Distribution and Host Range of ParasiticFlowering Plants of Saudi Arabia. A Review

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Abstract

Distribution and host range of more than thirty species and infraspecific taxa of parasitic flowering plants belonging to seven families in six phytogeographical regions of Saudi Arabia are reviewed. Most of these parasitic flowering plants specially members of Loranthaceae, Orobanchaceae and Scrophulariaceae are confined to the Southern Region. None of the studied parasitic flowering plants were found to occur in the Empty Quarter (Al-Rub Al-khali desert) with the exception of the root parasite *Cistanche phelypaea* (Orobanchaceae), which was found parasitizing the perennial members of Chenopodiaceae and Zygophyllaceae.

Keywords: : Parasitic flowering plants, Distribution, Host range Phytogeographic regions, Saudi Arabia.

1. Introduction

The kingdom of Saudi Arabia (Lat. 16° 83º N- 32° 34º N , Long. 34° 36º E - 56° E) is a vast arid desert with an area of about 2,200,000 square kilometers, occupying 4/5th of the Arabian Peninsula (Figure 1). It has a Mediterranean climate in the North and monsoon one in the South. According to[14], Saudi Arabia can be classified into eight phytogeographical regions i.e. Northern region, Nefud region, North Hijaz region, South Hijaz region, Southern region, Najd region, Eastern region, and Al-Rub al-Khali Desert. Other classifications have also been proposed such as that by [17] who suggested six phytogeographical regions : Northern, Southern, Central, Western, Eastern and The Empty Quarter (Al-Rub Al-Khali Desert).For the sake of consistency, " this six regions"

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classification will be used in this study. Each of the six phytogeographical regions has its local climatic conditions and hence each of them has different types of vegetation and plant communities. In Saudi Arabia six vegetation types have been recognized, viz. mangrove, reed swamp, halophytic, xerophytic, woodland and ephemeral vegetation's [17].

The distribution and host range of parasitic flowering plants in Saudi Arabia have so far received little more than a mere mention in predominantly floristic works; a few publications dealing mostly with individual species in limited parts of the country are on record [6, 13,16,8, 2, 12]. Among the parasitic species repeatedly mentioned in floristic and other studies are *Orobanche, Cistanche* and *Cuscuta* spp., perhaps owing to their much wider distribution. Therefore, this study presents a comprehensive review on the distribution and host range of parasitic flowering plants of Saudi Arabia.

2. The Parasitic Flowering Plants of Saudi Arabia

Seven families including 13 genera and 32 species and infraspecific taxa of parasitic flowering plants occurring in Saudi Arabia are listed In Table 1. Most of these plants have more than ninety years of floristic history in Arabia since the work of [4].

1.OROBANCHACEAE. Members of this family are obligate root parasites. There are two genera of this family in Saudi Arabia, *Cistanche* and *Orobanche*) (Table 2).

***a. Cistanche*:** (Figure. 2)**.** Three species of this genus including *Cistanche phelypaea* L. Cout., *Cistanche tubulosa* (Schenk) R. Wight and *Cistanche violacea* (Desf.) G. Beck**,** have been reported in Saudi Arabia [5]. The first species is the most common and is distributed throughout nearly all phytogeographical zones of Saudi Arabia. However, the ecological aspects of *C. phelypaea* in Saudi Arabia have been reported by [8],and its distribution and host range in Al-Ahsa Oasis, Saudi Arabia have been recently investigated by [12]. *Cistanche tubulosa* is mostly found on *Tamarix* spp. in North Hijaz (Western Region), Najd (Central Region) and the Eastern region [14,5].*Cistanche*

violacea has been reported only from the Turaif area (Northern region) on *Atriplex leucoclada* and *Astragalus spinosus* [5].

b. *Orobanche*: (Figure 3). Members of this genus are parasites on solanaceous and leguminous plants. There are ten species and infraspecific taxa of *Orobanche* in Saudi Arabia (Table 1).They occur mainly in the Central, Western and Southern regions. Among the Orobanche species, *Orobanche ramosa* L. and *Orobanche aegyptiaca* Pers. are the most serious. *Orobanche ramosa* was found on *Juniperus* spp. in the area between Jeddah and Taif (Western region), while *Orobanche aegyptiaca* was reported on *Horwoodia dicksoniae* near Zabira, north of Burayda and around Riyadh (Central region) [5] and on tomatoes in Al-Kharj and Unayzah (Central region).

