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Occurrence and pathogenicity of various pathogenic fungi on cucurbits from Kermanshah province, Iran

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Cucurbits (*Cucurbitaceae*) are among the important plant families providing edible products to humans worldwide. It is known fact that various pathogenic fungi can attack the plants and cause diseases and resultantly yield losses. The aim of this study was to isolate and identify the plant pathogenic fungi from cucurbit plants and to evaluate their pathogenicity on cucurbits. A total of 101 cucurbit samples infected with diseases were collected from different places in Kermanshah Province, Iran. From these samples 101 strains of various pathogenic fungi were isolated and identified through morphological characters. All strains were belongs to *Fusarium oxysporum* , *Macrophomina phaseolina, Phytophthora melonis, Phytophthora drechsleri, Pythium aphanidermatum* and two morphotypes of *Fusarium solani* species complex (FSSC). *P. aphanidermatum* and *Phytophthora* sp. strains were recovered from the samples collected from irrigated field, while *Fusarium* and *M. phaseolina* strains from rain fed field. All these pathogenic fungi were evaluated to study their pathogenicity on cucumber (*Cucumis sativum*) and honeydew melon (*Cucumis melo*) . *P. melonis*, *P. drechsleri*, *F. oxysporum* and *P. aphanidermatum* caused the damping off within 10 - 20 days on both plants tested. The stem rot symptoms were observed on the 7th day after inoculation of *F. solani* and *M. phaseolina* on both plants tested. The inoculated fungi were re-isolated from the diseased plants to prove the Koch's postulates. This is the first comprehensive report on identity and distribution of major plant pathogenic fungi causing root and stem rots on cucurbits in west of Iran.

Key words: Root and stem rot, pathogenicity, cucurbits, Iran.

INTRODUCTION

Annually it is estimated that over 3,000 ha of agricultural area in Kermanshah province are under cucurbits cultivation. Major diseases of cucurbits in Kermanshah province especially in cucumber and melon is sudden death and complete destruction of these economic plants. Various plant pathogenic fungi namely, *Fusarium oxysporum*, *Macrophomina phaseolina, Phytophthora melonis, Phytophthora drechsleri, Pythium aphanidermatum* and two morphotypes of *Fusarium solani* species complex (FSSC) are the major disease causing fungi on cucurbits in Kermanshah province, Iran (Figure 1). The most important pathogens that cause sudden death in cucurbits in the entire world are *Phytophthora* (Erwin and Ribeiro, 1996) and *Fusarium* sp. (Armstrong and Armstrong, 1981). The genus *Phytophthora* is a serious threat to production of susceptible crops worldwide, particularly cucurbits and solanaceous plants. *Phytophthora* species are known to infect many species of pepper, tomato and other agronomic and ornamental crops of *Solanaceae* and *Cucurbitaceae* families (Zhang et al., 2006). All the cucurbits are susceptible to *Phytophthora* rot, but squash and pumpkin are the most commonly affected. Cucumber and melon are considered to be somewhat tolerant for *Phytophthora* (Erwin and Ribeiro, 1996) . Banihashemi (1969) and Sharif and Ershad (1966) first reported the major causal agent of honeydew melon sudden death due to *Phytophthora* sp. in Iran. *P. drechsleri* also has been known as a dominant species in root and foot rot in Iran (Ershad and

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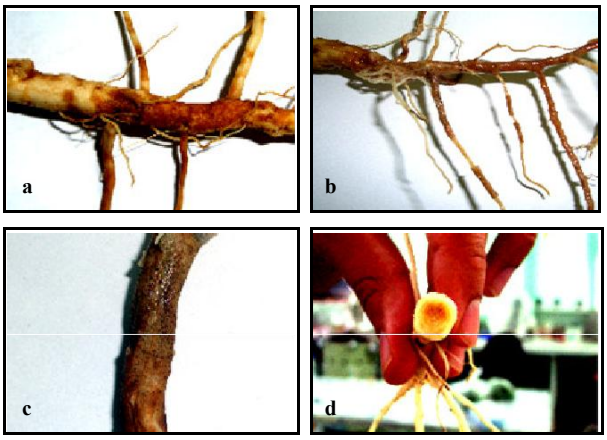

Figure 1. Diseases caused by pathogenic fungi on cucurbits; a = root rot on watermelon by *Pythium aphanidermatum*, b = root rot on melon by *Phytophthora* sp., c = Stem infection of honeydew melon by *M. phaseolina*, d = brown discoloration of the root phloem in melon caused by *F. oxysporum.*

Mostowfipoor, 1969).

