Food and Agriculture Organization of the United Nations

SUSTAINABLE MANAGEMENT OF
KHARGA OASIS AGRO-ECOSYSTEMS PROJECT

Crop wild relatives
of Kharga Oasis atlas

2022

GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

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Crop wild relatives Of kharga Oasis atlas 2022

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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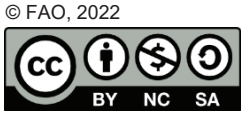

CONTENTS

FIGURES AND TABLES

FIGURES

TABLES

ACKNOWLEDGEMENTS

The crop wild relatives of Kharga Oasis was produced as part of the agrobiodiversity assessment activity of the project titled Sustainable Management of Kharga Oasis Agro-ecosystems (GCP /EGY/030/GFF). The project is funded by the Global Environment Facility (GEF) and is executed by the Food and Agriculture Organization of the United Nations (FAO) in Egypt and the Desert Research Center (DRC).

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ABBREVIATIONS AND ACRONYMS

CCR	cultivated crop relative
CWR	crop wild relatives
DRC	Desert Research Center
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
GP	gene pool
IUCN	International Union for Conservation of Nature
LC	least concern
NE	not evaluated
NT	near threatened
TG	taxonomic group

ABSTRACT

The Crop wild relatives of Kharga Oasis atlas was produced as part of the agrobiodiversity assessment activity of the project titled Sustainable Management of Kharga Oasis Agro ecosystems (GCP /EGY/030/GFF). The project is funded by the Global Environment Facility (GEF) and is executed by FAO Egypt and the Desert Research Center (DRC). A total of 22 CWRs in Kharga oasis have been surveyed and presented in this atlas. The recorded species belong to 10 families, with the Poeacea family having the highest number of species i.e. 6. Most species (64 percent) are annual while the perennials only represent 36 percent of the recorded species. Based on the IUCN criteria of endangered species, out of the 22 recorded species, 11 species were not evaluated, 9 species are of least concern and only 2 species are classified as nearthreatened species.

01

INTRODUCTION

01

A crop wild relative is defined as a wild plant species that is more or less closely related to a particular crop and to which it may contribute genetic material, but that, unlike the crop species, has not been domesticated (Heywood ***et al.***, 2007). Crop wild relatives are known as wild ancestors of cultivated crops. They can contain useful features which can help breeders develop crops that are more resilient to climate change. CWRs are considered enormous reservoirs of genetic variation, useful for plant breeding initiatives and critical to meeting the challenge of global food security through enhanced agricultural production. They exhibit more genetic diversity than cultivated crops, as they have not been selected for domestication from a larger population, and can grow in a wide range of climates, soil and other physical features. In addition, wild species, climate and other environmental factors continue to adapt to their environment as they change (Benlioglu and Adak, 2019).

CWRs are a very diverse group of plants that occur in a wide variety of habitats. They range from forest trees and shrubs to climbers, perennials, biennials and annuals. Some of them are widespread and may even occur as weeds while others have scattered or restricted distributions, and some are rare and endangered.

Without any human intervention, CWRs are able to survive and propagate in the wild and can therefore develop traits to cope with environmental changes. These accumulated traits and genes are vital sources of variation for adapting to climate changes and environmental disasters (aridity, salinity, pollution, habitat fragmentation and diversity loss). These undomesticated crops also contain micronutrients for human nourishment (Redden ***et al.***, 2015).

Due to human-made disturbances, CWRs as well as domesticated species are endangered and may be at risk of extinction in the absence of adequate conservation programs. The accelerating rate of human food consumption, along with an unsustainable use of natural resources, invasive species, displacement of natural vegetation, and climate change generates consequences that affect the distribution and availability of the most important plant genetic resources for food and agriculture.

As populations of some of these taxa have adapted to extreme climates, adverse soil types, and significant pests and diseases, they have been identified as key contributors in breeding for sustainability and climate adaptation (Dempewolf, 2013). In the 1970s and 1980s, recognition of CWRs as significant components of plant genetic resources began to increase. Indeed, modern cultivars of many crops now contain some genes that are derived from a wild relative. For example, genes from several wild species of ***Aegilops***, which are closely related to ***Triticum***, have been transferred to cultivated wheat, including those that confer resistance to leaf rust, stem rust, powdery mildew and nematodes (Schneider ***et al.***, 2008).

The increase in agricultural biodiversity, especially plant genetic resources, will play an important role in improving both the adaptability and resilience of agricultural systems. In general, CWR and wild food plants are genetically diverse, locally adapted and represent a potential source of genes and alleles for adapting crops to changing environmental conditions and human needs.


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02

GENERAL FEATURES OF LOCATION AND CLIMATE OF KHARGA OASIS

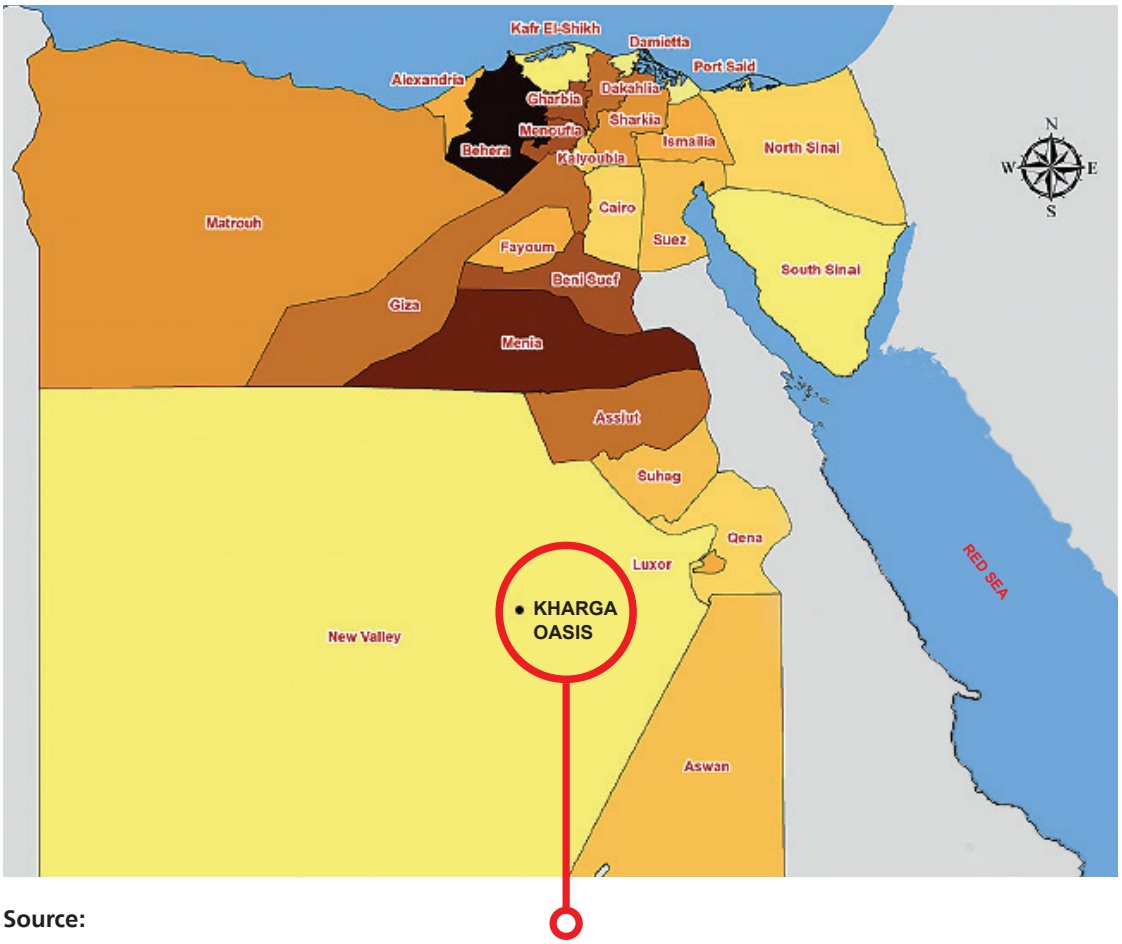
02

The Kharga Oasis is the largest oasis in the western Egyptian desert. It is located in the New Valley Province, which represents 44 percent of Egypt's territory. The Kharga Oasis spans 145 887 km2, 33 percent of the total area of the New Valley Province.

