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PARASITIC FLOWERING PLANTS ON CULTIVATED PLANTS IN JORDAN-THE PRESENT STATUS AND MANAGEMENT

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ABSTRACT

Parasitic flowering plants are problematic species, posing high concern to farmers, and potential threat to agriculture and forestry in Jordan. Recent field research revealed the occurrence of 8 parasitic genera belonging to 6 plant families in the country. Parasitic plants found belong to the families Orobanchaceae (Orobanche and Cistanche), Cuscutaceae (Cuscuta), Santalaceae (Osyris and Thesium), Cynomoriaceae (Cynomorium), Viscaceae (Viscum) and Loranthaceae (Loranthus). Parasites were found attacking a wide host range of plants of wild herbs, field crops, forage plants, rangeland shrubs and forest and fruit trees. They are spread in different biogeographical regions with clear variations in their ecological tolerance. Many of the hosts recorded and certain parasitic species are reported for the first time. Possible management of these parasites based on recent research findings, some recommendations and experiences of local farmers are discussed.

Keywords: Parasitic plants, host species, problematic weeds, management.

INTRODUCTION

Weeds represent a major threat to agriculture in Jordan and cause great yield losses due to their negative interference with crop plants (Qasem, 2003). Parasitic weeds are one group of high concern to farmers as well as to researchers, and represent a real danger to agriculture. These parasites subset on the root system or aerial vegetative parts of the host species and can lead to severe growth damage, yield failure and in most cases death of host plants under heavy infestation. Parasitic weeds may or may not have chlorophyll pigments and thus may partially or completely depend on host plants for food and/or water (Parker and Riches, 1993).

In Jordan, three families including 3 genera have already been reported to attack 34 wild and cultivated species (Abu-Iramileh, 1979). The danger these parasites exert is mainly due to their difficult

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control with available weed control methods, except by soil fumigation against certain species, which is not economically feasible on a wide scale. In addition the huge number of seeds produced accompanied with long seed viability and adaptability to disseminate by wind (*Orobanche*, *Cistanche*, and *Cynomorium*), animals or birds (*Loranthus*, *Viscum* and *Osyris*), or crop infested seeds (*Cuscuta*, *Orobanche* and *Thesium*) added more complications to control methods. The interrelationship and the way they connect to host plants through the absorptive organs (suckers or haustoria) are another means through which they challenge control measures. Morphological and physiological similarities between these and their hosts and the ability of certain species to develop additional shoots from epicortical roots or embedded haustoria (*Cuscuta* spp.) especially after damage to or removal of the primary shoot (*Viscum* and *Loranthus*) hinder pruning and herbicide use as a common method of control.

The aim of this study was to: (1) survey parasitic flowering plants of cultivated crops in Jordan; (2) familiarize agriculturist with the threat these species exert on agriculture; and (3) quantify the significant changes that have occurred on these species distribution, and hosts.

This paper introduces an update on information and findings on species of parasitic weeds, their hosts and possible management

MATERIALS AND METHODS

Field studies were carried out during the period from 2003 to 2009 at which parasitic flowering species and their hosts were recorded throughout the country. During the survey, parasitic species were identified and recorded with their hosts from cultivated species. Visual estimation was considered to quantify the severity and intensity of infestation on different host species and in the total area surveyed using a scale of light, moderate and high for intensity of infection and another scale of rare, limited, sporadic, common, and very common to indicate prevalence in the total area of the country. All parasitic species were photographed with their hosts.

