.		Per.	Chamaephyte	Threatened
	<i>Deverra triradiata</i> Hochst. ex Boiss.		Per.	Chamaephyte	Least Concern
	<i>Eryngium glomeratum</i> Lam.		Per.	Hemicryptophyte	Threatened
	* <i>Ferula sinaica</i> Boiss.		Ann.	Hemicryptophyte	Threatened
	<i>Pycnocycla tomentosa</i> Decne.		Per.	Hemicryptophyte	Not threatened
	<i>Ridolfia segetum</i> (Guss.) Moris		Ann.	Therophyte	Not threatened
	<i>Torilis leptophylla</i> (L.) Rchb.f.		Ann.	Therophyte	Endangered
Apocynaceae	<i>Calotropis procera</i> (Aiton) W.T.Aiton	5	Per.	Phanerophyte	Not Threatened
	<i>Cynanchum acutum</i> L.		Per.	Chamaephyte	Threatened
	<i>Leptadenia pyrotechnica</i> (Forssk.) Decne.		Ann.	Phanerophyte	Threatened
	<i>Pergularia tomentosa</i> L.		Per.	Chamaephyte	Not Threatened
	<i>Solenostemma arghel</i> (Delile) Hayne		Per.	Chamaephyte	Threatened
Araceae	<i>Eminium spiculatum</i> (Blume) Schott	1	Per.	Geophyte	Not Threatened
Arecaceae	<i>Hyphaene thebaica</i> (L.) Mart.	2	Ann.	Phanerophyte	Threatened
	<i>Phoenix dactylifera</i> L.		Per.	Phanerophyte	Not Evaluated
Asclepiadaceae	<i>Asclepias sinaica</i> (Boiss.) Muschl.	2	Per.	Therophyte	Threatened
	* <i>Caralluma sinaica</i> (Decne.) A.Berger		Per.	Hemicryptophyte	Threatened
Asparagaceae	<i>Asparagus aphyllus</i> L.	6	Per.	Phanerophyte	Threatened
	<i>Asparagus stipularis</i> Forssk.		Per.	Phanerophyte	Threatened
	<i>Bellevalia eigii</i> Feinbrun		Ann.	Geophyte	Threatened
	<i>Dipcadi erythraeum</i> Webb & Berthel.		Ann.	Geophyte	Endangered

	<i>Muscari comosum</i> (L.) Mill.		Ann.	Geophyte	Threatened
	<i>Urginea maritima</i> (L.) Baker		Per.	Geophyte	Threatened
Asphodelaceae	<i>Asphodelus macrocarpus</i> Parl.	3	Per.	Hemicryptophyte, Geophyte	Not Threatened
	<i>Asphodelus tenuifolius</i> Cav.		Ann.	Hemicryptophyte, Geophyte	Not Threatened
	<i>Asphodelus viscidulus</i> Boiss.		Ann.	Hemicryptophyte	Near Threatened
	<i>Achillea fragrantissima</i> (Forssk.) Sch.Bip		Per.	Hemicryptophyte	Threatened
Asteraceae	<i>Achillea santolina</i> L.	72	Per.	Chamaephyte	Endangered
	<i>Andryala integrifolia</i> L.		Per.	Therophyte	Not Evaluated
	<i>Anthemis melampodina</i> Delile		Ann.	Therophyte	Not Threatened
	<i>Anvillea garcinii</i> (Burm.f.) DC.		Ann.	Chamaephyte	Threatened
	<i>Artemisia herba-alba</i> Asso		Per.	Chamaephyte	Not Threatened
	<i>Artemisia judaica</i> L.		Per.	Chamaephyte	Critically Endangered
	<i>Artemisia monosperma</i> Delile		Per.	Chamaephyte	Not Threatened
	<i>Aster squamatus</i> (Spreng.) Hieron		Per.	Therophyte	Threatened
	<i>Asteriscus graveolens</i> (Forssk.) Less.		Per.	Chamaephyte	Not Threatened
	<i>Asteriscus hierichunticus</i> (Michon) Wiklund		Ann.	Therophyte	Not Threatened
	<i>Atractylis boulosii</i> Täckh.		Per.	Therophyte	Threatened
	<i>Atractylis cancellata</i> L.		Ann.	Therophyte	Not Evaluated
	<i>Atractylis carduus</i> (Forssk.) C.Chr.		Ann.	Chamaephyte	Not Threatened
	<i>Atractylis flava</i> Desf.		Per.	Chamaephyte	Endangered
	<i>Atractylis mernepthae</i> Asch. & Schweinf. & Letourn.		Ann.	Therophyte	Threatened
	<i>Atractylis prolifera</i> Boiss.		Ann.	Therophyte	Not Threatened
	<i>Atractylis serratulooides</i> Sieber ex Cass.		Ann.	Chamaephyte	Not Threatened
	<i>Bidens pilosa</i> L.		Ann.	Therophyte	Not Applicable
	<i>Calendula arvensis</i> L.		Ann.	Therophyte	Endangered
	<i>Calendula tripterocarpa</i> Rupr.		Ann.	Therophyte	Threatened
	<i>Carduus getulus</i> Pomel		Ann.	Therophyte	Critically Endangered
	<i>Carduus pycnocephalus</i> L.		Ann.	Hemicryptophyte, Therophyte	Not Applicable
	<i>Centaurea aegyptiaca</i> L.		Per.	Chamaephyte	Endangered
	<i>Centaurea calcitrapa</i> L.		Per.	Hemicryptophyte	Not Applicable
	<i>Centaurea eryngioides</i> Lam.		Per.	Hemicryptophyte	Endangered
	<i>Centaurea lippii</i> L.		Per.	Therophyte	Threatened
	<i>Centaurea pallescens</i> Delile		Per.	Therophyte	Not Threatened
	<i>Chiliadenus montanus</i> (Vahl) Brullo		Per.	Hemicryptophyte	Not Threatened
	<i>Conyza bonariensis</i> (L.) Cronquist		Ann.	Therophyte	Not Threatened
	<i>Conyza canadensis</i> (L.) Cronquist		Ann.	Therophyte	Endangered
	<i>Conyza dioscoridis</i> (L.) Desf.		Per.	Phanerophyte	Critically Endangered
	<i>Cotula cinerea</i> Delile		Per.	Therophyte	Not Threatened
	<i>Crepis sancta</i> (L.) Bornm.		Ann.	Therophyte	Not Threatened
	<i>Echinops galalensis</i> Schweinf.		Per.	Chamaephyte	Threatened
	<i>Echinops spinosus</i> L.		Per.	Hemicryptophyte	Threatened
	<i>Eclipta prostrata</i> L.		Ann.	Therophyte	Threatened
	<i>Filago contracta</i> (Boiss.) Chrtek & Holub		Ann.	Therophyte	Not Threatened
	<i>Filago desertorum</i> Pomel		Ann.	Therophyte	Threatened
	<i>Francoeuria crispa</i> (Forssk.) Cass.		Per.	Chamaephyte	Threatened
	<i>Galinsoga parviflora</i> Cav.		Ann.	Therophyte	Not Evaluated.
	<i>Hedypnois rhagadioloides</i> (L.) F.W.Schmidt		Ann.	Therophyte	Not Threatened
	<i>Hyoseris lucida</i> L.		Per.	Hemicryptophyte	Not Threatened
	<i>Ifloga spicata</i> (Forssk.) Sch.Bip.		Ann.	Therophyte	Threatened
	<i>Iphiaea mucronata</i> (Forssk.) Asch. & Schweinf		Per.	Chamaephyte	Not Threatened
	<i>Iphiaea scabra</i> DC. ex Decne.		Per.	Chamaephyte	Threatened
	<i>Koelpinia linearis</i> Pall.		Ann.	Therophyte	Near Threatened
	<i>Launaea capitata</i> (Spreng.) Dandy		Ann.	Therophyte	Not Threatened
	<i>Launaea cassiniana</i> (Jaub. & Spach) Kuntze		Ann.	Therophyte	Endangered
	<i>Launaea fragilis</i> (Asso) Pau		Per.	Hemicryptophyte	Endangered
	<i>Launaea mucronata</i> (Forssk.) Muschl.		Ann.	Therophyte	Threatened
<i>Launaea nudicaulis</i> (L.) Hook.f.	Per.	Hemicryptophyte	Not Evaluated		
<i>Launaea spinosa</i> (Forssk.) Sch.Bip. ex Kuntze	Per.	Chamaephyte	Threatened		
<i>Onopordum alexandrinum</i> Boiss.	Per.	Hemicryptophyte	Not Threatened		
<i>Phagnalon barbeyanum</i> Asch. & Schweinf	Ann.	Therophyte	Threatened		
<i>Picris altissima</i> Delile	Ann.	Therophyte	Threatened		
<i>Picris cyanocarpa</i> Boiss.	Ann.	Therophyte	Threatened		
<i>Picris longirostris</i> Sch.Bip.	Ann.	Hemicryptophyte	Not Threatened		
<i>Picris sulphurea</i> Delile	Ann.	Therophyte	Critically Endangered		
<i>Pluchea dioscoridis</i> (L.) DC.	Per.	Phanerophyte	Least Concern		
<i>Pulicaria incisa</i> (Lam.) DC.	Per.	Chamaephyte	Least Concern		