The Kharga Oasis is located 230 km southwest of Asyut Province and about 645 km southwest of Cairo (Figure 1). It is an elongated depression extending about 185 km north to south and 80 km east to west, with an area of 68 223 km², and lies between 25.5656 °N, 30.4205 °E in the north and 24.2314 °N, 30. 3745 °E in the south. It is at an altitude ranging from 300 to 400 metres below the general level of the Libyan plateau, which separates it from the Nile by 140 km of waterless limestone. The eastern and northern boundaries are sharply defined by steep scarps capped by Eocene or Cretaceous limestone. Its fossiliferous deposits occur mainly along the eastern scarp and consist of gravels, silts, and tufas.

Its climate is characterized by hyper-arid conditions with rare rainfall and extremely high temperatures (> 40 °C), as well as by a marked difference in maximum and minimum air temperatures not only between the summer and winter months, but also between day and night. Maximum temperatures during the summer months often exceed 40 °C, whereas minimum temperatures between October and April are often close to zero. Wind velocity varies by season: from November to January it is higher than in the summer season, is low in August, and reaches a peak between March to May causing sand storms, erosion and deposition by wind as well as sand dune mobilisation. Because of the extreme aridity, erosion and deposition by wind as well as sand dune mobilisation represent the main causes of desertification and land degradation in the oasis (Anonymous, 1979).

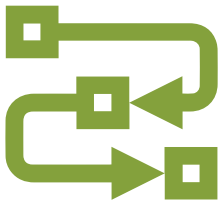
FIGURE 1 Map of Egypt showing location of Kharga.



Source:

Map of Egyptian Governorates. Food and Agriculture Organization of the United Nations, 2011, Mohamed A. El-Nahrawy, Country pasture/Forage Resource Profile. http://www.fao.org/ag/ AGP/ AGPC/doc/Counprof/PDF%20files/Egypt.pdf. Reproduced with permission

03



CRITERIA OF SELECTION FOR THE CWR OF KHARGA OASIS

03

According to Harlan & de Wet (1971) and Maxted et al (2008), there is a potential pool of genetic diversity within each group available for utilisation and a gradation of that diversity dependent on the relative crossing ability between the crop itself and the primary non domesticated species (GP1), secondary (GP2) and tertiary (GP3) gene pool of the crop. Each gene pool is described as follows: GP1 (primary gene pool divided into GP1A, referring to the cultivated crop, and GP1B, which refers to the wild form of the same crop); GP2 (secondary gene pool, i.e. the wild type of the same genus is cultivated and gene transfer is possible using common breeding techniques); GP3 (tertiary gene pool, meaning gene transfer is impossible or only possible with modern techniques such as genetic engineering). Due to the lack of information about gene crossing and genetic diversity, an alternative concept has been accepted to determine the degree of the relatedness between the crop form and wild forms, namely: Taxonomic Groups (Hunter & Heywood, 2011), subdivided into: TG1 (TG1A for crop, and TG1B for the wild form of the crop); TG2 (the same series as the crop); TG3 (for subspecies and varieties of wild relatives); TG4 (for the same genus of wild relatives); and TG5 (for the same tribe or different species). Unfortunately, to this day, no breeding system exists for Kharga oasis CWRs. As a result, we depend on other countries' breeding programs, particularly the Mediterranean and Europe inventories Kell ***et al***., 2005, as well as the Harlan and de Wet CWR inventory (Vincent ***et al.***, 2013). As a result, we found 8 out of 22 recorded species in Kharga in the CWR inventory (Table 1). In addition, 5 CWRs are recorded in neighboring countries (e.g.: Zohary & Heyood, 1995, in Europe and Landucci ***et al.***, 2014, in Italy). These species are: ***Solanum nigrum***, ***Lactuca serrolia***, ***Cyperus laevigatus***, ***Mentha longifolia*** subsp.***typhoides***, and ***Trifolium resupinatum*** In evaluating the rest of the Kharga CWRs we depended on both taxonomic groups and moropholical features, as well as the functional traits of 9 CWRs (Table, 2). Moreover, Landucci ***et al.*** (2014) lists a wide range of CWRs. He states that all taxa (both cultivated and wild, native and exotic taxa) belonging to the same genus or to the same complex as a crop cultivated anywhere in the world and/or to the primary, secondary or tertiary GP of a crop are included.

Table (1)

A list of 8 CWR recorded species in Kharga Oasis showing their relatedness represented by their gene pool (GP) and taxonomic groups (TG), according to Vincent *et al.* (2013).