RESULTS

Prevalence and host status on parasitic weeds in Jordan

Parasitic weeds and their hosts from cultivated species found in different biogeographical regions of Jordan as listed in Table-1. Results showed the presence of 8 genera including *Cuscuta* (6 species) attacking 41 cultivated species of 19 families, *Loranthus* (1 species) attacking 14 species from 8 plant families, *Orobanche* (7 species) parasitizing 55 cultivated plant species belonging to 19 families,

Cistanche (3 species) attacking 9 species from 8 families, *Viscum* (1 species) attacking 7 cultivated species of 4 plant families, *Osyris* (1 species) attacking 10 cultivated hosts from 8 families, *Thesium* (1 species) attack 2 crop species of monocot plant families and *Cynomorium* (1 species) on 2 cultivated species of the same family. However, many of the reported hosts were attacked by more than one parasitic species. Among the recorded parasitic weeds, it appeared that *Cuscuta* and *Orobanche* were the most common on field crops (mainly vegetables) in different biogeographical regions, while *C. campestris* and *O. ramosa* were most spread species. Results showed that different plant species from cultivated plants of different plant families were attacked by these parasites. There is a great potential for *Cuscuta* and *Orobanche* to infest more agricultural lands due to their wide host range from wild species or common weeds. *Loranthus*, *Viscum*, *Cistanche* and *Osyris* species appeared restricted to shrubs, fruit and forest trees, while certain species of *Orobanche* (*cernua*, *palaestina, ramos*a, and *schultzii*) were found parasitizing fruit trees as well as herbaceous plants. Results revealed that a wide host range of plants of different economic importance are parasitized and infestation on certain hosts is quite severe. It has been also shown that many of the common wild species served as hosts for certain noxious parasites (*Orobanche* and *Cuscuta*) giving these a survival strategy to exist and tolerate control measures.

Table-1. Parasitic flowering plants, their families, host intensity of infectionandprevalence in Jordan for the period 2003-2009.

Parasitic species / host	Family	Intensity of infection	Prevalence*
Cuscutaceae			
Cuscuta			
***Cuscuta campestris* Yuncker**			
Allium cepa L.	Liliaceae	Moderate	Common
Allysum maritima (L.) Desv.	Crucifereae	Moderate	Rare
Beta vulgaris Music	Chenopodiaceae	Moderate	Rare
Cicer arietinum L.	Leguminosae	Moderate	Common
Cichorium inthybus L.	Compositae	Light	Common
Citrullus vulgaris Schrad.	Cucurbitaceae	Light	Rare
Corchorus olitorius L.	Tiliaceae	High	Very common
Coriandrum sativum L	Umbelliferae	High	Common
Cucumis melo L	Cucurbitaceae	Light	Rare
Daucus Carota L.	Umbelliferae	Moderate	Common
Duranta plumieri Jacq	Verbenaceae	Moderate	Rare
Foeniculum vulgare Mill.	Umbelliferae	Light	Common
Fragaria vesca L.	Rosaceae	Light	Rare
Lactuca sativa L.	Compositae	High	Common

