

## Diversity of Parasitic Plants in Qatar

By

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Prof. Fahmy examine the haustoria of the parasite during a research field trip in desert area near Kharrarah (April 2005). Mr. Saoud Helmy was his companion.

### Welcome...

... This is the fourth issue of volume 2 of the monthly scientific newsletter which concerns all research activities of Qatar biodiversity.

... Prof. Gamal M Fahmy was seconded to Qatar University (2002-2007). In Qatar he continued his brilliant research works on Plant ecology and Ecophysiology. He also investigated deeply the biological relationships between Qatari plants and other organisms specially microbes and animals. Moreover, he was the chief person who supervised the herbarium of Biology Department in Qatar University. As a dedicated person, he wrote this article which selected from one of his many valuable research articles.

### Introduction

Parasitic plants are diverse group of angiosperms (flowering plants) that rely on host plants for growth and development. Parasitic plants depend partially or completely on host for carbon, nutrients and water which they require by attaching to it by specialist multicellular structures known as haustoria [1]. The site of attachment to the host classifies the parasite as either root or shoot parasite. The presence or absence of functional chloroplasts defines the parasite further as being either hemiparasitic or holoparasitic, respectively [2]. Parasitic plants are common in many ecosystems from tropical rain forests to the high arctic [3]. It has been estimated that about 1% of the flowering plants, approximately 3000 species in total, are parasitic [4]. The flora of Qatar comprises 371 species in 236 genera and 62 families including 53 of Dicotyledons, 8 of Monocotyledons, one of Gymnosperms [5]. In the State of Qatar there are four genera of parasitic plants. They represent 1.7% of the total genera.

### Diversity:

In the State of Qatar all the parasitic plants are total parasites (holoparasites) and belong to the families Cuscutaceae, Orobanchaceae and Cynomoriaceae of the Dicotyledons. The parasitic plants in the flora of Qatar include the following genera and species:

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**Fig. 1.** Thin yellow richly branched stems of *C. chinensis* Lam. parasitizing the shoots of *Clerodendrum inerme* Gaertn. The gardens of the Qatar University Campus. October 21, 2006.



**Fig. 2.** The thin yellow stems of *C. chinensis* twines around the shoot of *Clerodendrum inerme* and send two haustoria in the stem of the host (on the left side of the figure).

## 1- *Cuscuta* L.

**Description:** The genus *Cuscuta* belongs to the family Cuscutaceae which includes the stem parasites *Cuscuta pedicellata* Ledeb., and *C. chinensis* Lam., [6]. These plants are known as Hamool in Arabic. The parasites have yellow, richly branched thin stems and very small scaly leaves (**Figs. 1 and 2**). The stem of the parasite twines around the host stem and sends many haustoria which penetrate the tissues to obtain water and nutrients. The flowers are small in dense clusters. The fruits are capsules. **Hosts:** *Cuscuta* species are fairly common in Qatar [6], parasitizing some wild and cultivated plants such as *Ziziphus nummularia* (Burm.) f. Wight et Walk-Arn., from the family Rhamnaceae, Alfalfa, watercress and many ornamental plants such as *Clerodendrum inerme* Gaertn, from the family Verbenaceae. **Uses:** The stems of *C. chinensis* are expectorant, carminative, tonic, anathelmentic, purgative, diaphoretic and lessens inflammations and useful in muscles and joints pain [7].The seeds are carminative, tonic, diaphoretic, sedative and diuretic.



**Fig. 3.** *Cistanche phelypaea* (L.) Cout., (known as Dhanoon in Arabic) parasitizing *Arthrocnemum macrostachyum* (Mor.) K. Note the numerous aboveground flowering stalks carrying yellow flowers of the parasite. Coastal salt marsh at Ras Matbach. March 5, 2006.