CWR	CROP	GENE POOL (GP)	TAXONOMIC GROUP (TG)
Avena fatu L.	*Avena Sativa* L.	GP2	TG2
Brassica nigra (L.) Kouch	*Brassica rapa* L.	GP3	TG3
Brassica tournefortii Gouan	*Brassica rapa* L.	GP3	TG3
	Brassica oleracea L.	GP2	TG2
Cirtulls colocynthis (L.) Schrad	*Cirtulls lanatus* (Thunb).	GP2	TG2
Eleusine africana K.Obyrne	*Eleusine coracana* (L.) Gaertn.	GP1	TG2
Lathyrus hirsutus L.	*Lathyrus sativus* L.	GP3	TG2
Panicum repens L.	*Panicum miliaceum* L.	GP3	TG2
Sorghum halepense (L.)Pres.	*Sorghum biocolor* (L.) Moench.	GP2	TG2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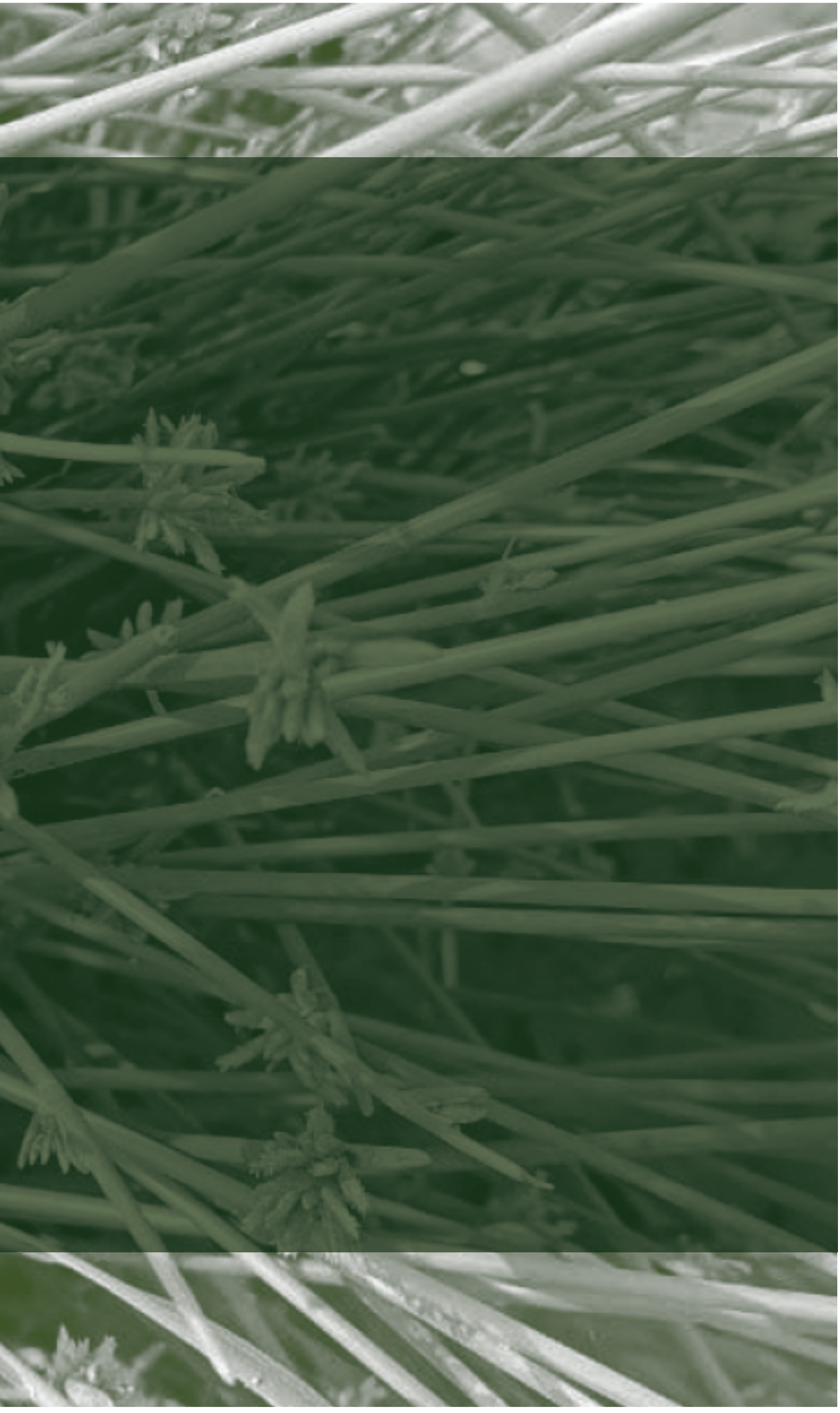
04

CROP WILD RELATIVES OF KHARGA OASIS



04

CROP WILD RELATIVES (CWR) OF KHARGA OASIS

A total of 22 CWRs have been recorded at Kharga Oasis. These species belong to 10 families. The Poacea family is the largest (6 species), followed by Fabaceae (4 species) and Brassicaceae (3 species), Cyperacea and Solanaceae (2 species each) and there are also 5 families sharing one species (i.e. Malvaceae and Amaranthaceae) (Table 2). Most species are annuals (64 percent), and 36 percent are perennials. This pattern of life duration suggests the dominance of Therophyte life forms (14 species out of 22). Both Chamaophytes and Hemicrptophytes are represented with 3 species. On the other hand, 2 species represent Geophytes. Fortunately, according to IUCN criteria of endangered species, half (11 species) of the recorded CWRs are not classed as endangered, and 9 species are of least concern. In addition, 2 species are classified as near threatened species, namely Leersia hexandra and Trigonella hamosa. There are 6 main habitat types supporting the presence of CWRs: wheat fields, waste lands, cultivated lands, canal banks, margin of cultivated lands and sand dunes. Most of the species grow in cultivated lands and their margins (6 and 5 species respectively). Five species occur in the waste lands, and 4 species are found on the canal banks. Sand dunes and wheat fields are host to 1 species each (Table 2).

TABLE (2)

A list of crop wild relatives in Kharga Oasis showing their families, life duration, life forms, abundance status according to IUCN scales

CROP WILD RELATIVES	ARABIC	FAMILY	LIFE DURATION
Avena fatua L.	Zommeir	Poaceae	A
Brassica nigra (L.) Koch	Khardal	Brassicaceae	A
Brassica tournefortii Gouan	Shiltam	Brassicaceae	A
Chenopodium murale L.	Lesan EL- Teir	Amaranthaceae	A
Citrullus colocynthis (L.) Schrad.	Hanthal	Cucurbitaceae	P
Cyperus laevigatus L. var. l*aevigatus*	Borbeit	Cyperaceae	P
Cyperus rotundus L. var. *rotundus*	Se'ed	Cyperaceae	P
Eleusine africana Kenn.	Nigeel	Poaceae	A
Eruca sativa Mill.	Gargeer	Brassicaceae	A
Hibiscus trionium L.	Teel Sheitani	Malvaceae	A
Lactuca serriola L.	Khass El- Baqar	Astraceae	A

(NE: not evaluated as endangered species; LC: least concern; NT: near threatened), habitats and cultivated crops relatives, as well as their arabic names.

LIFE FORMS	STATUS	HABITAT	CULTIVATED CROP RELATIVE	ARABIC NAMES OF CCR
Therophytes	NE	Wheat fields	*Aventa sativa*	Shofan
Therophytes	LC	Waste land	*Brassica rapa*	Leeft
Therophytes	LC	Waste land	*Brassica rapa*	Leeft
Therophytes	NE	cultivated lands	*Chenopodium quinoa*	Qunio
Chamaphytes	NE	sand dunes	*Citrullus lanatus*	Bateekh
Geophytes	NE	Canal banks	*Cyperus esculentus*	Habb El- Aziz
Geophytes	NE	Canal banks	*Cyperus esculentus*	Habb El- Aziz
Therophytes	LC	cultivated lands	*Eleusine coracana*	Dakhan
Therophytes	NE	Waste land	*Eruca sativa Mill.*	Gargeer
Therophytes	LC	cultivated lands	*Hibiscus sabdariffa*	Karkadie
Therophytes	LC	Waste land	*Lactuca sativa*	Khass

TABLE (2)

A list of crop wild relatives in Kharga Oasis showing their families, life duration, life forms, abundance status according to IUCN scales

CROP WILD RELATIVES	ARABIC	FAMILY	LIFE DURATION
Lathyrus hirsutus L.	Gelban	Fabaceae	A
Leersia hexandra Sw.	Orze Baldi	Poaceae	P
Mentha longifolia subsp. *typhoides*	Habaq El- Barr	Lamiaceae	P
Panicum repens L.	Nseila	Poaceae	P
Pennisetum glaucum (L.) R. Br.	Dakhan	Poaceae	A
Solanum nigrum L.	Enab El- Deeb	Solanaceae	A
Sorghum halepense (L.) Pers.	Hashish El- Faras	Poaceae	P
Trifolium resupinatum L.	Qort	Fabaceae	A
Trigonella hamosa L.	Eshb El-Malik	Fabaceae	A
Vicia monantha Retz.	Qireinet Ghazal	Fabaceae	A
Withania somnifera Täckh	Semm Fraakh	Solanaceae	P

(NE: not evaluated as endangered species; LC: least concern; NT: near threatened), habitats and cultivated crops relatives, as well as their arabic names.