Lens esculentus (L.) Moench	Leguminosae	High	Rare
Lycopersicon esculentum Mill	Solanaceae	Moderate	Common
Medicago sativa L.	Leguminosae	High	Very common
Mentha viridis L.	Labiatae	Moderate	Rare
Ocimum basilicum L.	Labiatae	Light	Rare
Olea europea L.	Oleaceae	Light	Rare
Origanum syriacum L.	Labiatae	High	Rare
Pelargonium zonale (L.) Aiton (N)	Geraniaceae	Moderate	Rare
Petroselinum sativum Hoffm.	Umbelliferae	Light	Common
Phaseolus vulgaris L.	Leguminosae	Moderate	Rare
Solanum melongena L	Solanaceae	High	Common
Solanum tuberosum L	Solanaceae	Light	Rare
Thymus syriaca Boiss.	Labiatae	High	Rare
Trifolium alexandrium L.	Leguminosae	High	Very common
Triticum durum Desf.	Graminae	Moderate	Rare
Vigna sinensis (L.) Savi ex Hassk.	Leguminosae	Moderate	Rare
*Vinca major*L. (N)	Apocynaceae	High	Rare
Vitis vinifera L.	Vitaceae	Moderate	Common
***Cuscuta epilinum* Weihe**			None
***Cuscuta epithymum* (L.) L.**			
Nicotiana tabaccum L.	Solanaceae	High	Common
Thymus capitatus (N)	Labiatae	High	Rare
***Cuscuta indecora* Choisy**			None
***Cuscuta monogyna* Vahl**			
Allium cepa L.	Liliaceae	High	Common
Casuarina equisetifolia L.	Casuarinaceae	Light	Rare
Cicer arietinum L.	Leguminosae	High	Common
Citrus maxima Merr.	Rutaceae	Light	Rare
Citrus aurantifolia Swingle	Rutaceae	Moderate	Very common
Citrus deliciosa Ten.	Rutaceae	High	Common
Citrus limon (L.) Burm.	Rutaceae	High	Very common
Citrus paradisi Macf.	Rutaceae	Moderate	Rare
Malus domestica Borkh.	Rosaceae	High	Rare
Olea europea L.	Oleaceae	Light	Common
Origanum syriacum L.	Labiatae	High	Rare
Solanum melongena L	Solanaceae	High	Rare
Triticum durum Desv.	Gramineae	Light	Rare
Vitis vinifera L.	Vitaceae	High	Common
***Cuscuta planiflora* Ten.**			
Amygdalus communis L.	Rosaceae	Light	Rare
Trifolium alexanderinum L.	Leguminosae	Light	Common
Loranthaceae			
Loranthus			
Loranthus acaciae			
Acacia arabica (Lam.) Willd	Leguminosae	Light	Rare

Acacia asak (Forssk.) Willd.	Leguminosae	Light	Rare
Acacia cyanophylla L.	Leguminosae	Light	Rare
Acacia farnesiana (L.) Willd.	Leguminosae	Moderate	Common
Casuarina equisetifolia L. ex J.R. & G. Forst	Casuarinaceae	High	Very common
Ficus carica L.	Moraceae	Moderate	Common
Juglans regia L.	Juglandaceae	Light	Rare
Melia azedarach L.	Meliaceae	High	Rare
Parkinsonia aculeata L.	Leguminosae	Moderate	Common
Pistacia vera L.	Anacardiaceae	Light	Rare
Poinciana gilliesii Wallich ex Hook.	Leguminosae	High	Common
Punica granatum L.	Punicaceae	Moderate	common
Retama raetam (Forssk.) Webb & Berthel	Leguminosae	High	Very common
Zizyphus jujuba Mill.	Rhamnaceae	High	Common
Viscaceae			
Viscum			
Viscum cruciatum			
Amygdalus communis L.	Rosaceae	High	Very common
Olea europaea L.	Oleaceae	High	Very common
Prunus armeniaca L.	Rosaceae	Light	Rare
Prunus cerasifera Ehrh.	Rosaceae	Light	Rare
Prunus domestica L.	Rosaceae	Light	Rare
Punica granatum L.	Punicaceae	High	Very common
Retama raetam (Forssk.) Webb & Berthel	Leguminosae	High	Common
Orobanchaceae			
Orobanche			
***Orobanche ramosa* L.**			
Allium cepa L.	Liliaceae	Light	Rare
Anethum graveolens L.	Umbelliferae	Light	GH
Apium graveolense L.	Umbelliferae	Moderate	GH
Brassica oleracea L. var. *botrytis*	Cruciferae	Light	Limited
Brassica oleracea L. var. *Capitata*	Cruciferae	Light	Limited
Brassica oleracea L. var. *Caulorapa*	Cruciferae	Moderate	GH
Calendula officinalis L.	Compositae	High	Rare
Capsicum annum L.	Solanaceae	Moderate	Sporadic
Capsicum fruitisence L.	Solanaceae	Moderate	Limited
Carthamus tinctorius L.	Compositae	Moderate	Rare
Citrullus vulgaris Schrad.	Cucurbitaceae	Light	Rare
Coleous blumei Benth.	Labiatae	Light	Rare
Coriandrum sativum L.	Umbelliferae	Light	Sporadic
Cucumis melo L.	Cucurbitaceae	Light	Limited
Cucumis melo L.var. *flexosus*	Cucurbitaceae	Light	Rare