Orobanche *caucasica* Beck on *Calligonum comosum*, *Orobanche cernua* Loefl. var. *cernua* on solanaceous plants e.g. *Lycium* spp. and *Orobanche cernua* Loefl. var. *deserotum* on members of the Compositae e.g. *Rhanterium eppaposum* were found to occur in the North of Burayda, Central region [5]. According to [1,14] and [5], the following species and infraspecific taxa are confined to the Southern region: *Orobanche cernua* Loefl. var. *latebracteata* Beck, *Orobanche minor* Sm. on *Juniperus* spp., *Orobanche muteli* F. Schultz var. *angustiflora* Beck on *Romex nervosus*, *Orobanche oxyloba* (Reuter) Beck var. *oxyloba* on *Rumex nervosus* as well, and *Orobanche pubescens* Urv. on unspecified host plants.

2. **Cuscutaceae** (Figure 4). Members of this family are leafless obligate stem parasites subsisting on a wide range of host plants. All four species of *Cuscuta* reported in Saudi Arabia and their geographical distribution are given in Table 2. These are *Cuscuta campestris* Yuncker, *Cuscuta hyalina* Roth., *Cuscuta pedicillata* Ladeb. And *Cuscuta planiflora* Tenore [2]. The first is the most serious pest with regard to its host range and injurious effects on host plants. It has reported on 28 host plants belonging to 17 different families in the Riyadh area (Central region) [6]**.** In Al-Ahsa (Eastern region) , the same species was found parasitizing the cultivated species : *Allium cepa, Capsicum annum, Citrus aurantifolia, Cucumis melo, Cucurbita moschata, Lycopersicon esculentum,*

Medicago sativa, Phoenix dactylifera (offshoots), *Pimpnella anisum, Solanum melongena, Vicia faba* and *Vitis vinifera*, as well as some weeds such as *Convolvulus arvensis, Chenopodium murale, Cynodon dactylon, Malva parviflora, Phragmites australis, Polygonum aviculare* and *Suaeda* spp. [16]. In a pot experiment**,** *Cuscuta campestris* was found to parasitize twelve legume crops namely, *Cicer arietinum***,** *Clitoria ternatea, Lablab purpureus, Lathyrus sativus, Lens culinaris, Lupinus termis, Medicago sativa, Phaseolus vulgaris, Pisum arvense, Pisum sativum* and *Vicia faba* [11]**.** *Cuscuta planiflora* was found parasitizing a number of host plants in Al-Ahsa campus of King Faisal University (Eastern region) , e.g. *Clerodendron inerme, Convolvulus arvensis, Dodonaea viscosa, Lantana camara, Ocimum basilicum, Petunia hybrid, Setaria verticillata* and *Sonchus oleraceous*. It was also reported on *justicia flava* along the Jeddah- Taif road, Western region [5]. *Cuscuta hyalina* and *Cuscuta pedicellata* were reported to parasitize a vaiety of herbs and grasses in Central, Eastern and Western regions [14,5].Cultural control of *Cuscuta* consists of cutting the prasitized branches and burning them. Tillage operations are also practiced to bury the seeds deep into the ground. Chemical control using glyphosate (Isopropylamine salt of N-phosphonomethyl-glycine) was recommended at a concentration of 200 ml/100 L on *Citrus aurantifolia* and 125 ml/100 L on *Medicago sativa* [16].

3. SCROPHULARIACEAE (Figure. 5). Among the 26 parasitic genera of this family **[10],** only two genera namely *Alectra* and *Striga* were reported to occur in the Southern region of Saudi Arabia. *Alectra parasitica* Hochst. ex. A. Rich. was found parasitizing *Hypoestes forskalei* [5]. The genus *Striga* is represented by three species including *Striga asiatica* (L.) Kuntze on wild grasses, *Striga gesnerioides* (Willd.)Vatke ex Engl. on *Euphorbia inarticulata* [5] and *Striga hermonthica* on its favoured host, *Sorghum bicolor* [15].