LIFE FORMS	STATUS	HABITAT	CULTIVATED CROP RELATIVE	ARABIC NAMES OF CCR
Therophytes	LC	cultivated lands	*Lathyrus sativum*	Bseilla
Hemicryptophyte	NT	Canal banks	*Oryza sativa*	Oryz
Chamaphytes	LC	Margin of cultivated field	*Mehntha varidis*	Niania
Hemicryptophyte	LC	Canal banks	*Panicum miliaceum*	Nseila
Therophytes	NE	Margin of cultivated field	*Pennisetum glaucum*	Dakhan
Therophytes	NE	Margin of cultivated field	*Solanum lycopersicum*	Tamatm, Batatus
Hemicryptophyte	LC	Margin of cultivated field	*Sorghum bicolor*	Hashish El- Sudan
Therophytes	NE	cultivated lands	*Trifolium sativum*	Barseem
Therophytes	NT	cultivated lands	*Trigonella foenum - graecum*	Heliba
Therophytes	NE	Margin of cultivated field	*Vicia faba*	Fool
Chamaphytes	NE	Waste land	*Physalis philadelphica*	Harnkish

Families

- A — AMARANTHACEAE
- B — ASTERACEAE
- C — BRASSICACEAE
- D — CUCURBITACEAE
- E — CYPERACEAE

F FABACEAE

G LAMIACEAE

H MALVACEAE

I POACEAE

K SOLANACEAE

Family

AMARANTHACEAE

- 1- *Chenopodium murale* L.

A

Morphological description

Annual or perennial herbs or shrubs, rarely small tree or climbers. Stem often jointed and /or succulent. Leaves simple, jointed, alternate or opposite. Flowers unisexual on monoecious or dioecious plants sometimes unisexual in spicate or capitate bracteactae infloresences, or in few flowered cymes, perianth dry and scarious, usually 4 or 5 - merous. Perianth segments free or connate at the base. Stamens 1-5, opposite the perianth – segments, ovary superior, 1- locular, fruit in achene or small nut or 1-seeded capsule, with a membranous, rarely fleshy wall. Seeds with rich starchy perisperm more than 170 genera and 2000 species distributed at tropical, warm and arid regions (Boulos, 1999).

1 *Chenopodium murale* L.

- **Synonyms:** *Chenopodium murale* var. *albescens* Moq
  Chenopodium biforme Nees
- **Arabic name:** Lesan EL-Teir
- **English names:** Nettle - leaved - goose foot.
- **Habitats:** Cultivated lands
- **Uses:** Medicinal
- **Relatedness:** TG2, TG3

General view of Chenopodium murale

Morphological description

Annual herb 10-70 cm, dark green. Stem erect or ascending, branching at the base, angular, stricate. Leaves 1-10 X 1-6 cm, rather fleshy, ovate-rhombic or deltoided, sometimes elliptic lanceolate, coarsely dentate. Basel leaves long petiolate becoming progressively short petiolate toward the top. Inflorescence of terminal and axiallery leafy cymes. Perianth segments 5 conmate to the one third of their length (Boulos, 1999).

Notes

***Chenopodium murale* is one of the most common weeds. Its distribution is restricted to temperate regions. It is considered as a cushion plant of the newly introduced species to Kharga Oasis, *Chenopodium quinoa*. Recently, quinoa has become one of the best adapted pseudocereals to the Kharga climate and environment.**

Close-up view showing leaves and fruits of Chenopodium morale

Family

ASTERACEAE

- 2- *Lactuca serriola* L.

B

Morphological description

Annuals, perennials or low shrubs, sometimes trees, rarely woody climbers, lianes epiphytic or aquatic, tissues with latex or not. Leaves alternate or opposite usually simple, often lobed or divided. Inflorescence a capitulum surrounded by an involucre of one or more series of phyyaries, capitula solitary and scapiform, in cymose or corymbiform inflorescences, or aggregated into glomerules or compound secondary inflorescences. Receptacle naked or with scales (Paleae) or bristles subtending the florets. Florets small, 1-500 or more, sessile on the common receptacle. Corollas gamopetalous of 3-5 united petals. Capitulum ligluate or discoid. Fruits A 1-Seeded achene, usually crowned by a persistent or deciduous pappus. Globally, about 1600 genera and 25000 species. It is considered as one of the largest families of the Egyptian Flora. It consists of 98 genera and 228 species (Boulos, 2002).

2 *Lactuca serriola* L.

- **Synonyms:** *Lactuca verticalis* Gaterau
  Lactuca coriacea-Sch.Bip.
  Lactuca albicaulis Boiss
- **Arabic name:** Khass El-Baqar
- **English names:** Prickly lettuce
- **Habitats:** waste lands
- **Uses:** Food
- **Relatedness:** TG2, GP2

Close-up view of Lactuca serriola L.

Morphological description

Glabrous or setose annual or biennial, stem erect, rigid usually unbranched at the base. Leaves 3-8 X 1-5 cm. The midrib spinulose on the lower surface, basel leaves tapering at the base, scarcely petiolate. Capitula 7-20 flowered in lax paniculate inflorescences. Corolla tube 4 mm hairy. Achenes 6-8 mm including the beak (Boulos, 2002).

Notes

According to Meikle (1985), cultivated lettuce (***Lactuca sativa*** L.) is thought to be an ancient derivative of ***Lactuca serriola***, but differs in its smooth stems, leaves and in the leave blade. Tutin (1976) noted that ***L. sativa*** probably originated in Egypt from ***L.serriola.***

General view of Lacutuca serriola L showing its habitats and associated species

Family

BRASSICACEAE

- 3- *Brassica nigra* (L.) Koch
- 4- *Brassica tournefortii* Gouan
- 5- *Eruca sativa* Mill.

C

Morphological description

Annual or perennial herbs or small shrub. Leaves alternate, exstipulate. Flower bisexual actinomorphic. Inflorescence a raceme, usually ebracteate, sepals 4 free in 2 decussate pairs, petals 4 free clawed, alternate with sepals. Stamens usually 6 rarely 4 or 2, tetradynamous. Filaments liner, sometimes winged or with tooth like appendages. Overy of 2 carpels, with 2 parietal placentas, usually 2- locular through the formation of a membranous false septum. Fruit a siliqua or silicula sometimes indehiscent and breaking into 1-seeded portion or indehiscent; seeds in 1 or 2 rows in each cell. Globally, about 365 genera and 3250 species, whereas, 53 genera and 104 species recorded in the Egyptian Flora (Boulos, 1999).

3 *Brassica nigra* (L.) Koch

- **Synonyms:** *Brassica bracteolate* Fisch. & C.A.Mey.
  Sinapis nigra L.
  Brassica sinapioides Roth
- **Arabic name:** Khardal
- **English names:** Black mustard
- **Habitats:** waste lands
- **Uses:** Medicinal, food
- **Relatedness:** GP3, TG3

General view of Brassica nigra habitat

Morphological description

Annual herb 40-150 cm, sparingly hispid with stiff hairs, stem erect branched above the base. Basal leaves 10-35 X 3-12 cm, petiolate, lyrate-pinnatisect, the lateral lobes oblong-ovate, serrate-dentate, upper leaves short-petiolate, liner entire. Inflorescence richly branched. Sepals 4-7 mm, petals 0.5-1.5 cm, yellow. Fruit siliqua, 1-3 X 0.14-0.4 cm cylindrical (Boulos, 1999).