Cucumis sativus L.	Cucurbitaceae	Light	Common
Cucurbita pepo L.	Cucurbitaceae	High	Very common††
Dahlia pinnata Cav.	Compositae	Light	Rare
Daucus carota L.	Umbelliferae	Light	Limited
Dianthus caryophyllus L.	Caryophyllaceae	Light	Rare
Eriobotrya japonoca Lindl.	Rosaceae	Moderate	Rare
Foeniculum vulgare Mill.	Umbelliferae	High	Common
Gazania splendens Kiss. Mix.	Compositae	Moderate	Rare
Lactuca sativa L.	Compositae	High	Common
Lens culinaris Medik.	Leguminosae	High	Limited
Lepidium sativum L.	Cruciferae	Light	Limited
Linum usitatissimum L.	Linaceae	Light	GH
Lycopersicon esculentum Mill.	Solanaceae	High	Very common
Matthiola annua (L.) Sweet	Cruciferae	Moderate	GH
Medicago sativa L.	Leguminosae	Light	Rare
Mesebryanthemum sp.	Aizoaceae	Light	GH
Nicotiana tabaccum L.	Solanaceae	Light	Limited
Ocimum basilicum L.	Labiatae	Light	Sporadic
Pelargonium grandiflorum (Andrews) Willd.	Geraniaceae	Light	Rare
Pelargonium zonale (L.) Aiton	Geraniaceae	Moderate	GH
Petonia hybrida Vilm	Solanaceae	Moderate	GH
Punica granatum L.	Punicaceae	Light	GH
Rosa damascena Mill.	Rosaceae	Light	GH
Salvia splendens Sellow ex Roem. & Schult	Labiatae	Moderate	GH
Solanum melongena L.	Solanaceae	High	Common
Solanum tuberosum L.	Solanaceae	Moderate	Common
Thunbergia alata Bojer ex Sims	Acanthaceae	Moderate	GH
Thymus syriaca Boiss.	Labiatae	Moderate	GH
Trifolium pratense L.	Leguminosae	Moderate	Common
Tropaeolum majus L.	Tropaeolaceae	Moderate	GH
Vicia faba L.	Leguminosae	High	Very common
***Orobanche aegyptiaca* Pers.**			
Brassica oleracea L. var.*capitata*	Cruciferae	Moderate	Limited
Lactuca sativa L.	Compositae	High	Common
Lycopersicon esculentum Mill.	Solanaceae	High	Very common
Pelargonium grandiflorum L.	Geraniaceae	Light	GH
Prunus persica (L.) Batsch	Rosaceae	Light	Sporadic
Solanum melongyna L.	Solanaceae	High	Common
Solanum tuberosum L.	Solanaceae	High	Limited