	<i>Pulicaria undulata</i> (L.) C.A.Mey.		Ann.	Chamaephyte	Not Threatened
	<i>Reichardia tingitana</i> (L.) Roth		Ann.	Therophyte	Not Evaluated
	<i>Senecio glaucus</i> L.		Ann.	Therophyte	Least Concern
	<i>Silybum marianum</i> (L.) Gaertn.		Ann.	Hemicryptophyte, Therophyte	Endangered
	<i>Sonchus asper</i> (L.) Hill		Ann.	Hemicryptophyte, Therophyte	Not Evaluated
	<i>Sonchus oleraceus</i> L.		Ann.	Therophyte	Not Evaluated
	<i>Sonchus tenerrimus</i> L.		Ann.	Hemicryptophyte, Therophyte	Not Evaluated
	<i>Urospermum picroides</i> (L.) Scop. ex F.W.Schmidt		Ann.	Therophyte	Not Threatened
	<i>Verbesina encelioides</i> (Cav.) Benth. & Hook.f. ex A.Gray		Ann.	Therophyte	Threatened
	<i>Volutaria lippi</i> (L.) Cass. ex Maire		Ann.	Hemicryptophyte	Threatened
	<i>Xanthium spinosum</i> L.		Ann.	Therophyte	Endangered
Boraginaceae	<i>Alkanna orientalis</i> (L.) Boiss.		Per.	Hemicryptophyte	Not threatened
	<i>Anchusa hispida</i> Forssk.		Ann.	Therophyte	Critically Endangered
	<i>Anchusa humilis</i> (Desf.) I.M.Johnst.		Ann.	Therophyte	Threatened
	<i>Anchusa milleri</i> Lam. ex Spreng.		Ann.	Therophyte	Not Threatened
	<i>Arnebia decumbens</i> (Vent.) Coss. & Kralik		Ann.	Therophyte	Not Threatened
	<i>Arnebia tinctoria</i> Forssk.		Ann.	Therophyte	Not Threatened
	<i>Echiochilon fruticosum</i> Desf.		Per.	Chamaephyte	Not Threatened
	<i>Heliotropium arbainense</i> Fresen.		Per.	Chamaephyte	Not Threatened
	<i>Heliotropium bacciferum</i> Forssk.		Per.	Chamaephyte	Threatened
	<i>Heliotropium curassavicum</i> L.		Per.	Chamaephyte	Not Threatened
	<i>Heliotropium digynum</i> (Forssk.) Asch. ex C.Chr.		Per.	Chamaephyte	Not Threatened
	<i>Heliotropium lasiocarpum</i> Fisch. & C.A.Mey.		Ann.	Therophyte	Threatened
	<i>Heliotropium ramosissimum</i> (Lehm.) Sieber ex DC.		Per.	Chamaephyte	Threatened
	<i>Moltkiopsis ciliata</i> (Forssk.) I.M.Johnst.		Per.	Chamaephyte	Threatened
	<i>Paracaryum rugulosum</i> (DC.) Boiss.		Per.	Hemicryptophyte	Threatened
	<i>Trichodesma africanum</i> (L.) Sm.		Ann.	Therophyte	Not Threatened
Brassicaceae	<i>Alyssum desertorum</i> Stapf		Ann.	Therophyte	Threatened
	<i>Anastatica hierachuntica</i> Crantz		Ann.	Therophyte	Critically Endangered
	<i>Biscutella didyma</i> L.		Ann.	Therophyte	Not Threatened
	* <i>Brassica deserti</i> Danin & Hedge		Ann.	Therophyte	Not Evaluated
	<i>Brassica tournefortii</i> Gouan		Ann.	Therophyte	Not Evaluated
	<i>Cakile maritima</i> Scop.		Ann.	Therophyte	Not Evaluated
	<i>Capsella bursa-pastoris</i> (L.) Medik.		Per.	Hemicryptophyte, Therophyte	Endangered
	<i>Carrichtera annua</i> (L.) DC.		Ann.	Therophyte	Not Evaluated
	<i>Conringia orientalis</i> (L.) C.Presl		Ann.	Therophyte	Least Concern
	<i>Coronopus didymus</i> (L.) Sm.		Ann.	Therophyte	Not Applicable
	<i>Coronopus niloticus</i> (Delile) Spreng.		Ann.	Therophyte	Endangered
	<i>Coronopus squamatus</i> (Forssk.) Asch.		Ann.	Therophyte	Not Evaluated
	<i>Diplotaxis acris</i> (Forssk.) Boiss.		Ann.	Hemicryptophyte	Not Evaluated
	<i>Diplotaxis eruroides</i> (L.) DC.		Ann.	Therophyte	Least Concern
	<i>Diplotaxis harra</i> (Forssk.) Boiss.		Ann.	Hemicryptophyte, Therophyte	Threatened
	<i>Eremobium aegypticum</i> (Spreng.) Asch. ex Boiss		Ann.	Hemicryptophyte	Vulnerable
	<i>Eruca sativa</i> Mill.		Ann.	Therophyte	Not Evaluated
	<i>Erucaria hispanica</i> (L.) Druce		Ann.	Phanerophyte	Least Concern
	<i>Erucaria microcarpa</i> Boiss.		Ann.	Therophyte	Not Evaluated
	<i>Erucastrum nasturtifolium</i> (Poir.) O.E.Schulz		Ann.	Hemicryptophyte, Therophyte	Not Evaluated
	<i>Farsetia aegyptia</i> Turra		Per.	Chamaephyte	Not Threatened
	<i>Farsetia longisiliqua</i> Decne.		Per.	Chamaephyte	Not Evaluated
	<i>Lobularia arabica</i> (Boiss.) Muschl.		Ann.	Therophytes	Not Evaluated
	<i>Lobularia libyca</i> (Viv.) Meisn.		Ann.	Therophytes	Not Evaluated
	<i>Malcolmia nana</i> (DC.) Batt.		Ann.	Therophyte	Not Evaluated
	<i>Maresia pygmaea</i> (DC.) O.E.Schulz		Ann.	Therophyte	Endangered
	<i>Matthiola livida</i> (Delile) DC.		Ann.	Helophyte	Not Evaluated
	<i>Matthiola longipetala</i> (Vent.) DC.		Ann.	Therophyte	Not Evaluated
	<i>Morettia canescens</i> Boiss.		Per.	Chamaephyte	Not Evaluated
	<i>Morettia philaena</i> (Delile) DC.		Per.	Chamaephyte	Not Evaluated
	<i>Moricandia nitens</i> (Viv.) E.A.Durand & Barratte		Per.	Chamaephyte	Not Evaluated
	<i>Moricandia sinaica</i> (Boiss.) Boiss.		Per.	Hemicryptophyte	Not Evaluated
	<i>Rapistrum rugosum</i> (L.) All.		Ann.	Therophyte	Not Applicable
	<i>Savignya parviflora</i> (Delile) Webb		Ann.	Therophyte	Not Evaluated
	<i>Sisymbrium irio</i> L.		Ann.	Therophyte	Least Concern
	<i>Zilla spinosa</i> (L.) Prantl		Per.	Chamaephyte	Not Evaluated
Capparaceae	<i>Capparis decidua</i> (Forssk.) Edgew.		Per.	Phanerophyte	Least Concern
	<i>Capparis spinosa</i> L.		Per.	Phanerophyte	Not Evaluated