Notes

***Brassica nigra* is a common winter weed that is closely related to the cultivated Turnip (*Brassica rapa*), Landucci *et al.*, 2014 .**

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Close-up view of Brassica nigra showing flowers

4 *Brassica tournefortii* Gouan

- **Synonyms:** *Brassica amblyorhyncha* Coustur. & Gand
  Brassica tournefortii var. *sisymbrioides* Fisch. ex DC
  Eruca erecta Lag.
- **Arabic name:** Khardal
- **English names:** Asian mustard
- **Habitats:** waste lands
- **Uses:** Medicinal
- **Relatedness:** GP3, TG3

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Close-up view of Brassica tournefortii showing the leaves

Morphological description

Annual herb up to 80 cm tall, glabrous above, hispid below, stem erect and spreading much branched. Basel leaves mostly in a rosette 4-40 X 2-12 cm, lyrate-pinnatisect, with 6-12 pairs of lateral serrate-dentate lobes. Sepals 3-4 mm, petals 6-8 mm, pale yellow, long-clawed. Siliqua 4-7 X 0.2-0.3 cm, torulose, beak 1-2 cm.

Notes

***Brassica tournefortii* is a common winter weed and is closely related to the cultivated turnip (*Brassica rapa*), Vincient *et al.* (2013).**

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General view of Brassica tournefortii showing its habitat

5 *Eruca sativa* Mill.

- **Synonyms:** *Eruca lativalvis* Boiss.
  Eruca vesicaria (L.) Cav.
- **Arabic name:** Gargeer
- **English names:** Rocket
- **Habitats:** Waste lands
- **Uses:** Food
- **Relatedness:** TG1B, GP1B

Morphological description

Annual herb 10-60 cm, glabrous or hairy. Stem erect simple or branching lower leaves 5-18 cm, lyrate-pinnatisect, petiolate, upper shorter.Ssepals 1-1.2X.2 cm, and petals 1.5-2.5 X .3-7 cm pale lemon-yellow with dark violet veins. Fruits siliqua 2-3.5 X 0.3-0.4 cm valves 1- nerved (Boulos, 1999).

Notes

***Eruca sativa* is present in Kharga in two cases: cultivated and as wild types that have escaped from cultivation to the wild habitat. Wild types live in a wide range of environmental stress, and modify mechanisms to cope with harsh wild environmental conditions, (Heywood & Zohary, 1995; Landucci *et al.*, 2014).**

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General view of Eruca sativa

Family

CUCURBITACEAE

- 6- *Citrullus colocynthis* (L.) Schrad. Koch

D

Morphological description

Herbaceous or woody climbers, or stem trailing; tendrils usually present. Leaves alternate, simple and palmately veined or compound. Flower usually unisexual, axillary, monoecious or dioecious. Petals 3-5 free or united. Stamens usually 5 sometimes 3 alternate with the petals. Ovary usually inferior, generally 1 - locular of 2-5 united carpels. Placentation parietal or rarely axillary. Fruits dry or fleshy capsule, berry or hard-shelled pepo, indehiscent or dehiscent, 1 - or many seeded, seed large compressed. There are 775 species in arid and warm regions (Boulos, 2000).

6 *Citrullus colocynthis* (L.) Schrad. Koch

- **Synonyms:** *Cucumis colocynthis* L.
  Colocynthis vulgaris Schrad.
- **Arabic name:** Hanthel
- **English names:** Bitter apple
- **Habitats:** Sand dunes.
- **Uses:** medicinal
- **Relatedness:** GP2, TG2

General view of Citrulus colocynthis in the sandy habitat

Morphological description

Scabrous perennial, stem procumbent, branched, hirsute, root fleshy. Leaves rough on both surfaces. Leave blade 3-10 X 2-5 cm triangular- ovate, deeply 5-7 lobed. Tendrils simple, short. Calyx lobes 2-4 mm lanceolate, petals 1 X 0.5 cm yellow, connate at the base. Fruits 5-15 cm diameter, globose, smooth, green, mottled with yellow or entirely yellow when ripe, with a firm wall, fleshy, on a stalk 1.5-5.5 cm, seeds ovate, compressed (Boulos, 2000).

Notes

Citrullus colocynthis is one of the more common species in the Egyptian desert. It is distributed in sandy habitats, especially in arid regions. It is thought to be one of the ancient ancestors of the refreshing summer fruit *Citrullus lanatus* (Heywood & Zohary , 1995; Landucci *et al.*, 2014)

Close-up view of Citrulus colocynthis showing leaves, architecture and flowers

Family

CYPERACEAE

- 7- *Cyperus laevigatus* L. Var. laevigatus

- 8- *Cyperus rotundus* L. Var. rotundus

Morphological description

Perennials, rarely annuals, caespitose or rhizome creeping, often stoloniferous, sometimes tuberous or with bulbils. Culms mostly scapose and solid, trigonous to triquetrous, glabrous, edges scabrous, or terete, smooth. Leaves sheathed, in 3 ranks, mostly basal or near the base, with or without ligules. Blade usually glabrous but apex and margin barded. Ifloresencece unbranched to a several time branches, umbel like or paniculate of many spikelets. Flowers bisexual or unisexual, seldom dioecious. Flower with or without a bristle like perianth. Stamens 1-3, stigma 2-3. Flower with stamens subtented by a glume. Fruit a nutlet, trigonous or biconvex, sometime winged. About 108 genera and 5500 species (Boulos, 2005).

7 *Cyperus laevigatus* L. Var. laevigatus

- **Synonyms:** *Cyperus mucronatus* Rottb, *Cyperus lateralis* Forssk.
- **Arabic name:** Borbeit
- **English names:** Boredrain sedge
- **Habitats:** Canal banks
- **Uses:** Fiber plant
- **Relatedness:** GP3, TG3

Morphological description

Rhizomatous mat forming perennial, roots fibrous reddish sand –binding, and horizontally creeping. Culms up to 100 cm, tufted or solitary terete or trigonus, wiry, often curved rigid, smooth. Inflorescence pseudolateral. Spikelets 1-50, sessile, clustered. Glumes ovate to broadly ovate, imbricate, 3-5 veined. Stamens 3 filaments flat persistent (Boulos, 2005).

Notes

***Cyperus laevigatus* is common in wet habitats, alluvial canal banks, near wells and shallow brackish water. It is considered as one of the ancestors of the very important medicinal plant earth almond (*Cyperus esculentus*), Zohary & Heywood (1995).**

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Close-up view of Cyperus laevigatus var. laevigatus showing its fruits

8 *Cyperus rotundus* L. Var. rotundus

- **Synonyms:** *Cyperus tuberosus* Rottb, *Cyperus subcapitatus* C.B. Clarke. *Cyperus hexastachyos* Rottb.
- **Arabic name:** Se'ed
- **English names:** Nut grasses
- **Habitats:** Canal banks
- **Uses:** Medicinal
- **Relatedness:** GP3, TG3

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Close-view of Cyperus rotundus

Morphological description

Perennial rhizomatous with wooly brownish roots. Rhizome creeping, wiry, purplish brown, their fibrous remains, ending in a swollen ellipsoid, woody tuber, covered with fiber. Culmus 10-130 cm, rigid, triquetrous. Inflorescences, rigid; leaves several, basel, crowded or cauline, shorter or longer the culms. Ligule very small or abscent. Inflorescence umbel-like. Spikes ovoid to fan shaped (Boulos, 2005).