## 2- *Cistanche* Hoffmanns & Link

**Description:** This genus belongs to the family Orobanchaceae. In Qatar, *Cistanche* is represented by one species which is *Cistanche phelypaea* (L.) Cout., (known as Dhanoon in Arabic). *C. phelypaea* is an obligate root parasite (holoparasite) of perennial hosts. The mature body of the parasite consists of an underground perennial fleshy or tuberous rhizome from which arise thick above ground annual flowering stalks (**Fig. 3**) (ranging from 1 to 7) appearing during the spring time [12, 13]. The flower (3-5 cm in length) is yellow and curved in the middle. Flowering period extends from March to April. The fruit is a capsule with two valves and persistent style. **Hosts:** *C. phelypaea* is very common in the littoral salt marshes in Qatar. It

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parasitizes *Arthrocnemum macrostachyum* (Moric.) Koch, from the family Chenopodiaceae and *Zygophyllum qatarense* Hadidi, from the family Zygophyllaceae. **Uses:** The acute toxicity of the plant is low [7]. The plant is aphrodisiac, used as a tonic in spermatorrhea and impotence. It is used against diarrhea and is employed as a cataplasm against contusions [14].

**Fig. 4.** *Orobanche ramosa* L., (known as Halook in Arabic).



### 3- *Orobanche* L.

**Description:** This genus belongs to the family Orobanchaceae which is also known as the broomrape family. In Qatar, *Orobanche* is represented by one species; *Orobanche ramosa* L., (known as Halook in Arabic) which is non-native to the country [8]. It is most probable that it has been introduced with the soil and seeds imported from its native habitats in Europe, Africa and south west Asia. The plant is an annual or short lived perennial parasitic herb (Fig. 4), 15-40 cm high with branched stem mostly bulbous thickened at the base. The plants are devoid of chlorophyll and the leaves are reduced to scale-like structures. From the underground stem arise above ground glandular hairy inflorescences carrying many flowers with pale blue flowers [9]. The fruits are capsules. The seeds of *O. ramosa* are minute and are found in capsules in prodigious numbers. Most weeds have seed weights ranging from about 0.1 g per 1000 seeds to about 3.0 g per 1000 seeds, and the lighter seeds are considered to have a decided advantage in dissemination. The seeds of *O. ramosa* are minute and of near-microscopic size. The length of a single seed reaches 0.05 mm. Additionally, 1000 seeds of most *Orobanche* species weigh fractions of one gram (less than 0.005 g) and one plant may produce 270,000 seeds. For survival, parasitic plant seedlings must quickly find a suitable host plant. To germinate, broomrape seed requires exposure to a biochemical exudates produced by the root of the host plant, a phenomenon highly advantageous to the parasite. The radicle of *Orobanche* species grows chemotropically toward host plant roots. This germination feature probably is highly evolved and acts to enhance seeding survival [10]. There are many haustoria arising from the underground stems. The haustoria penetrate the host roots to absorb water and nutrients.

**Hosts:** The parasite attacks a number of crop plants and vegetables growing in cultivation such as tomato and marrow. The parasite causes considerable yield losses. **Uses:** According to my knowledge there is no particular medicinal use of *O. ramosa*. During the 16<sup>th</sup> and 17<sup>th</sup> centuries some broomrape species were used as medicinal herbs throughout most of Europe and Russia [11]. They have been prescribed as a remover of stone in the bladder and kidneys. Applied externally, the juice was regarded as a singular remedy in the treatment of wounds and ulcers. The decocted flower spikes were used as a wash for cleansing the skin.

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**Fig. 5.** *Cynomorium coccineum* L. (known as Trathuth in Arabic) associated with its host *Arthrocnemum macrostachyum*. The soil was dug to the level of the underground rhizome, where it was peeled off to be easily contrasted in the figure.



**Fig. 6.** Numerous haustoria (arrows) emerging form the underground rhizome of *Cynomorium coccineum*. Magnification is 1.8 X.