Diseases caused by *Fusarium* sp. in cucurbits are fast spreading, aggressive and capable of complete crop failures. The most common species of *Fusarium* that cause vascular wilts in cucurbits in different regions of world are *F. oxysporum, F. solani* and *F. proliferatum* (Namiki et al., 1994). *Rhizoctonia solani*, *M. phaseolina*, *P. aphanidermatum* and *Olpidium* sp. are other pathogens most frequently isolated from the root systems of cucurbit plants (Pivonia, et al., 1997) . *F. oxysporum* f. sp. *melonis, P. drechsleri* and *Pythium aphanidermatum* have been reported as causal agents of melon root and foot rot in Khorasan province (Vahid, 1998) and in Sistan and Baluchistan province, *Macrophomina phaseolina* as a causal agent of root rot in cucurbits (Safarnezhad, 2004). Our objectives in this research are: (i) To isolate and identify different disease causing pathogenic fungifrom infected cucurbit plants; (ii) To determine the pathogenicity of identified fungi on cucurbits in Kermanshah province, Iran.

MATERIALS AND METHODS

Sample collection

Infected cucurbit plants were collected from different regions of Kermanshah province, Iran (Table 1). Each sample were stored in a paper envelope and kept in a cool box with dry ice. In the lab, roots and stems of diseased samples were washed and cut into small blocks (1.5 cm) for further analysis.

Isolation and identification of *Phytophthora* sp. and *P. aphanidermatum*

For isolation of *Phytophthora* spp. and *P. aphanidermatum*, the blocks were rinsed with several changes of sterile distilled water and after desiccation by filter paper (Esmaili-Shirazifard and Banihashemi, 2008) were placed onto selective medium of Corn Meal Agar-PARP (CMA- PARP) (Kannwischer and Mitchell, 1981) and incubated at 25°C in dark. Identification of *Phytophthora* strains were based on species description of Erwin and Ribeiro (1996) and identification of *Pythium* strains were based on Waterhouse (1967, 1968).

Isolation and identification of *Fusarium* sp. and *M. phaseolina*

For isolation of *Fusarium* spp. and *M. phaseolina*, the blocks were surface sterilized with 1% sodium hypochlorite for 3 min and rinsed in several changes of sterile distilled water. All the sterilized samples were placed onto general medium (water agar) (Burgess et al., 1994) and Pentachloronitrobenzene agar (PPA) plates, a selective medium for *Fusarium* (Nash and Snyder, 1962). The plates were incubated at 25°C for 24 h. The resulting single-spore *Fusarium* colonies were transferred to fresh Potato dextrose agar plates and maintained at 4°C for further studies. To study the growth rates and pigment production of *Fusarium* sp., all strains were transferred onto potato dextrose agar (PDA) plates and incubated at 25°C. Ten replications were maintained for each *Fusarium* strain. For microscopic observations, all strains of *Fusarium* were transferred to Carnation leaf agar (CLA) (Fisher et al., 1982), Spezieller nahrstoffarmer agar (SNA) (Nirenberg, 1976), and Potassium chloride agar (KClA) (Fisher et al., 1983) medium. The species were identified on the basis of macroscopic characteristics. Identification of species was based on species description of Gerlach and Nirenberg (1982) and Leslie and Summerell (2006).

Pathogenicity test on potato for differentiation of *P. melonis* and *P. drechsleri*

Based on the morphological characters, the two species of *P. melonis* and *P. drechsleri* cannot be easily identified (Ho, 1986). These two species were discriminated by studying their pathogenicity on potato. In this study, the ability of isolates for causing pink rot on potato was considered (Mostowfizadeh-Ghalamfarsa, 2005). Potato (*Solanum tuberosum*) of alpha cultivar was used in this experiment. Initially, tubers were sterilized with 1% sodium hypochlorite (NaClO) (20 min) and then air dried. Then the tubers were inoculated with fresh *Phytopthora* mycelium by putting CMA blocks (7 mm). Inoculated tubers were incubated at ambient temperature for 5 days. For control we used CMA blocks without fungi. After five (5) days of incubation, tubers were cut from inoculation regions and incubated at ambient temperature for 30 min. In this condition infected tubers to *P. drechsleri* would be pink color.

Pathogenicity assay of *Phytophthora* sp. and *P. aphanidermatum* on cucurbits

The pathogenicity of *Phytophthora* and *Pythium* species isolates obtained from cucurbits were tested on seedlings of healthy cucumber (*Cucumis sativum*) and honeydew melon (*Cucumis melon*) through pot experiment studies. Each pot was filled with 400 g of autoclaved soil mixed with 10 ml of 6 days old cultures of each strain grown in V-8 juice agar at 25°C. The seedlings were planted (one seedling in one pot) in infested soils and the experiments were carried out in the plant house with day and night temperatures of 30 - 35 and 23 - 30°C, respectively. Sterile soils without inoculum served as control. Three replications were maintained for each strain and the experiment was repeated twice. The inoculated fungi were re-isolated from the infected plants to prove the Koch's postulates.