Caprifoliaceae	<i>Scabiosa eremophila</i> Boiss.	2	Ann.	Therophyte	Critically Endangered
	<i>Scabiosa palaestina</i> L.		Ann.	Therophyte	Endangered
Caryophyllaceae	<i>Gymnocarpus decander</i> Forssk.	20	Per.	Chamaephyte	Threatened
	<i>Gypsophila capillaris</i> (Forssk.) C.Chr.		Per.	Chamaephyte	Not Evaluated
	<i>Herniaria hirsuta</i> L.		Ann.	Therophyte	Near Threatened
	<i>Paronychia arabica</i> (L.) DC.		Ann.	Hemicryptophyte	Not Evaluated
	<i>Paronychia argentea</i> Lam.		Ann.	Hemicryptophyte	Threatened
	<i>Paronychia sinaica</i> Fresen.		Per.	Hemicryptophyte	Not Threatened
	<i>Polycarpon repens</i> (Forssk.) Asch. & Schweinf		Per.	Hemicryptophyte	Not Evaluated
	<i>Polycarpon prostratum</i> (Forssk.) Asch. & Schweinf.		Ann.	Hemicryptophyte	Least Concern
	<i>Polycarpon succulentum</i> J.Gay		Ann.	Therophyte	Not Evaluated
	<i>Polycarpon tetraphyllum</i> L.		Ann.	Therophyte	Not Evaluated
	<i>Pteranthus dichotomus</i> Forssk.		Ann.	Therophyte	Not Evaluated
	<i>Silene arabica</i> Boiss.		Ann.	Therophyte	Endangered
	<i>Silene linearis</i> Decne.		Ann.	Therophyte	Endangered
	<i>Silene succulenta</i> Forssk.		Per.	Chamaephyte, Hemicryptophyte	Endangered
	<i>Silene villosa</i> Boiss.		Ann.	Therophyte	Not Evaluated
	* <i>Spergula fallax</i> (Lowe) E.H.L.Krause		Ann.	Therophyte	Endangered
	* <i>Spergularia diandra</i> (Guss.) Heldr.		Ann.	Therophyte	Not Evaluated
<i>Spergularia marina</i> (L.) Besser	Ann.	Hemicryptophyte, Therophyte	Not Threatened		
<i>Stellaria media</i> (L.) Vill.	Ann.	Hemicryptophyte, Therophyte	Not Evaluated		
<i>Telephium sphaerospermum</i> Boiss.	Ann.	Therophyte	Threatened		
<i>Ceratophyllum demersum</i> L.	Per.	Hydrophyte	Threatened		
Chenopodiaceae	<i>Agathophora alopecuroides</i> (Delile) Fenzl ex Bunge	12	Per.	Chamaephyte	Threatened
	<i>Atriplex dimorphostegia</i> Kar. & Kir.		Ann.	Halophyte	Not Evaluated
	<i>Atriplex farinosa</i> Forssk.		Per.	Chamaephyte	Least Concern
	<i>Atriplex halimus</i> L.		Per.	Phanerophyte	Least Concern
	<i>Atriplex inflata</i> F.Muell.		Ann.	Therophyte	Endangered
	<i>Atriplex leucoclada</i> Boiss.		Per.	Chamaephyte	Least Concern
	<i>Atriplex nummularia</i> Lindl.		Per.	Phanerophyte	Not Evaluated
	<i>Atriplex rosea</i> L.		Ann.	Therophyte	Not Evaluated
	<i>Chenopodium album</i> L.		Ann.	Therophyte	Not Evaluated
	<i>Chenopodium glaucum</i> L.		Ann.	Therophyte	Not Threatened
<i>Chenopodium murale</i> L.	Ann.	Therophyte	Not Threatened		
<i>Chenopodium vulvaria</i> L.	Ann.	Therophyte	Not Evaluated		
Cistaceae	<i>Helianthemum ledifolium</i> (L.) Mill.	4	Ann.	Therophyte	Not Evaluated
	<i>Helianthemum lippii</i> (L.) Dum.Cours.		Per.	Chamaephyte	Not Evaluated
	<i>Helianthemum sancti-antoni</i> Schweinf. ex Boiss.		Per.	Chamaephyte	Endangered
	<i>Helianthemum ventosum</i> Boiss.		Per.	Chamaephyte	Not Evaluated
Cleomaceae	<i>Cleome africana</i> Botsch.	4	Ann.	Therophyte	Endangered
	<i>Cleome amblyocarpa</i> Barratte & Murb.		Ann.	Therophyte	Not Evaluated
	<i>Cleome droserifolia</i> (Forssk.) Delile		Per.	Chamaephyte	Endangered
	<i>Cleome gynandra</i> L.		Ann.	Therophyte	Not Evaluated
Convolvulaceae	<i>Convolvulus lanatus</i> Vahl	5	Per.	Chamaephyte	Vulnerable
	<i>Convolvulus oleifolius</i> Desr.		Per.	Chamaephyte	Not Evaluated
	<i>Convolvulus pilosellifolius</i> Desr.		Per.	Hemicryptophyte, Geophyte	Not Evaluated
	<i>Cressa cretica</i> L.		Per.	Chamaephyte	Critically Endangered
	<i>Ipomoea stolonifera</i> J.F.Gmel.		Per.	Hemicryptophyte, Geophyte	Endangered
Cucurbitaceae	<i>Citrullus colocynthis</i> (L.) Schrad	3	Per.	Hemicryptophyte	Vulnerable
	<i>Cucumis prophetarum</i> L.		Per.	Hemicryptophyte	Least Concern
	<i>Momordica charantia</i> L.		Ann. or Per.	Phanerophyte	Endangered
Cupressaceae	<i>Juniperus phoenicea</i> L.	1	Per.	Phanerophyte	Near Threatened
Cyperaceae	<i>Cyperus alopecuroides</i> Rottb.	7	Per.	Hemicryptophyte	Least Concern
	<i>Cyperus capitatus</i> Vand.		Per.	Hemicryptophyte, Geophyte	Least Concern
	<i>Cyperus difformis</i> L.		Ann.	Therophyte	Least Concern
	<i>Cyperus glaber</i> L.		Ann.	Therophyte	Least Concern
	<i>Cyperus iria</i> L.		Ann.	Therophyte	Least Concern
	<i>Cyperus laevigatus</i> L.		Per.	Geophyte	Least Concern
	<i>Cyperus rotundus</i> L.		Per.	Hemicryptophyte, Geophyte	Least Concern
Ephedraceae	<i>Ephedra alata</i> Decne.	2	Per.	Chamaephyte	Least Concern
	<i>Ephedra foeminea</i> Forssk.		Per.	Phanerophyte	Least Concern
Euphorbiaceae	<i>Chrozophora obliqua</i> Schweinf.	11	Ann.	Therophyte	Least Concern
	<i>Chrozophora tinctoria</i> (L.) A.Juss.		Ann.	Therophyte	Least Concern
	<i>Euphorbia forskalii</i> J.Gay		Ann.	Therophyte	Not Evaluated

	<i>Euphorbia granulata</i> Forssk.		Ann. or Per.	Chamaephyte	Critically Endangered
	<i>Euphorbia hirta</i> L.		Ann.	Therophyte	Least Concern
	<i>Euphorbia indica</i> Lam.		Ann.	Hemicryptophyte	Not Evaluated
	<i>Euphorbia peplus</i> L.		Ann.	Therophyte	Not Evaluated
	<i>Euphorbia prostrata</i> Aiton		Ann.	Therophyte	Endangered
	<i>Euphorbia retusa</i> Forssk.		Ann.	Therophyte	Not Evaluated
	<i>Euphorbia terracina</i> L.		Per.	Hemicryptophyte	Not Evaluated
	<i>Ricinus communis</i> L.		Ann. or Per.	Phanerophyte, Therophyte	Least Concern
Fabaceae	<i>Acacia pachyceras</i> O.Schwartz		Per.	Phanerophyte	Critically Endangered
	<i>Acacia raddiana</i> Savi		Per.	Phanerophyte	Not Threatened
	<i>Acacia saligna</i> (Labill.) H.L.Wendl.		Per.	Phanerophyte	Not Evaluated
	<i>Acacia tortilis</i> (Forssk.) Hayne		Per.	Phanerophyte	Least Concern
	<i>Alhagi graecorum</i> Boiss.		Per.	Hemicryptophyte	Not Evaluated
	<i>Argyrobium uniflorum</i> (Decne.) Jaub. & Spach		Per.	Chamaephyte	Not Evaluated
	<i>Astragalus annularis</i> Forssk.		Ann.	Therophyte	Not Evaluated
	<i>Astragalus fruticosus</i> Forssk.		Per.	Hemicryptophyte	Not Evaluated
	<i>Astragalus peregrinus</i> Vahl		Ann.	Therophyte	Not Evaluated
	<i>Astragalus sieberi</i> DC.		Per.	Chamaephyte	Critically Endangered
	<i>Astragalus spinosus</i> (Forssk.) Muschl.		Per.	Chamaephyte	Not Threatened
	<i>Astragalus trigonus</i> DC.		Per.	Chamaephyte	Not Evaluated
	<i>Astragalus vogelii</i> (Webb) Bornm.		Ann.	Therophyte	Not Threatened
	<i>Caesalpinia gilliesii</i> (Hook.) D.Dietr.		Per.	Phanerophyte	Least Concern
	<i>Colutea istria</i> Mill.		Per.	Phanerophyte	Not Evaluated
	<i>Crotalaria aegyptiaca</i> Benth.		Per.	Chamaephyte	Not Evaluated
	<i>Hippocrepis areolata</i> Desv.		Ann.	Therophyte	Not Threatened
	<i>Hippocrepis constricta</i> Kunze		Ann.	Therophyte	Not Threatened
	<i>Hippocrepis cyclocarpa</i> Murb.		Ann.	Therophyte	Not Threatened
	<i>Hippocrepis unisiliquosa</i> L.		Ann.	Therophyte	Endangered
	<i>Lathyrus marmoratus</i> Boiss. & Balansa		Ann.	Therophyte	Least Concern
	<i>Lotononis platycarpa</i> (Viv.) Pic.Serm		Ann.	Therophyte	Threatened
	<i>Lotus corniculatus</i> L.		Per.	Hemicryptophyte	Not Evaluated
	<i>Lotus glaber</i> Mill.		Per.	Hemicryptophyte	Not Threatened
	<i>Lotus halophilus</i> Boiss. & Spruner		Ann.	Therophyte	Not Evaluated
	<i>Lotus hebranicus</i> Hochst. ex Brand		Ann.	Therophyte	Not Evaluated
	<i>Lotus peregrinus</i> L.		Ann.	Therophyte	Not Evaluated
	<i>Medicago laciniata</i> (L.) Mill.		Ann.	Therophyte	Not Evaluated
	<i>Medicago minima</i> (L.) Bartal.		Ann.	Therophyte	Not Applicable
	<i>Medicago sativa</i> L.		Per.	Hemicryptophyte	Threatened
	<i>Melilotus indicus</i> (L.) All		Ann.	Therophyte	Not Applicable
	<i>Ononis reclinata</i> L.		Ann.	Therophyte	Not Threatened
	<i>Ononis serrata</i> Forssk.		Ann.	Therophyte	Not Threatened
	<i>Ononis sicula</i> Guss.		Ann.	Therophyte	Not Threatened
	<i>Parkinsonia aculeata</i> L.		Per.	Therophyte	Threatened
	<i>Retama raetam</i> (Forssk.) Webb & Berthel.		Per.	Phanerophyte	Not Threatened
	<i>Senna alexandrina</i> Mill.		Per.	Phanerophyte	Least Concern
	<i>Sesbania sesban</i> (L.) Merr.		Per.	Therophyte	Not Evaluated
	<i>Tephrosia purpurea</i> (L.) Pers.		Ann. or Per.	Chamaephytes	Least Concern
	<i>Trifolium resupinatum</i> L.		Ann.	Therophyte	Least Concern
	<i>Trifolium tomentosum</i> L.		Ann.	Therophyte	Not Applicable
	<i>Trigonella arabica</i> Delille		Ann.	Therophyte	Not Evaluated
	<i>Trigonella cylindracea</i> Desv.		Ann.	Therophyte	Least Concern
	<i>Trigonella stellata</i> Forssk.		Ann.	Therophyte	Not Threatened
	<i>Vicia sativa</i> L.		Ann.	Therophyte	Not Applicable
Geraniaceae	<i>Erodium chium</i> (L.) Willd.		Ann.	Therophyte	Not Evaluated
	<i>Erodium ciconium</i> (L.) L'Hér.		Per.	Hemicryptophyte, Therophyte	Not Evaluated
	<i>Erodium crassifolium</i> L'Hér.		Per.	Hemicryptophyte	Not Evaluated
	<i>Erodium glaucophyllum</i> (L.) L'Hér.		Per.	Hemicryptophyte	Not Evaluated
	<i>Erodium laciniatum</i> (Cav.) Willd.		Ann.	Therophyte	Not Evaluated
	<i>Monsonia nivea</i> (Decne.) Webb		Ann. Or Per.	Therophyte	Not Evaluated
Hydrocharitaceae	<i>Halophila ovalis</i> (R.Br.) Hook.f.		Per.	Halophyte	Not Threatened
	<i>Najas marina</i> subsp. <i>armata</i> Horn		Per.	Hydrophyte	Least Concern
Juncaceae	<i>Juncus rigidus</i> Desf.	1	Per.	Hemicryptophyte	Not Threatened
Lamiaceae	<i>Ballota undulata</i> (Sieber ex Fresen.) Benth.		Per.	Chamaephyte	Not Evaluated
	<i>Lavandula pubescens</i> Decne.	11	Per.	Chamaephyte	Not Evaluated