Vicia faba L.	Leguminosae	Light	Limited
***Orobanche cernua* Loefl.**			
Amygdalus communis L.	Rosaceae	High	Limited
Cucumis melo L.	Cucurbitaceae	Moderate	Limited
Daucus carota L.	Umbelliferae	Moderate	Common
Ficus carica L.	Moraceae	Moderate	Limited
Helianthus annuus L.	Compositae	Light	Rare
Lycopersicon esculentum Mill.	Solanaceae	High	Very common
Nicotiana tabaccum L.	Solanaceae	High	Very common
Olea europaea L.	Oleaceae	Light	Limited
Petunia hybrida Vilm	Solanaceae	Light	GH
Prunus armeniaca L.	Rosaceae	Moderate	Rare
Prunus persica (L.) Batsch	Rosaceae	Light	Sporadic
Punica granatum L.	Punicaceae	Light	GH
Quercus coccefera L.	Fagaceae	Light	Limited
Solanum melongyna L.	Solanaceae	High	Limited
Solanum tuberosum L.	Solanaceae	Light	Common
Salvia splendens	Labiatae	High	GH
Vicia faba L.	Leguminosae	Light	Common
***Orobanche crenata* Forskl.**			
Daucus carota L.	Umbelliferae	High	Very common
Lycopersicon esculentum Mill.	Solanaceae	High	Very common
Pisum sativum L.	Leguminosae	High	Limited
Vica faba L.	Leguminosae	High	Very common
***Orobanche palaestina* Reut.**			
Amygdalus communis L.	Rosaceae	Moderate	Sporadic
Daucus carota L.	Umbelliferae	Light	Rare
Olea europaea L.	Oleaceae	High	Rare
***Orobanche minor* Sm.**			
Daucus carota L.	Umbelliferae	Moderate	Very common
Vicia faba L.	Leguminosae	Moderate	Common
***Orobanche schultzii* Mutel**			
Amygdalus communis L.	Rosaceae	Moderate	Limited
Olea europaea L.	Oleaceae	High	Limited
Prunus armeniaca L.	Rosaceae	High	Limited
Prunus cerasifera Ehrh.	Rosaceae	High	Limited
Cistanche			
Cistanche lutea (Desf.) Hoffmanns and Link			
Haloxylon persicum	Chenopodiaceae	Moderate	Limited
Cistanche tubulosa (Schrenk) Hook			
Acacia cyanophylla L. (NC)	Leguminosae	Light	Rare
Casuarina equisetifolia L. ex J.R. and G. Forst	Casuarinaceae	Light	Limited

Eucalyptus camaldulensis Dehnh. (NC)	Myrtaceae	Moderate	Rare
Olea europaea L. (NC)	Oleaceae	Light	Rare
Opuntia ficus-carieca L. (NC)	Cactaceae	Moderate	Rare
Pinus sp. (NC)	Pinaceae	Moderate	Rare
Punica granatum L.	Punicaceae	Light	Rare
Trifolium pratense L.	Leguminosae	Light	Common
***Cistanche salsa* (C.A. Mey.) Benth. et Hook.**			
Haloxylon persicum	Chenopodiaceae	Moderate	Limited
Santalaceae			
Osyris			
Osyris alba			
Acacia cyanophylla Lindl.	Leguminosae	Moderate	Limited
Amygdalus communis L.	Rosaceae	High	Moderate
Casuarina equisetifolia L.**	Casuarinaceae	Moderate	Rare
Cupressus sempervirens L. *var. horizontalis* (Miller) Gordon	Cupressaceae	High	Sporadic
Cupressus sempervirens L. *var. pyramidalis* Nyman	Cupressaceae	High	Sporadic
Ficus cariaca L.	Moraceae	Moderate	Rare
Olea europaea L.	Oleaceae	High	Sporadic
Pinus halepensis Mill.	Pinaceae	Light	Sporadic
Prunus domestica L.	Rosaceae	Moderate	Limited
Retama raetam (Forskal) Webb & Berth	Leguminosae	Moderate	Rare
Vitis vinifera L.	Vitaceae	High	Moderate
6. Cynomoriaceae			
Cynomorium			
Cynomorium coccineum			
Atriplex leucoclada	Chenopodiaceae		High
Haloxylon persicum	Chenopodiaceae	Moderate	Limited

* Rare: only on few plants in 1-2 sites of a biogeographical region; Sporadic: few plants infected in one or more biogeographical regions; Limited: on many plants localized in certain locations of 1 or 2 biogeographical regions; Common: on certain plant species in > one biogeographical regions; Very common: on many plant species in different locations of different biogeographical regions; GH: in glasshouses; NC: attachment was not confirmed.