Table 1. Place of sample collection, host and name of the pathogen identified from each sample.

Place of sample collection	Host	Source	Irrigation type	Pathogen identified
DoroodFaraman - MaoquFeh	Cucumber	Root and Crown	Flooding irrigation	*P. drechsleri*
DoroodFaraman - MaoquFeh	Cucumber	Root	Flooding irrigation	*P. drechsleri*
DoroodFaraman -MaoquFeh	Cucumber	Root and Crown	Flooding irrigation	*P. drechsleri*
DoroodFaraman -MaoquFeh	Cucumber	Root and Crown	Flooding irrigation	*P. melonis P.*
DoroodFaraman -MaoquFeh	Cucumber	Root	Flooding irrigation	*melonis P.*
DoroodFaraman - MaoquFeh	Cucumber	Crown	Flooding irrigation	*melonis P.*
DoroodFaraman - MaoquFeh	Cucumber	Root and Crown	Flooding irrigation	*melonis P.*
DoroodFaraman - MaoquFeh	Cucumber	Crown	Flooding irrigation	*melonis P.*
DoroodFaraman -MaoquFeh	Cucumber	Crown	Flooding irrigation	*melonis P.*
Road DoroodFaraman	Cucumber	Root and Crown	Flooding irrigation	*melonis P.*
Road DoroodFaraman	Cucumber	Crown	Flooding irrigation	*melonis P.*
Road DoroodFaraman	Cucumber	Root	Flooding irrigation	*drechsleri P.*
Road DoroodFaraman	Cucumber	Root and Crown	Flooding irrigation	*drechsleri P.*
Road DoroodFaraman	Cucumber	Root and Crown	Flooding irrigation	*drechsleri P.*
Road DoroodFaraman	Cucumber	Root	Flooding irrigation	*drechsleri P.*
Road DoroodFaraman	Cucumber	Root and Crown	Flooding irrigation	*melonis F.*
Road Kamyaran - Varmele	Honeydew melon	Root and Crown	Rain-Fed	*oxysporum F.*
Road Kamyaran -Varmele	Honeydew melon	Crown	Rain-Fed	*oxysporum F.*
Road Kamyaran - Varmele	Honeydew melon	Root and Crown	Rain-Fed	*oxysporum F.*
Road Kamyaran-Varmele	Honeydew melon	Root	Rain-Fed	*oxysporum*
Road Kamyaran - Varmele	Honeydew melon	Crown	Furrow irrigation (Gholam-gardeshy)	*F. oxysporum*
Miandarband -JaFar Abad	Honeydew melon	Root	Furrow irrigation (Gholam-gardeshy)	*F. oxysporum*
Miandarband - JaFar Abad	Honeydew melon	Root	Furrow irrigation (Gholam-gardeshy)	*F. oxysporum*
Miandarband - JaFar Abad	Honeydew melon	Root	Furrow irrigation (Gholam-gardeshy)	*F. oxysporum*
Miandarband -JaFar Abad	Honeydew melon	Root	Furrow irrigation (Gholam-gardeshy)	*F. oxysporum*
Miandarband -JaFar Abad	Honeydew melon	Root	Furrow irrigation (Gholam-gardeshy)	*F. oxysporum*
Miandarband -Varmenjeh	Cucumber	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. drechsleri*
Miandarband -Varmenjeh	Cucumber	Crown and Stem	Furrow irrigation (Gholam-gardeshy)	*F. solani*
Miandarband -Varmenjeh	Cucumber	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Miandarband - Varmenjeh	Cucumber	Crown	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Miandarband - Varmenjeh	Cucumber	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Miandarband - Varmenjeh	Cucumber	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. melonis*

Table 1. Contd.