	<i>Lavandula stricta</i> Delile		Per.	Chamaephyte	Endangered
	<i>Marrubium alysson</i> L.		Per.	Chamaephyte, Hemicryptophyte	Not Evaluated
	* <i>Origanum isthmicum</i> Danin		Per.	Chamaephyte	Not Evaluated
	<i>Salvia aegyptiaca</i> L.		Per.	Chamaephyte	Least Concern
	<i>Salvia lanigera</i> Poir.		Per.	Chamaephyte	Least Concern
	* <i>Satureja sinaica</i> (Benth.) Briq.		Per.	Chamaephyte	Not Evaluated
	<i>Stachys aegyptiaca</i> Pers.		Per.	Chamaephyte	Not Evaluated
	<i>Teucrium leucocladum</i> Boiss.		Per.	Chamaephyte	Not Evaluated
	<i>Teucrium polium</i> L.		Per.	Chamaephyte	Not Evaluated
Malvaceae	<i>Brachychiton populneus</i> (Schott & Endl.) R.Br.	4	Ann.	Therophyte	Not Evaluated
	<i>Malva nicaeensis</i> All.		Per.	Hemicryptophyte, Therophyte	Not Evaluated
	<i>Malva parviflora</i> L.		Ann.	Therophyte	Not Evaluated
	<i>Malva pusilla</i> Sm.		Ann. or Per.	Chamaephyte	Not Evaluated
Moraceae	<i>Ficus pseudosycamoros</i> Decne.	1	Per.	Phanerophyte	Least Concern
Neuradaceae	<i>Neurada procumbens</i> L.	1	Ann.	Therophyte	Endangered
Nitrariaceae	<i>Nitraria retusa</i> (Forssk.) Asch.	1	Per.	Phanerophyte	Not Evaluated
Nyctaginaceae	<i>Boerhavia diffusa</i> L.	1	Per.	Chamaephyte	Least Concern
Onagraceae	<i>Jussiaea repens</i> L.	2	Per.	Chamaephyte	Least Concern
	<i>Oenothera biennis</i> L.		Per.	Chamaephytes	Not Applicable
Orobanchaceae	<i>Cistanche phelypaea</i> (L.) Cout.	2	Ann.	Therophyte	Not Evaluated
	<i>Orobanche cernua</i> Loefl.		Per.	Geophyte	Not Evaluated
Oxalidaceae	<i>Oxalis corniculata</i> L.	2	Ann. or Per.	Hemicryptophyte, Geophyte, Therophyte	Least Concern
	<i>Oxalis debilis</i> Kunth		Per.	Geophyte	Not Applicable
Papaveraceae	<i>Hypecoum pendulum</i> L.	4	Ann.	Therophyte	Critically Endangered
	<i>Papaver dubium</i> L.		Ann.	Therophyte	Not Applicable
	<i>Papaver rhoeas</i> L.		Ann.	Therophyte	Least Concern
	<i>Roemeria hybrida</i> (L.) DC.		Ann.	Therophyte	Least Concern
Passifloraceae	<i>Passiflora edulis</i> Sims	1	Per.	Phanerophyte	Not Threatened
Phyllanthaceae	<i>Andrachne aspera</i> Spreng	2	Per.	chamaephyte	Vulnerable
	<i>Andrachne telephioides</i> L.		Per.	Hemicryptophyte	Endangered
Plantaginaceae	<i>Globularia arabica</i> Jaub. & Spach	12	Per.	Chamaephyte	Not Evaluated
	<i>Linaria haelava</i> (Forssk.) Delile		Ann.	Therophyte	Not Threatened
	<i>Linaria tenuis</i> (Viv.) Spreng.		Ann.	Therophyte	Not Evaluated
	<i>Plantago afra</i> L.		Ann.	Therophyte	Not Applicable
	<i>Plantago albicans</i> L.		Per.	Chamaephyte, Hemicryptophyte	Least Concern
	<i>Plantago ciliata</i> Desf.		Ann.	Geophyte	Endangered
	<i>Plantago cylindrica</i> Forssk.		Ann. or Per.	Geophyte	Not Evaluated
	<i>Plantago lagopus</i> L.		Ann.	Therophyte	Not Evaluated
	<i>Plantago ovata</i> Forssk.		Ann.	Therophyte	Not Evaluated
	<i>Plantago phaeostoma</i> Boiss. & Heldr.		Ann.	Therophyte	Not Evaluated
	<i>Plantago pumila</i> L.f.		Ann.	Geophyte	Not Evaluated
	<i>Veronica anagallis-aquatica</i> L.		Per.	Hemicryptophyte, Therophyte	Least Concern
Plumbaginaceae	<i>Limonium axillare</i> (Forssk.) Kuntze	2	Per.	Chamaephyte	Vulnerable
	<i>Limonium pruinolum</i> (L.) Chaz.		Per.	Chamaephyte	Not Applicable
Poaceae	<i>Aegilops kotschyi</i> Boiss.	77	Ann.	Therophyte	Least Concern
	<i>Aegilops longissima</i> Schweinf. & Muschl.		Ann.	Therophyte	Least Concern
	<i>Aeluropus littoralis</i> (Gouan) Parl.		Ann. or Per.	Hemicryptophyte, Geophyte	Least Concern
	<i>Agrostis semiverticillata</i> (Forssk.) C.Chr.		Per.	Hemicryptophyte	Least Concern
	<i>Ammochloa palaestina</i> Boiss.		Ann.	Therophyte	Least Concern
	<i>Ammophila arenaria</i> (L.) Link		Per.	Geophyte	Critically Endangered
	<i>Arundo donax</i> L.		Per.	Hemicryptophyte, Geophyte	Near Threatened
	<i>Avena barbata</i> Pott ex Link		Ann.	Therophyte	Least Concern
	<i>Avena fatua</i> L.		Ann.	Therophyte	Least Concern
	<i>Avena sativa</i> L.		Ann.	Therophyte	Vulnerable
	<i>Avena sterilis</i> L.		Ann.	Therophyte	Least Concern
	<i>Brachypodium distachyon</i> (L.) P.Beauv.		Ann.	Therophyte	Least Concern
	<i>Bromus catharticus</i> Vahl		Ann. or Per.	Hemicryptophyte	Least Concern
	<i>Bromus diandrus</i> Roth		Ann.	Therophyte	Least Concern
	<i>Bromus fasciculatus</i> C.Presl		Ann.	Therophyte	Least Concern
	<i>Bromus madritensis</i> L.		Ann.	Therophyte	Least Concern
	<i>Bromus rubens</i> L.		Ann.	Therophyte	Least Concern
	<i>Bromus sterilis</i> L.		Ann.	Therophyte	Least Concern
	<i>Bromus tectorum</i> L.		Ann.	Hemicryptophyte	Least Concern
	<i>Cenchrus ciliari</i> L.		Per.	Hemicryptophyte	Least Concern