Managements of Parasitic Flowering Plants in Jordan

Surveys of control management methods of parasitic flowering plants in Jordan are generally traditional/primitive or absent for certain parasitic genera. However, farmers' practices in controlling these parasites are shown in Table-2. For most species hand removal is widely practiced in different locations. A combination of more than one method of control is commonly followed against certain genera (e.g. *Orobanche* and *Cuscuta*), while hand removal and pruning are both

used for mistletoes control. In contrast, hand pulling is the only operation practiced against *C. coccineum* while farmers are not familiers with *O. alba* as a parasitic species. Application of soil solarization followed by plastic mulching of the solarized soil and application of chicken manure and\or ammonium sulphate or urea fertilizers are common practices in the Jordan Valley location and may be in other regions. These practices have effectively restricted the infestation and abundance of *Orobanche* spp. and to a less extent *Cuscuta* infestation to vegetable crops. However, soil plastic mulching can be also applied in certain fruit tree orchards. This however, is under experimentation at present while the application of animal manure and straw mulch is a common traditional practice followed by farmers in different regions which may lower infestation by certain root parasitic species (mainly *Orobanche).*

Control of other parasitic species is still at infancy. Mistletoes are usually pruned at later stages and hand removed at earlier phase of infestation. However, the second practice is not effective in most cases since these parasites can revegetate from the inserted suckers inside their hosts and difficult to adopt against *Loranthus* because of many epicortical roots extended on the host stem surface. Herbicide application for control of these parasites is completely absent. *O. alba* control is not practiced by any mean except removal through tillage or by the hoe without any previous knowledge of the farmers on this parasite.

Control of *Cynomorium* and *Cistanche* spp. is mainly practiced through hand-removal of both parasites in different regions while farmers are not enough concerned on losses resulted from these parasites since they mostly attack forage plants and wild shrubs in the desert.

Natural enemies of some parasites may play an important role in their control although no studies on these were conducted under local conditions. The present survey revealed that some of the parasites are attacked by different insects. The larvae of *Thrips* sp. was found in seed capsule (*C. tubulosa*), in the stem of *O. schultzii*, or on leaves and branches of *V. cruciatum* (*Ceroplastes rusci*). Al-Khesraji *et al.* (1987) reported that different natural enemies attacked *Cynomorium* and *Cistanche* spp. in southern desert of Iraq including *Tropinota squalida* attacking species of both genera, *Aphis gossypii* on *Cistanche* spp., larvae of *Eumerus* spp. and those of Lepidoptera (Fam. Sesiidae) on both genera and the larvae was found very effective on *Cynomorium*. *Phytomyza orobanchia* Kaltenbach [Diptera: Agrornyzidae] was also found in the capsules of certain *Orobanche* species. In addition, the same parasitic species were found attacked by different fungi.

Managements of Parasitic Weeds in other Parts of the World

Managements of parasitic species reported from different parts of the world are many and varied but these are still limited in effetivenes and magnitude. However, most recent reported methods are summarized below and for different parasitic genera (Qasem, 2006), viz. (i) the use of natural enemies including *Fusarium* and *Trichoderma, Phytomyza* for *Orobanche*; *Smicronyx* sp. and fungal species for *Cuscuta;* (ii) use of herbicides mainly glyphosate for *Orobanche* control in fababean and different sulfonylurea herbicides for other species (e.g. *O. aegyptiaca* and *O. ramosa* in tomato); (iii) soil solarization and plastic mulch for *Orobanche* and *Cuscuta* species; (iv) plant residue and natural products allelopathy (e.g. for *Orobanche*, root extracts (sunflower), Plant oils (gingelly, groundnuts, palm, sunflower, safflower, castorbean, linseed, neem, coconut or tobacco seed oils, niger (*Guizotia abyssiniaca*), and mustard oils, orobanchol and alectrol germination stimulants, Different strains of *Streptomyces,* certain fungal metabolites including cotylenins and fusicoccins; (v) trap and catch species in crop rotation or intercropping; (vi) genetically engineered crops (herbicide resistant); (vii) plastic mulch with fertilizers (chicken manure, urea, ammonium sulphate); (viii) resistant cultivars for different crop species and screening studies on tolerant/resistant crop lines; (ix) mowing and general contact herbicides for *Osyris* and *Cuscuta* (early infestation in perennial field crops) species control; (x) pruning and shading for mistletoes control; (xi) selective application of MCPA and 2, 4-D for mistletoes control,; and (xii) integrated control