4. LORANTHACEAE. This family is represented in Saudi Arabia by five genera and eight species. Seven species are confined to the Southern and Western regions, while one (*Plicosepalus acaciae* (Zucc.) Wiens and Polhill) is confined to Tabuk (Northern region)

and was found on *Capparis decidua*. All species are stem parasites on trees with Acacias being the favourable hosts. *Oncocalyx schimperi* (Hochst. ex. A. Rich)M. Gilbert has been reported on *Maerua crassifolia* and *Monotheca buxifolia* from Taif (Western region) and Abha(Southern region), respectively [5]. *Plicosephalus curviflorus* (Benth Exoliv)Tiegh. (South of Makkah, Western region) was found on Acacias, while *Phragmanthera* sp. Aff. Rufescens (DC)Balle was reported on *Ziziphus spinachristi* in the areas of Asir and South Hijaz (Southern region) [5]. *Tapinanthus globiferus* (A. Rich) Tiegh. from Abha (Southern region) was reported on *Ficus salicifolia* and *Commiphora* sp**.** [5]. *Tapinanthus* sp., *Viscum schimperi* Engl., and *Viscum* sp. (Southern region) were found mainly on *Acacia* spp. Other reported host plants of *Tapinanthus acacia*e and *Viscum* sp. include *Ficus carica, Ficus rupestris, Olea europoea, Prunus domestica, Prunus persica, Psidium guajava, Ziziphus spinachristi* together with species of *Salix* ana *Tamarix* [13].

5, 6,& 7. LAURACEAE, CYNOMORIACEAE and HYDNORACEAE. Lauraceae, Cynomoriaceae and Hydnoraceae are represented by one parasitic species each. *Cassytha filiforms* L. (Lauraceae) was found parasitizing stems of trees and shrubs in lowlands around Jabal Fayfa (Southern region), and *Salvadora persica* being the favoured host [5], while in Al-Ahsa (Eastern region) it was observed on *Ziziphus spinachristi* (Personal observation). *Cynomorium coccineum* L. (Cynomoriaceae) is a root parasite on a number of host plants specially members of Chenopodiaceae. It was reported to occur in Al-ahsa and other areas of the Eastern region, Najd (Central region) and the Northern region [14,7,10,5]. *Hydnora johannis* Becc. (Hydnoraceae) was found in the area between Sabiya and Idabi (Southern region) parasitizing a variety of plants e.g. *Cissus rotundifolius* as well as species from *Commiphora, Grewia, Maytenus* and *Acacia* [5].

In view of the relatively small number of genera and species reported by various authors in the flora of Saudi Arabia, it may be concluded that this flora is remarkably rich in parasitic flowering plants. This poses potential threats not only to the nearby agricultural crops, but also to the sparse vegetation of this arid land, particularly other species from the same genera and families known to be afflicted by them.

Table 1. Parasitic flowering plants in Saudi Arabia, referred to their respective families (According to Riry Shaw,1966) .

Family	**Species**	
Cuscutaceae	*Cuscuta campestris* Yuncker *Cuscuta hyaline* Roth	.*Cuscuta pedicillata* Ladeb. *Cuscuta planiflora* Tenore
Cynomoriaceae	*Cynomorium coccineum* L.	
Hydnoraceae	*Hydnora johannis Be*cc.	
Lauraceae	*Cassytha filiformis* L.	
Loranthaceae	*Oncocalyx schimperi* (Hochst. Ex A. Rich)M. Gilbert *Phragmanthera sp.* Aff. Rufescens(DC.)Ball*e* *Plicosepalus acacia* (Zucc.)Wiens & Polhill	*Plicosepalus curviflorus* (Benth. Ex. Oliv.) Tiegh *Tapinanthus globiferus* (A. Rich)Tiegh *Tapinanthus* sp. *Viscum schimperi* Engl. *Viscum* sp.
Orobanchaceae	*Orobanche cernua* Loefl. var. *deserotum* *Orobanche cernua* Loefl. var. *latebracteata* *Orobanche minor* Sm. *Orobanche muteli* F. Schultz var. *angustiflora* Beck. *Orobanche oxyloba* (Reuter)Beck. Var. *oxyloba* *Orobanche pubescens* Urv. *Orobanche ramosa* L	*Cistanche phelypaea* (L.)Cout. *Cistanche tubulosa* (Schenk.)R.Wight *Cistanche violacea* (Desf)G. Beck *Orobanche aegyptiaca* Pers. *Orobanche caucasica* Beck. Orobanche cernua Loefl. var. cernua Orobanche cernua Loefl. var. deserotum
Scrophulariaceae	*Alectra parasitica* Hochst.ex.A Rich. *Striga asiatica* (L.)Kuntze .	*Striga gesnerioides* (Willd.)Vatke ex. Engl. Striga hermonthica (Del.)Benth