	<i>Chloris virgata</i> P.Durand		Ann.	Therophyte	Least Concern
	<i>Cutandia dichotoma</i> (Forssk.) Trab.		Ann.	Therophyte	Least Concern
	<i>Cutandia memphitica</i> (Spreng.) K.Richt.		Ann.	Therophyte	Least Concern
	<i>Cymbopogon schoenanthus</i> (L.) Spreng.		Per.	Hemicryptophyte	Vulnerable
	<i>Cynodon dactylon</i> (L.) Pers.		Per.	Geophyte, Hemicryptophyte	Least Concern
	<i>Dactyloctenium aegyptium</i> (L.) Willd.		Per.	Hemicryptophyte, Therophyte	Data Deficient
	<i>Desmostachya bipinnata</i> (L.) Stapf		Per.	Hemicryptophyte	Least Concern
	<i>Digitaria sanguinalis</i> (L.) Scop.		Ann.	Therophyte	Not Applicable
	<i>Diplachne fusca</i> (L.) P.Beauv. ex Roem. & Schult.		Ann. or Per.	Hemicryptophyte, Therophyte	Not Applicable
	<i>Elymus farctus</i> (Viv.) Runemark ex Melderis		Per.	Geophyte	Least Concern
	<i>Eremopyrum bonaepartis</i> (Spreng.) Nevski		Ann.	Hemicryptophyte, Therophyte	Least Concern
	<i>Hesperostipa comata</i> (Trin. & Rupr.) Barkworth		Ann.	Therophyte	Least Concern
	<i>Hordeum leporinum</i> Link		Ann.	Therophyte	Not Threatened
	<i>Hordeum marinum</i> Huds.		Ann.	Therophyte	Not Applicable
	<i>Hordeum murinum</i> L.		Ann.	Therophyte	Not Applicable
	<i>Hordeum vulgare</i> L.		Ann.	Therophyte	Not Applicable
	<i>Hyparrhenia hirta</i> (L.) Stapf		Per.	Hemicryptophyte	Least Concern
	<i>Imperata cylindrica</i> (L.) Raeusch.		Per.	Hemicryptophyte, Geophyte	Least Concern
	<i>Koeleria phleoides</i> Pers.		Ann.	Therophyte	Not Applicable
	<i>Lasiurus hirsutus</i> Boiss.		Per.	Hemicryptophyte	Least Concern
	<i>Lolium multiflorum</i> Lam.		Ann.	Hemicryptophyte, Therophyte	Not Applicable
	<i>Lolium perenne</i> L.		Per.	Hemicryptophyte	Not Applicable
	<i>Lolium rigidum</i> Gaudin		Ann.	Therophyte	Not Applicable
	<i>Oryzopsis miliacea</i> (L.) Asch. & Schweinf.		Per.	Hemicryptophyte	Least Concern
	<i>Panicum coloratum</i> L.		Per.	Chamaephyte	Least Concern
	<i>Panicum turgidum</i> Forssk.		Per.	Hemicryptophyte	Vulnerable
	<i>Parapholis incurva</i> (L.) C.E.Hubb.		Ann.	Therophyte	Not Threatened
	<i>Parapholis marginata</i> Runemark		Ann.	Therophyte	Not Evaluated
	<i>Pennisetum clandestinum</i> Hochst. ex Chiov		Ann.	Therophyte	Not Applicable
	<i>Pennisetum divisum</i> (J.F.Gmel.) Henrard		Ann. or Per.	Chamaephyte, Geophyte, Hemicryptophyte	Least Concern
	<i>Phalaris minor</i> Retz.		Ann.	Therophyte	Least Concern
	<i>Phragmites australis</i> (Cav.) Trin. ex Steud.		Per.	Geophyte, Helophyte	Least Concern
	<i>Poa annua</i> L.		Ann.	Hemicryptophyte, Therophyte	Least Concern
	<i>Poa infirma</i> Kunth		Ann.	Hemicryptophyte, Therophyte	Least Concern
	<i>Polypogon monspeliensis</i> (L.) Desf.		Ann.	Therophyte	Least Concern
	<i>Polypogon viridis</i> (Gouan) Breistr.		Per.	Hemicryptophyte	Least Concern
	<i>Rostraria hispida</i> (Savi) Dogan		Ann.	Therophyte	Not Evaluated
	<i>Rostraria pumila</i> (Lam.) Tzvelev		Ann.	Therophyte	Not Threatened
	<i>Rostraria smyrnaea</i> (Trin.) H.Scholz		Ann.	Therophyte	Not Applicable
	<i>Schismus arabicus</i> Nees		Ann.	Therophyte	Least Concern
	<i>Schismus barbatus</i> (L.) Thell.		Ann.	Therophyte	Least Concern
	<i>Setaria verticillata</i> (L.) P.Beauv.		Ann.	Therophyte	Not Applicable
	<i>Setaria viridis</i> (L.) P.Beauv.		Ann.	Therophyte	Not Applicable
	<i>Stipa arabica</i> Trin. & Rupr.		Per.	Hemicryptophyte	Least Concern
	<i>Stipa capensis</i> Thunb.		Ann.	Hemicryptophyte	Least Concern
	<i>Stipagrostis ciliata</i> (Desf.) De Winter		Per.	Hemicryptophyte	Least Concern
	<i>Stipagrostis obtusa</i> (Delile) Nees		Per.	Hemicryptophyte	Least Concern
	<i>Stipagrostis plumosa</i> (L.) Munro ex T.Anderson		Per.	Hemicryptophyte	Least Concern
	<i>Stipagrostis scoparia</i> (Trin. & Rupr.) De Winter		Per.	Hemicryptophyte, Geophyte	Not Evaluated
	<i>Tetrapogon cenchriformis</i> (A.Rich.)		Ann.	Hemicryptophyte	Endangered
	<i>Tetrapogon villosus</i> Desf.		Per.	Hemicryptophyte	Least Concern
	<i>Trachynia distachya</i> (L.) Link		Ann.	Therophyte	Not Evaluated
	<i>Tricholaena teneriffae</i> (L.f.) Link		Per.	Hemicryptophyte	Not Threatened
	<i>Trisetaria glumacea</i> (Boiss.) Maire		Per.	Hemicryptophyte	Not Evaluated
	<i>Trisetaria linearis</i> Forssk.		Ann.	Therophyte	Not Threatened
	<i>Vulpia bromoides</i> (L.) Gray		Ann.	Therophyte	Not Evaluated
	<i>Vulpia pectinella</i> (Delile) Boiss.		Ann.	Therophyte	Least Concern
Polygonaceae	<i>Calligonum polygonoides</i> L.		Per.	Phanerophyte	Not Threatened
	<i>Emex spinosa</i> (L.) Campd.		Ann.	Therophyte	Not Threatened
	<i>Persicaria senegalensis</i> (Meisn.) Soják		Per.	Hemicryptophyte	Least Concern
	<i>Polygonum bellardii</i> All.		Ann.	Therophyte	Not Threatened
	<i>Polygonum equisetiforme</i> Sm.		Per.	Chamaephyte	Not Threatened
	<i>Polygonum patulum</i> M.Bieb.		Ann.	Therophyte	Not Threatened
	<i>Polygonum salicifolium</i> Brouss. ex Willd.		Ann.	Hemicryptophyte	Not Threatened
	<i>Rumex cypricus</i> Murb.		Ann.	Therophyte	Least Concern
	<i>Rumex pictus</i> Forssk.		Ann.	Therophyte	Not Threatened
	<i>Rumex vesicarius</i> L.		Ann.	Therophyte	Not Applicable
Pontederiaceae	<i>Pontederia crassipes</i> Mart.	1	Per.	Hydrophyte	Not Evaluated
Portulacaceae	<i>Portulaca oleracea</i> L.	1	Ann.	Therophyte	Not Applicable