DISCUSSION

Parasitic flowering plants or parasitic weeds represent a real threat and challenge to farmers worldwide (Riches and Parker, 1993) mainly because of difficult control and poor management under field conditions. Difficulty in controlling these species is mainly due to the huge number of seeds they produce, the extended seed longevity of certain species (e.g. *Orobanche*), the wide host range they attack from both cultivated and wild grown species (Qasem, 2006; Qasem and Foy, 2007) the ease of seeds and/or fruits dispersal by different means of specialized or non-specialized agents. In addition, the nature of physiological, anatomical and/or morphological interrelations between parasitic species and their hosts that allows their germination and growth at different time and place and make the control job more difficult and sometimes far reaching. The absence of any suitable and effective method of control including selective and effective herbicides is another obstacle should be added to the problems that these species have in cultivated lands.

Table-2. Managements of parasitic weed control by local farmers in Jordan.

Method of control	*Cuscuta* spp.	*C. coccineum*	*O. alba*	*V. cruciatum*	*L. acaciae*	*Cistanche* spp.	*Orobanche* spp.	*C. coccineum*	*O. alba*
Hand pulling/removal	+	+	-	+	+	+	+	+	-
Hoeing	+	-	-	-	-	+	+	-	-
Soil solarization	+	-	-	-	-	-	+	-	-
Planting date	+	-	-	-	-	-	+	-	-
Root-stocks/Grafting	-	-	-	-	-	-	+	-	-
Plastic mulch	+	-	-	-	-	-	+	-	-
[(N-fertilizers) NH_4 $2SO_4$, Urea, Chicken manure]	+	-	-	-	-	-	+	-	-
Intercropping	-	-	-	-	-	-	+	-	-
Pruning	-	-	-	+	+	-	-	-	-
Soil applied herbicides	≈	-	-	-	-	-	≈	-	-
Foliage applied herbicides	-	-	-	-	-	-	-	-	-

+ = Effective, - = Ineffective

The present survey showed that the main and serious well known destructive parasitic species are available in Jordan, and there is a huge number of host species accommodate their parasitism and spread. While certain parasitic species appeared highly confined to fruit or forest trees, others infest field crops, herbs as well as fruit and forest species. This high variability in host range reflects high physiological tolerance of these species to different hosts. In the other hand, certain species require host stimulants (e.g. *Orobanche*) appeared with a wide host range reflecting their ability to stimulate seed germination and to break parasites seed dormancy. This however, may have an ecological implication in any control program of these parasites. Overall situation, it appears that all kind of vegetation in Jordan are under threat of different parasitic species and there is a great potential for these to spread and invade new regions in the country in absence of any attempt to stop or restrict their hosts and agents. During the survey it was found that many of the wild plant species were attacked by one or more parasitic species emphasizing the role these have in disseminating parasitic plants and the importance of weed control in any well managed control program. It is also shown that certain species attack fruit trees are confined to high lands (e.g. *Osyris alba*) while others (*Loranthus* and *Viscum*) are spreading in different biogeographical regions, which may indicate the role of environmental conditions in distribution and prevalence of these species in different regions and the differences in their ecological tolerance.

Parasitic species are different in the number of host plants they attack which is normal since certain species are highly specific while others are not. However, it is clearly shown that certain strategic crops such as olives, almonds and grapes are highly threaten by different parasitic genera. In addition certain parasites require stimulants for germination while this is not required for other species. It is well documented that chemical, physiological, anatomical and probably other factors are important factors in the compatibility between parasites and their host, in addition environmental factors are another constrain limiting factor of their distribution. It is worth indicating that this survey although covered most of the country area but probably more species of more or less importance are available. However, there is clear trend toward great potential of parasitic species to spread and to infest new areas and new hosts in absence of any awareness of the local farmers with the problem or the complete absence of any control measures and the situation deserve more studies and attention.

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