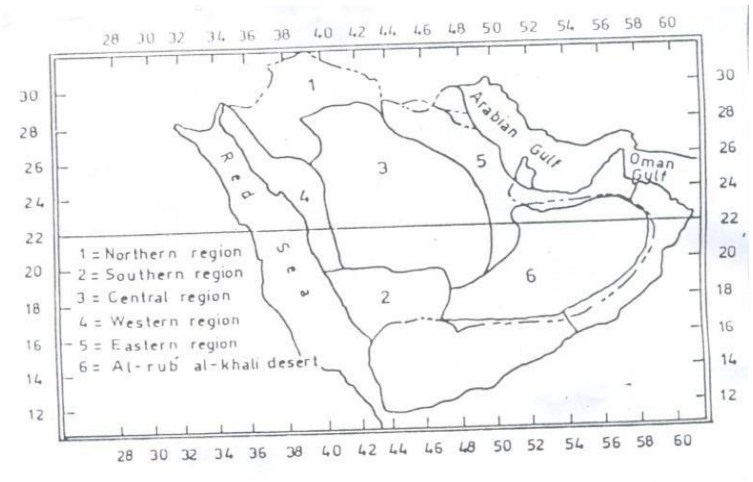

Figure 1. Phytogeographical Regions of Saudi Arabia

Table 2. Distribution of parasitic flowering plants in the six phytogeographical regions of Saudi Arabia.

Northern Region	Southern Region	Central Region	Western Region	Eastern Region
Cistanche phelypaea *Cistanche violacea* *ccineu mCynomorium coccineum* *acaciaePlicocepalus acacia*	*Alectra parasitica* *Tapinanthus globiferus* *Cassytha filiformis* *Viscum schimperi* *Cistanche tubulosa* *Cuscuta hyalina* *Hydnora johannis* *Oncocalyx schimperi* *Orobanche c ernua* var. *latebracteata* *Orobanche minor* *Orobanche muteli* var. *angustiflora* *Orobanche oxyloba* var. *oxyloba* *Orobanche pubescens* *Orobanche ramosa* *Phragmenthera rufescens*	*Cistanche phelypaea* *Cistanche tubulosa* *Cynomorium coccineum* *Cuscuta campestris* *Cuscuta pedicellata* *Cuscuta planiflora* *Orobanche aegyptiaca* *Orobanche caucasica* *Orobanche cernua* var. *cernua* *Orobanche cernua* var. *deserotum*	*Cistanche phelypaea* *Cistanche tubulosa* *Cuscuta hyalina* *Cuscuta planiflora* *Oncocalyx schimperi* *Orobanche muteli* var. *angustiflora* *Orobanche* ramosa *Plicosepalus curviflorus*	*Cassytha filiformis* *Cistanche phelypaea* *Cistanche tubulosa* *Cuscuta campestris* *Cuscuta hyalina* *Cuscuta planiflora* *Cynomorium coccineum* *Orobanche aegyptiaca* - Empty Quarter (Al-Rub Al-Khali Desert) *Cistanche phelypaea*

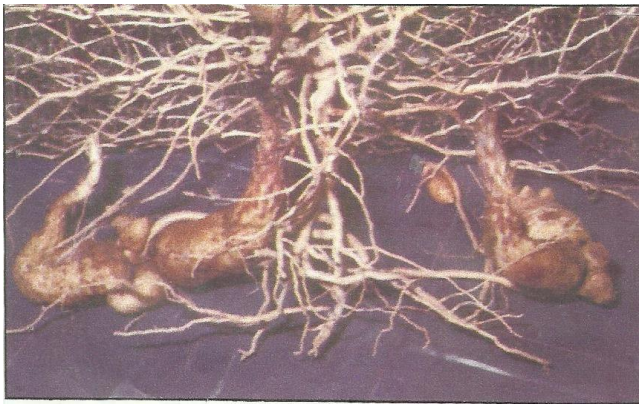

Figure 2. Cistanche Phelypaea Parasitizing The Root System of Zygophyllum Quatarense

Figure 3. Orobanche Aegyptiaca Attached to the Root System of Tomato (Lycopersicom Esculentum)

Figure 4. Field Dodder (Cuscta Compositris) Forming Tight Coils Around the Leaves of Onion (Sorghum Bicolor)

Figure 5. Striga Hermonthica with Its Favorable Host Sorghum (Sorghum Cicolor)

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