Potamogetonaceae	<i>Potamogeton nodosus</i> Poir.	1	Per.	Hydrophyte	Least Concern
Primulaceae	<i>Anagallis arvensis</i> L.	1	Ann.	Therophyte	Not Evaluated
Ranunculaceae	<i>Adonis dentata</i> Delile	3	Ann.	Therophyte	Endangered
	<i>Delphinium peregrinum</i> L.		Ann.	Therophyte	Least Concern
	<i>Nigella arvensis</i> L.		Ann.	Therophyte	Least Concern
Resedaceae	<i>Cayusea hexagyna</i> (Forssk.) M.L.Green	9	Ann.	Therophyte	Not Threatened
	<i>Ochradenus baccatus</i> Delile		Per.	Phanerophyte	Not Evaluated
	<i>Oligomeris linifolia</i> (Vahl ex Hornem.) J.F.Macbr.		Ann.	Therophyte	Not Evaluated
	<i>Reseda alba</i> L.		Ann.	Therophyte	Not Applicable
	<i>Reseda arabica</i> Boiss.		Ann.	Therophyte	Least Concern
	<i>Reseda lutea</i> L.		Per.	Hemicryptophyte, Therophyte	Least Concern
	<i>Reseda orientalis</i> (Müll.Arg.) Boiss.		Ann.	Therophyte	Not Threatened
	<i>Reseda pruinosa</i> Delile.		Ann.	Therophyte	Not Evaluated
	<i>Reseda urnigera</i> Webb.		Ann.	Therophyte	Not Evaluated
Rhamnaceae	<i>Ziziphus spina-christi</i> (L.) Desf.	1	Per.	Phanerophyte	Least Concern
Rhizophoraceae	<i>Rhizophora mucronata</i> Poir.	1	Ann.	Phanerophyte	Least Concern
Rosaceae	<i>Rosa damascena</i> Mill.	2	Ann.	Nano-phanerophyte	Not Evaluated
	<i>Rosa gallica</i> L.		Ann.	Therophyte	Not Applicable
Rubiaceae	<i>Callipeltis cucullaris</i> (L.) DC.	4	Ann.	Therophyte	Not Threatened
	<i>Crucianella membranacea</i> Boiss.		Ann.	Geophyte	Not Threatened
	<i>Galium parisiense</i> L.		Ann.	Therophyte	Near Threatened
	<i>Valantia hispida</i> L.		Ann.	Therophyte	Near Threatened
Rutaceae	<i>Haplophyllum tuberculatum</i> (Forssk.) A.Juss.	1	Per.	Chamaephyte	Least Concern
Salvadoraceae	<i>Salvadora persica</i> L.	1	Ann.	Phanerophyte	Least Concern
Scrophulariaceae	<i>Antirrhinum orontium</i> L.	7	Ann.	Therophyte	Not Threatened
	<i>Kickxia acerbiana</i> (Boiss.) Täckh. & Boulos		Ann.	Hemicryptophyte	Not Applicable
	<i>Kickxia aegyptiaca</i> (L.) Nábělek		Per.	Chamaephyte	Not Applicable
	<i>Kickxia floribunda</i> (Boiss.) Täckh. & Boulos		Per.	Chamaephyte	Data Deficient
	<i>Scrophularia syriaca</i> Benth.		Per.	Chamaephyte	Not Evaluated
	<i>Scrophularia xanthoglossa</i> Boiss.		Per.	Chamaephyte	Not Applicable
	<i>Verbascum fruticosum</i> Post		Per.	Chamaephyte	Not Applicable
Solanaceae	<i>Datura innoxia</i> Mill.	9	Ann.	Therophyte	Not Evaluated
	<i>Hyoscyamus albus</i> L.		Per.	Hemicryptophyte, Therophyte	Not Threatened
	<i>Hyoscyamus muticus</i> L.		Per.	Chamaephyte	Not Evaluated
	<i>Lycium shawii</i> Roem. & Schult.		Per.	Phanerophyte	Least Concern
	<i>Nicotiana glauca</i> Graham		Per.	Chamaephyte	Not Applicable
	<i>Solanum dubium</i> Fresen.		Per.	Chamaephyte	Endangered
	<i>Solanum elaeagnifolium</i> Cav.		Per.	Chamaephyte, Hemicryptophyte	Not Evaluated
	<i>Solanum nigrum</i> L.		Ann.	Therophyte	Least Concern
	<i>Solanum villosum</i> Mill.		Ann.	Therophyte	Not Applicable
Tamaricaceae	<i>Reaumuria hirtella</i> Jaub. & Spach	4	Per.	Chamaephyte	Not Threatened
	<i>Tamarix aphylla</i> (L.) H.Karst		Per.	Phanerophyte	Data Deficient
	<i>Tamarix nilotica</i> (Ehrenb.) Bunge		Per.	Phanerophyte	Least Concern
	<i>Tamarix tetragyna</i> Ehrenb.		Per.	Phanerophyte	Least Concern
Thymelaeaceae	<i>Thymelaea hirsuta</i> (L.) Endl.	1	Per.	Phanerophyte	Not Threatened
Typhaceae	<i>Typha domingensis</i> Pers.	1	Per.	Geophyte, Hydrophyte	Least Concern
Urticaceae	<i>Forsskaolea tenacissima</i> L.	3	Ann.	Chamaephyte, Hemicryptophyte	Least Concern
	<i>Parietaria alsinifolia</i> Delile		Ann.	Chamaephyte	Not Applicable
	<i>Urtica urens</i> L.		Ann.	Therophyte	Not Applicable
Zygophyllaceae	<i>Balanites aegyptiaca</i> (L.) Delile	17	Per.	Phanerophyte	Critically Endangered
	<i>Fagonia arabica</i> L.		Per.	Chamaephyte	Least Concern
	<i>Fagonia bruguieri</i> DC.		Per.	Chamaephyte	Least Concern
	<i>Fagonia glutinosa</i> Delile		Per.	Hemicryptophyte	Least Concern
	<i>Fagonia mollis</i> Delile		Ann.	Chamaephyte	Least Concern
	<i>Fagonia scabra</i> Forssk.		Ann.	Chamaephyte	Near Threatened
	<i>Peganum harmala</i> L.		Per.	Chamaephyte	Critically Endangered
	<i>Tribulus bimucronatus</i> Viv.		Ann.	Therophyte	Not Threatened
	<i>Tribulus kaiseri</i> Hosni		Ann.	Therophyte	Not Threatened
	<i>Tribulus longipetalus</i> Viv.		Ann.	Therophyte	Not Evaluated
	<i>Tribulus pentandrus</i> Forssk.		Ann.	Therophyte	Not Threatened
	<i>Tribulus terrestris</i> L.		Ann.	Therophyte	Least Concern
	<i>Zygophyllum aegyptium</i> Hosny		Per.	Therophyte	Not Threatened
	<i>Zygophyllum album</i> L.f.		Per.	Chamaephyte	Least Concern
	<i>Zygophyllum coccineum</i> L.		Per.	Chamaephyte	Not Threatened
	<i>Zygophyllum dumosum</i> Boiss.		Per.	Chamaephyte	Not Threatened
	<i>Zygophyllum simplex</i> L.		Ann.	Therophyte	Not Threatened

Table 4. A detailed comparison of the previous floristic studies with the present survey

References	Location of the study	No. of recorded species	No. of families
Boulos (1960)	G. Maghara	199	44
Batanouny (1964)	El-Arish	17	13
Danin (1973)	Sinai	64	29
Täckholm (1974)	Egypt	670	74
Danin <i>et al.</i> (1985)	Sinai	569	72
Danin (1986)	Sinai	19	10
Gibali, 1988	North Sinai	279	56
Taeckholmia (1989)	Sinai	641	69
Boulos and Gibali (1993)	Sinai	160	39
Gibali (2000)	North Sinai	119	32
Gamal El-Din (1993)	G. Halal	114	33
Gazara <i>et al.</i> (2000)	G. Halal	154	32
El-Bana <i>et al.</i> (2000)	Lake Bardawil	118	40
El-Bana <i>et al.</i> (2002)	Lake Bardawil	136	42
Kamel <i>et al.</i> (2008)	North Sinai	281	52
Present study	North Sinai	522	66

Surveying the literature for previous floristic status

It is necessary to refer to earlier floristic surveys when documenting any changes in an area's floristic makeup. Every relevant floristic and/or ecological study on North Sinai, Sinai, or even Egypt that has been published in the last fifty years has been carefully surveyed. Since Taeckholmia (1989) offers more thorough information on the distribution of taxa, it was utilized as the primary reference (prior status) for comparing the distribution of each taxon with the status. Table 4 summarizes comparisons of the previous floristic studies and our current study. As documented in Table 3, 284 species in the present survey were annuals (54.41%) and 226 species were perennials (43.29%) denoting that herbaceous plants are present more than woody plants in North Sinai. In addition, species that are considered either annual or perennial are 12 (2.29%). The results of the current survey showed a significant shift in the number of species, especially weeds. The rise in cultivated lands in North Sinai is the reason for the increase in species number. The increased number of weeds includes newly recorded species. Table 5 elaborates the newly recorded species in North Sinai. Fifty-two plant species from 22 families and 45 genera were recorded for the first time in North Sinai during the current study, and they were found in 10 different locations. The three largest families with the most newly observed species are the Poaceae (11 species), Asteraceae (8 species) and Brassicaceae (5 species). These species are found either in cultivated lands, farms, neutralized areas or in the wild.

DISCUSSION

The floristic composition represents a valuable floristic marker, because any change in floristic compositions reflects the existence of different ecological factors; there by leading to inter- and intra-specific diversity (Yavari *et al.*, 2010). The knowledge of the floristic composition of an area is a pre-requisite for any ecological, phytogeographical studies, and conservation management activities. To study a particular vegetation from an ecological point of view, the first step must be to determine the facts as they exist on the ground (Nicholes, 1930). The floristic composition of vegetation is more susceptible to direct study and exact characterization. The plant community in arid and semiarid zones is usually characterized by minimal precipitation and frequent droughts (Mabbutt, 1977); thus, the availability of water is one of the primary factors controlling the distribution of species. In the arid regions of the Middle East, many authors studied the soil-vegetation relationship (Abd El-Ghani and Amer, 2003), and these investigations include large areas and, therefore, reported striking gradients referring to soil conditions and vegetation.

North Sinai is characterized by the presence of 522 plant species, and it is characterized by sparse vegetation of herbs, shrubs and semi shrubs. Three main habitats can be recognized in the coastal area: open undulating sand plains, sand dunes, and sabkhas or salt marches. The open undulating sandy plains are dominated by *Artemisia monosperma*. The plant cover in this habitat may range from 20 to 30%.