Notes

According to the morphological features, *Cyperus rotundus* is very closely related to the very important medicinal plant i.e. earth almond (*Cyperus esculentus*), Heywood & Zohary (1995).

General view of Cyperus rotundus at the wet habitat

Family

FABACEAE

- 9- *Lathyrus hirsutus* L.
- 10- *Trifolium resupinatum* L.
- 11- *Trigonella hamosa* L.
- 12- *Vicia monantha* Retz.

Morphological description

Herbs, shrubs, trees or lianes. Leaves alternate, pinnate 1 or 3 foliolate, digitate, 2-pinnate or simple. Stipules usually present. Flower Zygomorphic or actinomorphic, solitary or in spikes, racemes or panicle, usually bisexual. Sepals usually united petals 5, free or united. Stamens 10 inserted with the petals at the rim of the receptacle. Filaments free or united or diadelphous, overy of 1- carpel, superior, 1-to several –ovulate. Fruit a legume (pod) usually dehiscent into 2 valves. Seeds with scanty endosperm. Worldwide, there are 642 genera and 18000 species. In Egypt, it's considered the second most important and diverse family with 228 species (Boulos, 1999).

9 *Lathyrus hirsutus* L.

- **Synonyms:** *Lathyrus hirsutus* L., *L. pseudoaphaca* Boiss, *L. affinis* Guss
- **Arabic name:** Gelban
- **English names:** Peavines
- **Habitats:** cultivated lands
- **Uses:** Food
- **Relatedness:** GP2, TG2

General view of Lathyrus hirsutus

Morphological description

Annual herb up to 80 cm tall, glabrous. Stem trailing, branched, winged and angular, striate. Stipules 1-1.5 cm, sagittate, acuminate. Tendrils branched. Leaflets 2, 4-8 X 0.5-1.2 cm, oblong-liner, 4-6 veined. Calyx 5-8 mm, calyx –teeth as long as the tube. Corolla 1-1.5 cm, Crimson (standard) and blue (wings). Pod 3-5 X 0.8-1 cm oblong liner, silky.Seeds 2-3 mm, dark brown (Boulos, 1999).

Notes

Lathyrus hirsutus appears as a weed in cultivated lands. It is closely related to the cultivated ***Lathyrus sativum*** L, Landucci ***et al.***, 2014.

Close-up view of Lathyrus hirsutus showing flowers and fruits.

10 *Trifolium resupinatum* L.

- **Synonyms:** *Trifolium suaveolens* Willd.
  Amoria resupinata (L.) Roskov
- **Arabic name:** Qort
- **English names:** Persian clover
- **Habitats:** cultivated lands
- **Uses:** Range plant, fodder
- **Relatedness:** GP3,TG3

Trifolium resupinatum L.

Morphological description

Annual herb up to 50cm, glabrous or glabrescent, stem ascending, erect or procumbent, branched from the base, and hollow. Stipual 1-1.5 cm, oblong, caudate, distinctly veined in the basal part. Leaflets 1-2.2 X 0.5-1.5 cm obovate to elliptic, finely serrulate the apex rounded. Peduncles usually exceeding the leaves. Heads 1-1.5 cm diameter, many flowered. Calyx 3 mm, 12-veined. Corolla 5.5-7.5 mm resupinate , pink to purple. Fruiting heads villous (Boulos, 1999).

Notes

Trifolium resupinatum is a species introduced to Egyptian flora. It is thought to be an ancestor of the cultivated *Trifolium sativum* L, Landucci *et al.* (2014).

Close-up view of Trifolium resupinatum showing the leaves and the flowers

11 *Trigonella hamosa* L.

- **Synonyms:** *Trigonella glabra* Thunb.
- **Arabic name:** Eshb El-Malik
- **English names:** Fenugreek
- **Habitats:** Cultivated lands
- **Uses:** medicinal
- **Relatedness:** GP3, TG4

Trigonella hamosa L.

Morphological description

Annual to 40 cm, glabrous to glabrescent. Stem erect to procumbent. Leaves 1- 4.5 cm. Leaflets 0.5-1.5 X 0.5-1.2 cm, obovate to cuneate- oblong, denticulate towards the truncate or retuse apex. Flowers 4-5 mm, in 6-12-flowerd umbellate racemes. Corolla about twice as long as calyx, yellow. Pod 0.8-1.2 cm, subcylindrical, 8-16 seeded (Boulos, 1999).

Notes

Trigonella glabra is closely related to the most commonly cultivated species of Fenugreek (*Trigonella foenum-graecum* L.), Landucci ***et al.*** (2014).

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Close-up view of Trigonella hamosa L.

12 *Vicia monantha* Retz.

- **Synonyms:** *Vicia biflora* Desf.
  Vicia cinerea M.
  Vicia calcarata Desf.
- **Arabic name:** Qireinet Ghazal
- **English names:** Barn Vetch
- **Habitats:** Margin of cultivated field
- **Uses:** Food
- **Relatedness:** GP3, TG3

Vicia monantha

Morphological description

Annual herb 10-50 cm, sparingly hairy to glabrous. Stem erect or ascending, angular, branched. Stipules 3-5 mm, hastate. Leaves 3-8 cm, tendril branched. Leaflets 4-8 pairs, short-petioliolate, liner to oblong or narrowly elliptical. Calyx 4-5 mm pubescent, teeth shorter than the tube. Corolla 1.2 - 1.6 cm, bright purple, pod 2.5-5 X 0.5-1 cm, 4-6 seeded, flattened, oblong liner with short beak, glabrous , subglobose, dark brown (Boulos, 1999).

Notes

Vicia monantha is thought to be one of the wild relatives of Faba bean (*Vicia faba* L), Landucci *et al.*, (2014).

Close-up view of Vicia monantha

Family

LAMIACEAE

- 13- *Mentha longifolia*
  Subsp. Typhoides (Briq.)

G

Morphological description

Annual or perennial herbs, shrubs or rarely tress, usually aromatic. Stem mostly 4-angled. Leaves decussate, simple, undivided or variously divided. Inflorescence usually of axillary cymes forming whorls of verticillasters and subtended by 2 floral leaves or bracts. Flower zygomorphic, bisexual. Calyx 4-5 lobes or dentate, often bilabiate. Corolla usually bilabiate, upper lip 2-lobed, the lower 3-lobed. Stamens 4, didynamous, rarely 2. Hypogynous disc often present, nectariferous. Pistil 1, carpel 2, overy superior, divided mostly to the base into four 1- Locular, 1- ovulate lobes. Stigma 2-lobed. Fruit of 4, 1-seeded nutlets, enclosed by the calyx. Distribution in the Mediterranean basin. About 280 genera, and 6700 species (Boulos, 2002).

13 *Mentha longifolia* Subsp. Typhoides (Briq.)