**Fig. 7.** Several inflorescences arising from the thick underground tuberous rhizome of *Cynomorium coccineum*. Note that numerous host roots are connected to the haustoria on the tuberous rhizome of the parasite. April, 2005.



**Fig. 8.** The root parasite *Cynomorium coccineum* infecting the host *Limonium axillare* (Forssk.) Kuntze, in the coastal salt marsh at Ras Matbach, March 25, 2006.

#### 4- *Cynomorium* L.

**Description:** In Qatar, the family Cynomoriaceae is represented by *Cynomorium coccineum* L. which is a perennial holoparasite on roots of host plants in salt marshes and maritime sands, as well as, in some desert habitats [6]. The mature plant of *C. coccineum* (**Fig. 5**) consists of an underground unbranched thick reddish-brown rhizome carrying numerous haustoria (**Fig. 6**). It grows underground for most of the year, absorbing water and nutrients from the roots of its hosts. When winter rains come, its tuberous rhizome shoots red club-shaped inflorescences (**Fig. 7**) carrying numerous unisexual and bisexual minute flowers mixed together. Female and male flowers are about 3 and 5 mm in length, respectively. These tiny scarlet flowers are so small that they can hardly be seen individually. Tightly packed and scale-like, they look somewhat like coarse fur. Flowering occurs from April to May. Fruit is a one seeded nut let [6]. The lower part of the inflorescence is devoid of flowers and covered by fleshy deltoid scale leaves. The plant is rich in starch, anthocyanins, tannins and naphthoquinones [15]. The local name of the plant is "tarthuth" which is common through Arab countries. **Hosts:** In the desert and maritime habitats of Qatar, the field studies conducted by the author during the period from March 2003 to June 2007 indicated that the root parasite *C. coccineum* was found infecting two different hosts namely: *Limonium axillare* (Forssk.) Kuntze, (**Fig. 8**) and *Zygophyllum qatarense* Hadidi, from the family Zygophyllaceae. Previous studies indicated that *C. coccineum* infects the roots of

*Arthrocnemum macrostachyum*, *Seidlitzia rosmarinus* Bunge ex Boiss., and *Atriplex portulacoides* L., from the family Chenopodiaceae [6, 7]. **Uses:** *C. coccineum* has been harvested from the deserts of North Africa and the Middle East for thousands of years. Arabs and Bedouins eat the interior portions of fresh young stems, prepare infusions of older stems to treat colic or stomach ulcers, or dry and pulverize the plant for use as a spice or condiment with meat dishes [16]. Arab physicians of the Middle Ages considered *C. coccineum* (tarthuth) "the treasure of drugs" because it had a wealth of traditional therapeutic uses. Al-Razi (865-925), known to Europeans as Rhazes and one of the most influential of all Islamic physicians prescribed tarthuth as a remedy for hemorrhoids as well as for nasal and uterine bleeding. The red pigment of the plant provides another benefit. It has been used as an effective fabric dye by the women of at least one Arabian Tribe, the Manasir, many of whom now lives in the United Arab Emirates. The dye produces a rich, colorfast crimson hue known as *dami* or "blood-red" [16]. In 1978, researchers reported in an Iranian medical journal that *C. coccineum* harvested in Iran was found to possess significant blood pressure lowering activity when tested on dogs. The effect occurred chiefly in tests on the fresh juice of the plant, or juice dissolved in water [17]. The entire plant is aphrodisiac, spermatopoietic, tonic, astringent and is used for bile obstruction [9]. Modern biomedical and phytochemical research on *C. coccineum* has demonstrated a variety of activities from plant extracts. Effects of the parasite on mammalian reproductive cells include modulation of pituitary gonadotrophins [18] as well as changes in testicular development [19] and epididymal sperm patterns [20].

Ethnopharmacology, the study of traditional plants and herbal remedies- is a quickly developing field and further research is needed to identify the medicinal values of the parasitic plants, as well as, many wild plants in the Arabian desert.

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