Table 5. Family and Species diversity of newly recorded species in North Sinai

Family	Plant species	No. of Species
Aizoaceae	<i>Sesuvium revolutifolium</i> Ortega	2
	<i>Trianthema portulacastrum</i> L.	
Amaranthaceae	<i>Enchylaena tomentosa</i> R.Br.	2
	<i>Salsola tragus</i> L.	
Amaryllidaceae	<i>Allium triquetrum</i> L.	2
	<i>Pancratium maritimum</i> L.	
Asteraceae	<i>Andryala integrifolia</i> L.	8
	<i>Symphotrichum squamatum</i> (Spreng.) G.L.Nesom	
	<i>Atractylis cancellata</i> L.	
	<i>Filago contracta</i> (Boiss.) Chrtek & Holub	
	<i>Hyoseris lucida</i> L.	
	<i>Centaurea glastifolia</i> subsp. <i>glastifolia</i>	
	<i>Onopordum alexandrinum</i> Boiss.	
	<i>Picris sulphurea</i> Delile	
Boraginaceae	<i>Heliotropium curassavicum</i> L.	1
Brassicaceae	<i>Alyssum desertorum</i> Stapf	5
	<i>Lepidium niloticum</i> (Delile) Sieber ex Steud.	
	<i>Lepidium coronopus</i> (L.) Al-Shehbaz	
	<i>Erucastrum nasturtifolium</i> (Poir.) O.E.Schulz	
	<i>Maresia nana</i> (DC.) Batt.	
Chenopodiaceae	<i>Atriplex dimorphostegia</i> Kar. & Kir.	1
Cucurbitaceae	<i>Momordica charantia</i> L.	1
Cyperaceae	<i>Cyperus iria</i> L.	1
Caprifoliaceae	<i>Lomelosia palaestina</i> (L.) Raf.	1
Euphorbiaceae	<i>Euphorbia indica</i> Lam.	1
Fabaceae	<i>Erythrostemon gilliesii</i> (Hook.) Klotzsch	4
	<i>Lotus corniculatus</i> L.	
	<i>Lotus tenuis</i> Waldst. & Kit. ex Willd.	
	<i>Medicago laciniata</i> (L.) Mill.	
Geraniaceae	<i>Erodium glaucophyllum</i> (L.) L'Hér.	1
Malvaceae	<i>Malva pusilla</i> Sm.	1
Onagraceae	<i>Oenothera biennis</i> L.	1
Oxalidaceae	<i>Oxalis corniculata</i> L.	1
Plantaginaceae	<i>Plantago phaeostoma</i> Boiss. & Heldr.	2
	<i>Plantago exigua</i> Murray	
Poaceae	<i>Bromus catharticus</i> Vahl	11
	<i>Bromus sterilis</i> L.	
	<i>Bromus tectorum</i> L.	
	<i>Chloris radiata</i> (L.) Sw.	
	<i>Diplachne fusca</i> (L.) P.Beauv. ex Roem. & Schult.	
	<i>Thinopyrum junceum</i> (L.) Á.Löve	
	<i>Cenchrus clandestinus</i> (Hochst. ex Chiov.) Morrone	
	<i>Cenchrus divisis</i> (J.F.Gmel.) Verloove, Govaerts & Buttler	
	<i>Polypogon viridis</i> (Gouan) Breistr.	
	<i>Stipa arabica</i> Trin. & Rupr.	
	<i>Festuca bromoides</i> L.	
Resedaceae	<i>Reseda pruinosa</i> Delile	1
Rubiaceae	<i>Galium parisiense</i> L.	1
Solanaceae	<i>Solanum villosum</i> Mill.	1
Zygophyllaceae	<i>Zygophyllum scabrum</i> (Forssk.) Christenh. & Byng	3
	<i>Tribulus bimucronatus</i> Viv.	
	<i>Zygophyllum aegyptium</i> Hosny	



Figure 3. *Zygophyllum aegyptium* Hosny.



Figure 4. *Mesembryanthemum crystallinum* L.



Figure 5. *Anchusa hispida* Forssk.



Figure 6. *Cotula cinerea* Delile.



Figure 7. *Chenopodium vulvaria* L.



Figure 8. *Solanum elaeagnifolium* Cav.



Figure 9. *Nigella arvensis* L.



Figure 10. *Moltkiopsis ciliata* (Forsk.) I.M. Johnst.



Figure 11. *Polypogon viridis* (Gouan) Breits.



Figure 12. *Bromus madritensis* L.



Figure 13. *Senecio gallicus* Vill. ex Chiaux.



Figure 14. *Echinops spinosus* L.

Sandy dunes are dominated by the perennial grass *Stipagrostis scoparia*. Plant cover of sandy dunes may reach 5% on average. Salt marshes are located at depressions and near the foothills of sandy dunes. They are characterized by halophytic vegetation. Plant cover ranges between 10-15%. The main plant communities characterizing the Mediterranean coastal area are: *Artemisia monosperma* – *Panicum turgidum*, *Artemisia monosperma* - *Stipagrostis scoparia*, *Artemisia monosperma* - *Thymelaea hirsuta*, *Artemisia monosperma* - *Zygophyllum album*, *Haloxylon salicornicum* - *Artemisia monosperma*, *Haloxylon salicornicum* - *Thymelaea hirsute*, *Nitraria retusa* – *Lycium shawii*, *Tamarix nilotica* - *Nitraria retusa*, *Tamarix nilotica* - *Zygophyllum album*, *Thymelaea hirsuta* - *Panicum turgidum*, *Arthrocnemum macrostachyum* – *Zygophyllum album*, *Halocnemum strobilaceum*, *Zygophyllum album* - *Cornulaca monacantha*.

The anticlines area includes Gebel Maghara, Halal, Lebni and Yi'allaq. Plant cover ranges from 10 to 25%. Three main different habitats are recognized in this area; sandy plains surrounding the mountains, wadis, and anticlines with limestone, chalk, dolomite, and marl outcrops. Sandy plains are mainly dominated by *Anabasis articulata*, *Panicum turgidum*. Wadis are mainly originated from the anticlines, then split and convert till pour in the plains surrounding the mountainous area. *Retama raetam*, *Acacia tortilis*, *Acacia pachyceras* var. *najdensis* and *Tamarix nilotica* or *Tamarix aphylla* grow in large wadis, e.g., W. Masaged. Slopes and gorges of the anticlines are dominated by *Zygophyllum dumosum*, *Reseda arabica*, *Retama raetam*, *Lycium shawii*, and *Juniperus phoenica*. The main plant communities in the anticlines area are: *Acacia pachyceras*, *Acacia tortilis*, *Chilidenus montanus* - *Zilla spinosa*, *Juniperus phoenica*, *Juniperus phoenica* - *Achillea fragrantissima*, *Juniperus phoenica* - *Chilidenus montanus*, *Lycium shawii* – *Fagonia scabra*, *Lycium shawii* – *Zilla spinosa*, *Retama raetam* - *Artemisia monosperma*, *Retama raetam* – *Fagonia Arabica*, *Retama raetam* – *Haloxylon salicornicum*, *Retama raetam* – *Lycium shawii*, *Retama raetam* – *Panicum turgidum*, *Zilla spinosa* - *Thymelaea hirsute*, *Zygophyllum coccinium* - *Fagonia Arabica*, *Zygophyllum dumosum*, *Zygophyllum dumosum* – *Anabasis articulate*, *Zygophyllum dumosum* – *Reaumuria hirtella*, *Zygophyllum dumosum* – *Reseda Arabica*, *Zygophyllum dumosum* – *Zilla spinosa*.

The inland area is characterized by three main types of habitats; (a) coarse-texture sandy plains occupying

the western part, and characterized by poor vegetation cover of a few numbers of species dominated by *Anabasis articulata* and *Artemisia monosperma*; (b) fine-textured sandy plain with scattered mobile sandy dunes of different densities characterized by higher vegetation especially in channels and depression between the sandy dunes, and dominated by *Stipagrostis scoparia*; (c) gravelly plain covered by sand sheets shifted from the Mediterranean region and dominated by *Retama raetam* shrubs. The main plant communities recognized in this area are: *Stipagrostis scoparia*, *Artemisia monosperma* - *Anabasis articulata*, *Retama raetam* - *Anabasis articulate*, *Retama raetam* - *Artemisia monosperma*, *Calotropus procera*, *Artemisia monosperma* - *Haloxylon salicornicum*, *Haloxylon salicornicum* - *Tamarix nilotica*, *Alhagi graecorum* - *Zygophyllum dumosum*, and *Zygophyllum album*.

Human impacts convey a direct or indirect threat to Egypt's biodiversity. The latter involves habitat destruction for development and various forms of pollution with waste from industry and human settlements, while the former involves excessive cutting (Ibrahim et al., 2022). Many plants are threatened by pollutants in the air, water, and soil, which also significantly affect the balance of the ecosystem. Certain beneficial components of biodiversity are being lost as a direct result of this (UNDP, 1998). When the region of distribution of a taxon is substantially lower than the average for taxa of the same rank, the taxon is regarded as endemic. According to the current study, North Sinai encompasses 7 endemic species. Owing to their small population size and restricted geographic range, these taxa are highly vulnerable, and even a slight disturbance could lead to extinction. In the present study, 522 plant species are documented in North Sinai comprising 284 annual species (54.41%) and 226 perennial species (43.29%). The dominance of annuals could be related to their high reproductive capacity and ecological, morphological, and genetic plasticity under high levels of disturbance (Grime, 1979).