- **Synonyms:** *Mentha sylvestris* L. subsp. *typhoides* Briq.
  Mentha calliantha Stapf
  Mentha cyprica Heinr.Braun
- **Arabic name:** Habaq El- Barr
- **English names:** Mint
- **Habitats:** Margin of cultivated field
- **Uses:** medicinal
- **Relatedness:** GP2, TG3

General view of Mentha longifolia

Morphological description

Tomentose -canescent perennial 30-80 cm. Stem erect, leaves 1-6 X 0.5-1.8 cm, ovate lanceolate or broadly to narrowly lanceolate, almost entire or sharply serrate, acute, sessile, the base rounded. The hairs all simple, verticillasters 3-10 cm, in terminal dense spikes. Calyx 1.5 mm, campanulate, pubescent, teeth as long as the tube, triangular. Corolla 3mm, pink (Boulos, 2002).

Notes

Mentha longifolia subsp. _typhoides_ is considered to be a wild relative of cultivated mint (_Mentha varidis_ L), Zohary & Heywood (1995).

Close-up view of Mentha longifolia

Family

MALVACEAE

- 14- *Hibiscus trionium* L.

Morphological description

Herbs, shrubs or trees, usually stellate-hairy. Leaves alternate, stipulate, lobed or divided usually palmately lobed. Flower usually bisexual, actinomorphic, often conspicuous axillary, solitary or in terminal inflorescences. Epicalyx present or absent. Sepals 5, rarely 3 or 4, petals 5, usually connate at the base and andante to the staminal column. Receptacle short or elongate into a central axis. Stamens numerous, connate into a staminal column. Anthers 1-celled, overy superior, of 2- many carpels, placentation axile, style divided at apex into lobes or stigmas, as many as the number of carpels. Fruit a dehiscent capsule or schizocarp, rarely a berry. Seeds usually hairy. About 111 genera, and 1800 species, cosmopolitan especially in tropical regions (Boulos, 2000).

14 *Hibiscus trionium* L.

- **Synonyms:** *Hibiscus ternatus* Cav.
- **Arabic name:** Teel *Shei*tani
- **English names:** Veni*ce mall*ow
- **Habitats:** Cultiv*ated la*nds
- **Uses:** Gard*en plant*
- **Relatedness:** *GP2, TG4*

General view of Hibiscus trionium

Morphological description

Hispid annual 15-50 cm, stem erect or decumbent, branched with a simple or stellate haris. Leaf blade 3-7 X 3-6 cm, deltoid or rounded, 3- palmatiscect. Stipules 3-5 mm, subulate, covered with strigose and stellate haris. Epicalyx of 9-12 free segments, 0.8-1.3 cm, liner, with stiff tuberculate- based long hairs. Flowers 3-4 cm diameter, axillary, solitary, peduncle 2.5-5 cm, covered with strigose and stellate hairs. Calyx 1-1.2 cm, the lobes triangular lanceolate, membranous. Petals 2-2.5 cm broadly ovate-rounded. Capsule 1.5 cm subglobose, pubescent, enclosed in the calyx (Boulos, 2000).

Notes

Hibiscus trionium weed of cultivation. It is closely similar to *Hibiscus sabdariffa* L, which is widely cultivated in southern Egypt and oases for its fleshy calyx, which is used in the preparation of a refreshing drink.

Close-up view of Hibiscus trionium

Family

POACEAE

- 15- *Avena fatua* L.
- 16- *Eleusine africana* Kenn.
- 17- *Leersia hexandra* Sw.
- 18- *Panicum repens* L.
- 19- *Pennisetum glaucum* (L.) R. Br.
- 20- *Sorghum halepense* (L.) Pers.

Morphological description

Annual or perennial herbs, sometimes with rhizomes or stolon. Stem (Culms) cylindrical, jointed, usually hollow in the internodes, closed at the nodes. Branches subtended by a leaf and with 2-keeled hyaline leaflet at the base. Leaves solitary at the nodes, sometimes crowded at the base of the culm, alternate and 2-rowed, comprising sheath, ligule and blade. The culm, margin free, overlapping or connate into a tube. Sheaths encircling the culm. Ligule adaxial at the junction of sheath and blade. Blades usually long and narrow, flat or inrolled, usually passing gradually into the sheath, sometimes amplexicals. Inflorescence composed of spikelets arranged in a panicle or in racemes, the latter solitary, digitate or disposed along a centeral axis, usually terminal. Spikelets consisting of bracts distichously arranged along a slender axis (rhachillia, the 2-lowermost bracts (glumes) empty, each enclosing a flower and opposed by a hyaline scale (palea), the whole (lemma, palea and flower) termed a floret. Flower usually bisexual, sometimes unisexual. Stamens hypogynous 1-6, rarely more. Fruit a caryopsis with thin pericarp adnate to the seed. Worldwide, about 670 genera, 10000 species. It is the most diverse family in Egyptian flora, comprising 110 genera and 285 species (Boulos, 2005).

15 *Avena fatua* L.

- **Synonyms:** *Avena fatua* forma *deseticola* Hausskn.
  Avena cultiformis (Malzev).
  Anelytrum avenaceum Hack.
- **Arabic name:** Shofan
- **English names:** Wild oat
- **Habitats:** Wheat lands
- **Uses:** Food
- **Relatedness:** GP2, TG2

Morphological description

Culms to 1.5 m, panicle 10-40 cm, nodding narrowly to broadly pyramidal, loose. Spikelets 1.8-2.8 cm, 2-3 flowered. The rhachilla disarticulating at the base of each floret. Callus short with horseshoe-shaped disarticulation-scar. Glumes lanceolate, finely acute. Lemmas 1.4-2 cm, stiffly hairy in the lower two-thirds, scarbid above, unequally and shortly 2- to 4- toothed at the tip, the teeth muticous or shortly mucronate, central awn 2.5-4 cm, geniculate (Boulos, 2005).

Notes

***Avena fatua*, is closely related to the cultivated *Avena sativa* L, Landucci *et al.* (2014). Its occurrence is restricted to the wheat fields in the study area.**

Close-up view of Avena fatua

16 *Eleusine africana* Kenn.

- **Synonyms:** *Eleusine indica* subsp. *africana* Kenn.
- **Arabic name:** Nigeel
- **English names:** Millet
- **Habitats:** Cultivated lands
- **Uses:** Range plant, Fodder
- **Relatedness:** GP2, TG2

Morphological description

Moderately robust annual to 90 cm. Ligule with a pronounced ciliate fringe. Leaf blades without marginal hair-tufts. Inflorescence comprising 3-15 subdigitate racemes 4-17 cm, 4-7 cm wide. Spikelets 4-8 mm elliptic, 3-9 flowered breaking up at maturity. Glumes unequal, acute. Lemmas 3.5-5 mm, lanceolate in profile. Grain obliquely ridged (Boulos, 2005).

Notes

***Eleusine africana* is known as the wild ancestor of the cultivated finger millet (*Eleusine coracana*), Vincient *et al.* (2013). According to Boulos (2005), finger millet was domesticated in the uplands of East Africana as a derivative of *Eleusine africana* Kenn.**

Close=up view of Eleusine africana

17 *Leersia hexandra* Sw.

- **Synonyms:** *Leerisa hexandra* Sw.
- **Arabic name:** Orze *Bala*di
- **English names:** Wild Rice
- **Habitats:** Canal bank
- **Uses:** Fodder
- **Relatedness:** GP3, TG4

Morphological description

Perennial, culm to 1m, slender often decumbent, ascending from a creeping rhizome, silky- pubescent at the nodes. Leaf blades 10-20 X 0.4-0.8 cm flat, painfully retrorsely scarbid on the midrib beneath. Ligule 1-2mm, asymmetric, truncate. Panicle 5-12 X 1-4 cm narrowly elliptic to oblong. Branches ascending. Spikelets3-6 X 1-2 mm oblong, paleor purplish. Lemma conspicuously pectinate-ciliate on the keel with hairs 0.2 m rarely spinlose (Boulos, 2005).

Notes

***Leerisa hexandra* is related to common rice (*Oryza sativa* L.).**

©After Macleay Grass Man

Close-up view of Leersia hexandra

18 *Panicum repens* L.

- **Synonyms:** *Panicum grossarium* Forssk
  Panicum arenarium Brot.
  Panicum littorale C.Mohr ex Vasey
- **Arabic name:** Nseila
- **English names:** Creeping panic
- **Habitats:** Canal bank
- **Uses:** fodder grass
- **Relatedness:** GP3, TG2

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General view of Panicum repens showing its growth habitat

Morphological description

Subglabrous perennial with long creeping rhizome. Culms to 1 m, tough, erect or decumbent, often arising from a knotty base. Leaf sheath tough, wooly on the margins. Leaf-blades 7-25 X 0.2-0.8 cm, liner, flat, or inrolled when dry. Panicle 5-20 cm, narrowly oblong in outline, sparsely to moderately branched, the branches ascending spikelets 2.5-3 mm, ovate, pallid but often tinged with purple, acute. Lower glume one third of the length of the spikelets, broadly ovate (Boulos, 2005).

Notes

Panicum repens **is a wild ancestor of Guinea grass (*Panicum miliaceum* Jacq.), Vincient *et al.* (2013).**

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Close-up view of Panicum repens

19 *Pennisetum glaucum* (L.) R. Br.

- **Synonyms:** *Panicum glaucum* L.
  Panicum americanum L.
  Sataria glauca L.
  Sataria lutescens (Weigel)..
- **Arabic name:** Dokhin
- **English names:** Pearl Millet.
- **Habitats:** Margin of cultivated field
- **Uses:** Fodder
- **Relatedness:** GP1B, TG1B

Morphological description

Robust annual to 3 m, ligule a line of hairs, Leaf blades 1 X 0.07 m, flat. Panicle 10-50 cm, dense, rhachis tomentose. Bristles glabrous or plumose, often shorter than the spikelets. Spikelets 3-6 mm, obovate. The lemma as long as or almost as long as the spikelet, firmly membranous, truncate or shallowly emarginated, ciliolate at the tip and often pubescent on the margins. Upper lemma ovate, very obtuse, smooth and shining on the back (Boulos, 2005).

Notes

***Pennisetum glaucum* is known as pearl millet. It escaped from cultivated areas and is considered one of the wild relatives of the same grass, Vincient (2013).**

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Close-up view of Pennisetum glaucum

20 *Sorghum halepense* (L.) Pers.

- **Synonyms:** *Holcus halepensis* L. *Holcus exiguous* Forssk.,
- **Arabic name:** Hashish El- Faras
- **English names:** Johnson grass
- **Habitats:** Margin of cultivated field
- **Uses:** Fodder
- **Relatedness:** GP2, TG3

Sorghum halepense

Morphological description

Rhizomatous perennials to 1.5 m, slender to rather stout. Panicle 10-55 cm, lanceloate to pyramidal in outline, primary branched compound, bare at the base, ultimately bearing racemes of 1-5 spikelet-pairs. The sessile spikelet 4.5-5.5 mm, elliptic. Lower glume keeled above, the wings of the keels widening upwards to end in minute teeth, forming with the apex a distinctly equally 3-toothed tip, pilose on the back. Upper lemma acute and minutely mucronate to 2- dentate and with an awn 1-1.6 cm (Boulos, 2005).

Notes

Sorghum halepense **is closely related to the most common fodder plant in Kharga Oasis** ***Sorghum bicolor*****, Rocha *et al.* (2021).**

Close-up view of Sorghum halepense

Family

SOLANACEAE

- 21- *Solanum nigrum* L. Var. nigrum
- 22- *Withania somnifera* Täckh

J

Morphological description

Herbs, climbers without tendrils, shrubs or small trees, glabrous or pubescent, often with stellate hairs. Stem armed with prickles or unarmed. Leaves usually alternate, the margins entire or sinuate or divided and lobed. Inflorescences axillary or supra-axillary owing to adnation, or terminal cymes or panicles, sometimes flowers solitary, bisexual or rarely monoecious. Caylx lobes 4-6 or slightly dentate, often a crescent, rarely caduceus. Corolla gamopetalous, tubular, campanulate or rotate, usually regular or slightly zygomorphic or rarely bilabiate.

Corolla -lobes 4-6, usually imbricate. Anthers 2-locular, dehiscence by apical pores or longitudinal slits, disc often well marked, ovary superior, 2-5 locular with axillary placentation. Stamens 2, 4, 5 or more. Fruit a berry, drupe or capsule, indehiscent or dehiscing irregularly by 2-4 valves. About 94 genera, and 2950 species worldwide, especially the tropics (Boulos, 2002).

21 *Solanum nigrum* L. Var. nigrum

- **Synonyms:** *Solanum americanum* Mill.
- **Arabic name:** Enab El- Deeb
- **English names:** Black nightshades
- **Habitats:** Margin of cultivated field
- **Uses:** Medicinal
- **Relatedness:** GP2, TG3

Solanum nigrum

Morphological description

Erect annual to 70 cm, stem terete, branched, glabrescent to villose, with glandular and eglandular hairs. Leaves 3-7 X 1.5-3.5 cm, ovate-lancelolate, entire or dentate, Flower 5-10 in simple lax cymes, pedicel recurved in fruit. Calyx deeply lobed. Corolla 1.1.5 cm diameter, white, rather deeply lobed, berry 0.5-1 cm, spherical, black (Boulos, 2002).

Notes

Solanum nigrum is considered as an ancient ancestor of many vegetables such as: *Solanum lycopersicum* Landucci ***et al.*** (2014).

Fruits of Solanum nigrum

22 *Withania somnifera* Täckh

- **Synonyms:** *Physalis somminfera* (L.)
  Withania microphysalis Suess.
  Withania kansuensis Kuang & A. M. Lu
- **Arabic name:** Semm Fraakh
- **English names:** Winter cherry
- **Habitats:** Waste lands
- **Uses:** Medicinal
- **Relatedness:** GP2, TG3

Withania somnifera

Morphological description

Erect perennial or semi woody shrub, up to 1 m tall. Whole plant hoary with stellate hairs. Stem terete. Leaves 2-11 X 1.5-9 cm, broadly ovate, subacute, unequal at the base. Flowers 3-6 together. Caylx 2mm, enlarging after flowering to 1-2 cm, the teeth liner, Corolla 8 mm, clearly 5 lobed, greenish, ovary glabrous berry globose, bright red, compressed (Boulos, 2002)

Notes

Withania somnifera is very similar and closely related to Phsalis ***philadelphica Lam*** (Mexican Husk).

Fruits of Withania somnifera

05

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