In the reclaimed areas, as in several parts on the study area, the land reclamation processes entail an almost complete change of the environmental factors. Thus, weeds find the new conditions favourable for their growth. Close to the boundaries of the desert and within the agro-ecosystem, xerophytic species naturally grow among the weeds of the cultivation. This indicated that these species are native to the

natural desert vegetation and can remain after the reclamation process. The analysis of the vegetation components of the agroecosystem of the reclaimed lands consisted mainly of the weed species growing in the crops of the old, cultivated lands, in addition to some desert plant species. This suggests that land reclamation in the study area entails weed species replacing natural plant communities. Therefore, the reclaimed areas of this study can be considered as a transitional phase of the succession process between the habitat of the old, cultivated lands and that of the desert (Abd El-Ghani *et al.*, 2013). Additionally, species that are considered either annual or perennial were 12 (2.29%).

Moreover, comparing the number of annual plants in the current survey with annual plants recorded in the 2008 survey (Kamel *et al.*, 2008), we found that the numbers of annual plants in the current survey were more than that of the previous survey with an increase from 137 to 284. The increased number of annuals, mainly weeds, might be attributed to the intensive agriculture practices in the area, allowing several weeds from different agro-ecosystems of Egypt to grow and thrive. According to Abd El-Ghani and El-Sawaf (2004), the used seed for cultivation may be mixed with other weed seeds that can grow and flourish associated with the cultivated crop.

The newly recorded species are found in different sites and habitats in North Sinai. The 52 plant species found in North Sinai are associated with the fluctuations of climate either the extremely arid seasons or the humid, rainy seasons (Moustafa *et al.*, 2023). Furthermore, the cultivated areas and the irrigation process support the growth of more plant species. Weeds consequently find the ideal location for growth and development. Over the period of 2000 to 2015, the average area of the cultivated lands was 16.536 thousand feddans, reflecting around 6.1% of the average cultivated area within the governorate of North Sinai. The rate of increase in vegetative area is approximately 1.7 thousand feddans, which is statistically significant and accounts for 2.1% of the average yearly average for the years 2000-2015 (Nassar and Al-Sherbeny, 2018). This increase in the cultivated areas in North Sinai made a solid ground for weeds growth. Another factor that influenced the increasing number of weeds is rainfall. Weeds are still growing in plentiful numbers owing to the significant rainfall in 2023.

CONCLUSION

In conclusion, the study provides a comprehensive study of the plant diversity in North Sinai, highlighting 522 distinct species belonging to 66 families across various habitats of different localities. The study underscores the region's ecological significance and serves as a foundational resource for future biodiversity conservation efforts. Despite some limitations in data accessibility and seasonal variations, this study opens avenues for further research on the adaptive strategies of endemic species and their role in ecosystem resilience. By enhancing our understanding of local flora, we can better inform conservation policies and sustainable land management practices in North Sinai and similar arid regions.

REFERENCES

- Abd El-Ghani M, Amer W (2003) Soil-vegetation relationships in a coastal desert plain of southern Sinai, Egypt, *Journal of Arid Environments* Volume 55: Issue (4), P607-628.
- Abd El-Ghani MM, Soliman AT, Hamdy RS, and Bennoba IH (2013) Weed flora in the reclaimed lands along the northern sector of the Nile valley, Egypt. *Turkish Journal of Botany* 37: 464-488.
- Abd El-Ghani MM, and El-Sawaf N (2004) Diversity and distribution of plant species in the agro-ecosystem of Egypt. *Systematics and Geography of Plants* 74: 319-336.
- Abd El-Wahab RH (2003) Ecological evaluation of soil quality in South Sinai, Egypt. Ph.D. thesis. Botany Department, Faculty of Science, Suez Canal University, Ismailia, Egypt.
- Abd El-Wahab RH, MS Zaghoul, and AA Moustafa (2004) Conservation of Medicinal Plants in St. Catherine Protectorate, South Sinai. I. Evaluation of ecological status and human impact. Proceedings of First International Conference on Strategy of Egyptian Herbaria. 231-251 March 9-11: Giza, Egypt.
- Badr A, and El-Shazly H, (2024) Climate Change and Biodiversity Loss: Interconnected Challenges and Priority Measures. *Catrina: The International Journal of Environmental Sciences* 29 (1): 69-78. <https://doi.org/10.21608/cat.2024.340596>
- Boulos L (1999) *Flora of Egypt. (Azollaceae - Oxalidaceae)*. Al Hadara publishing, Cairo, Egypt, I.
- Boulos L (2000) *Flora of Egypt. (Geraniaceae - Boraginaceae)*. Al Hadara Publishing, Cairo, Egypt II.
- Boulos L (2002) *Flora of Egypt. (Verbenaceae - Compositae)*. Al Hadara Publishing, Cairo, Egypt III.
- Boulos L (2005) *Flora of Egypt. (Alismataceae - Orchidaceae)*. Al Hadara Publishing, Cairo, Egypt III.
- Feinbrun-Dathan N (1978) *Flora Palaestina*. Israel Academy of Sciences and Humanities, Jerusalem 3.

- Feinbrun-Dothan N (1986) *Flora Palaestina*. Israel Academy of Sciences and Humanities, Jerusalem 4.
- Gazara M, Moustafa A, and Kamel W (2000) Ecological Notes and Floristic Composition of Gebel El-Halal, North Sinai, Egypt. *Bull. FAC. SCI., Assiut Univ* 29 (1D): P-P.323-334.
- Gibali MAA (1988) Studies on the Flora of Northern Sinai. M.Sc. Thesis. Cairo University.
- Gibali MAA (2000) Plant Life in Northern Sinai Ecological and Floristic Studies. Ph.D. Thesis. Cairo University.
- Grime JP (1979) *Plant Strategies and Vegetation Processes*. John Wiley & Sons: New York.
- Hany S, Shendi E, Monsef H, Mohamed E, and Smith S (2022) Geotechnical Evaluation of Soil for the Suitability of Urban Planning Purposes, Western Bitter Lakes, Suez Canal Region, Egypt. *Catrina: The International Journal of Environmental Sciences*, 26 (1): 57-65.
<https://doi.org/10.21608/cat.2022.114258.1115>
- Ibrahim L, Saleh A, Ammar M, Helmy M, and Abd EL-Hamid H (2022) Weed communities of field crops in the Newly Reclaimed lands of Suez Canal region, Egypt. *Catrina: The International Journal of Environmental Sciences* 26(1): 33-55.
<https://doi.org/10.21608/cat.2023.163080.1144>
- IUCN (2024) The IUCN Red List of Threatened Species. Version 2024-1. <https://www.iucnredlist.org>.
- Kamel W, Zaghoul M, Abd El-Wahab R, and Moustafa A (2008) Current Status of the Flora of North Sinai: Losses and Gains. *Catrina: The International Journal of Environmental Sciences* 3(1): 11-26
- Fouad M, Moustafa A, Zaghoul M, and Arnous M (2023) Unraveling the Impact of Global Warming on *Phragmites australis* Distribution in Egypt. *Catrina: The International Journal of Environmental Sciences* 27 (1): 59-73.
<https://doi.org/10.21608/cat.2023.198301.1161>
- Mabbutt JA (1977) *Desert Landforms*. MIT Press, Cambridge, MA.
- Moustafa A, Elganainy R, and Mansour S (2023) Insights into the UNSG announcement: The end of climate change and the arrival of the global boiling era, July 2023 confirmed as the hottest month recorded in the past 120,000 years. *Catrina: The International Journal of Environmental Sciences* 28: (1), 43-51.
<https://doi.org/10.21608/cat.2023.234635.1197>
- Moustafa AA, MS Zaghoul, RH Abdelwahab, and M Shaker (2001) Evaluation of plant diversity and endemism in Saint Catherine Protectorate, South Sinai, Egypt. *Egyptian Journal of Botany* 41: 123-141.
- Nassar Z, and Al-Sherbeny M (2018) Economic evaluation of vegetable farms in North Sinai Governorate. *Egyptian Journal of Agricultural Economics* (Vol. 4. doi: 10.21608/meae.2018.112246) 28.
- Nicholes GE, (1930) Methods in floristic study of vegetation. *Ecology* 11: 127-135.
- Raunkiaer C (1934) *The Life Forms of Plants and Statistical Plant Geography*. Oxford University Press, London.
- Täckholm V (1974) *Students' Flora of Egypt*. 2nd Edition, Cairo University Publishing, Beirut 888.
- Täckholmia (1989) Cairo University Herbarium, Giza 1263, Egypt, (Vol. 12).
- UNDP (1998) Egypt: National Strategy and Action Plan for Biodiversity Conservation.
- Yavari A, Atri M, Shahgolzari M, and Karamian R (2010) Application of Floristic Marker in Eco-phytosociology Method for Diagnosing Existing Intra-specific Diversity in Plants: A Case Study of *Astragalus glaucops*. *International Journal of Agriculture and Biology* 12(6).
- Zaghoul MS (1997) Ecological studies on some endemic plant species in South Sinai, Egypt. M. Sc. Thesis, Faculty of Science, Suez Canal University.
- Zaghoul MS (2003) Population ecology of genus *Ballota* growing in southern Sinai, Egypt. Ph.D. Thesis, Faculty of Science, Suez Canal University.
- Zohary M (1966) *Flora Palaestina*. Israel Academy of Sciences and Humanities. Jerusalem 1.
- Zohary M (1972) *Flora Palaestina*. Israel Academy of Sciences and Humanities. Jerusalem 2.