Miandarband - Varmenjeh	Cucumber	Root	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Miandarband - Varmenjeh	Cucumber	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. drechsleri*
Miandarband - Varmenjeh	Cucumber	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. drechsleri*
Miandarband - Varmenjeh	Cucumber	Crown	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Qazanchi - Ahmad Abad	Watermelon	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. aphanidermatum*
Qazanchi - Ahmad Abad	Watermelon	Root	Furrow irrigation (Gholam-gardeshy)	*P. aphanidermatum*
Qazanchi - Ahmad Abad	Watermelon	Stem	Furrow irrigation (Gholam-gardeshy)	*M. phaseolina*
Qazanchi - Tazeh Abad	Honeydew melon	Stem	Rain-Fed	*M. phaseolina*
Qazanchi -Sarablah	Watermelon	Root	Furrow irrigation (Gholam-gardeshy)	*P. aphanidermatum*
Qazanchi -Ahmad Abad	Watermelon	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. drechsleri*
Qazanchi -Ahmad Abad	Watermelon	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. aphanidermatum*
Qazanchi -Ahmad Abad	Watermelon	Root	Furrow irrigation (Gholam-gardeshy)	*P. aphanidermatum*
Qazanchi -Docheshmeh	Watermelon	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Road Allah-yari	Honeydew melon	Stem	Rain-Fed	*M. phaseolina*
Road Allah-yari	Honeydew melon	Root	Rain-Fed	*F. oxysporum*
Road Allah-yari	Honeydew melon	Root	Rain-Fed	*F. oxysporum*
Road Allah-yari	Honeydew melon	Root	Rain-Fed	*F. oxysporum*
Road Allah-yari	Honeydew melon	Root	Rain-Fed	*F. oxysporum*
Road Allah-yari	Honeydew melon	Root	Rain-Fed	*F. oxysporum*
Road Allah-yari	Honeydew melon	Root	Rain-Fed	*F. oxysporum*
Road Allah-yari	Honeydew melon	Root	Rain-Fed	*F. oxysporum*
Ravansar	Honeydew melon	Root	Rain-Fed	*F. oxysporum*
Road Ravansar - Kamyaran	Pumpkin	Root	Furrow irrigation (Gholam-gardeshy)	*F. oxysporum*
Road Ravansar - Kamyaran	Pumpkin	Root	Furrow irrigation (Gholam-gardeshy)	*F. oxysporum*
Road Ravansar -Kamyaran	Pumpkin	Root	Furrow irrigation (Gholam-gardeshy)	*F. oxysporum*
Road Javanrood - Salas-Kanigohar-	Honeydew melon	Root	Furrow irrigation (Gholam-gardeshy) irrigation	*F. oxysporum*
Road Javanrood - Salas-Kanigohar -	Honeydew melon	Stem	Furrow irrigation (Gholam-gardeshy)	*F. solani*
Kangavar -Pol Shekasteh	Honeydew melon	Stem and Crown	Furrow irrigation (Gholam-gardeshy)	*F. solani*

Table 1. Contd.

Kangavar -Pol Shekasteh	Honeydew melon	Stem	Furrow irrigation (Gholam-gardeshy)	*F. solani*
Kangavar -Rahmat Abad	Cucumber	Root	Flooding irrigation	*F. oxysporum*
Kangavar -Gaodin	Cucumber	Root	Flooding irrigation	*P. melonis*
Kangavar	Pumpkin	Root	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Kangavar	Honeydew melon	Root	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Gaodin	Pumpkin	Root	Furrow irrigation (Gholam-gardeshy)	*P. drechsleri*
Gaodin *Continued*	Honeydew melon	Root	Furrow irrigation (Gholam-gardeshy)	*F. oxysporum*
Gaodin	Cucumber	Stem	Furrow irrigation (Gholam-gardeshy)	*P. aphanidermatum*
Sonqor	Pumpkin	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. drechsleri*
Sonqor	Cucumber	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Road Sonqor -Asad Abad	melon	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. drechsleri*
Road Sonqor -Asad Abad	Cucumber	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. drechsleri*
Road Sonqor -Asad Abad	Cucumber	Stem	Furrow irrigation (Gholam-gardeshy)	*M. phaseolina*
Harsin	Pumpkin	Root and Crown	Flooding irrigation	*P. melonis*
Dinavar -Shirkhan	Cucumber	Root and Crown	Flooding irrigation	*P. melonis*
Dinavar -Shirkhan	Melon	Root	Flooding irrigation	*P. melonis*
Biotins -Barnaj	Cucumber	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Bisotun -Barnaj	Pumpkin	Crown	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Bisotun -Barnaj	Cucumber	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Bisotun -Barnaj	Cucumber	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Bisotun -Hosein Abad	Cucumber	Root and Crow	Furrow irrigation (Gholam-gardeshy)	*P. melonis*
Bisotun -Hosein Abad	Pumpkin	Root and Crown	Furrow irrigation (Gholam-gardeshy)	*M. phaseolina*
Bisotun - Barnaj	Cucumber	Crown	Furrow irrigation (Gholam-gardeshy)	*M. phaseolina*
Kermanshah – Faculty agriculture–Razi university	Cucumber	Root and Crown	Furrow irrigation	*P. melonis*
Road Gilan Garb – Sarpol Zohab	Melon	Root and Crown	Flooding irrigation	*P. melonis*
Gahvareh	Cucumber	Crown	Furrow irrigation (Gholam-gardeshy)	*P. aphanidermatum*
Road Mahi Dasht - Chehar Zabar	Cucumber	Root and Crown	Flooding irrigation	*P. melonis*

Table 1. Contd.

Road Gilan Garb-Cheshmeh Nezami	Cucumber	Root and Crown	Flooding irrigation	*P. drechsleri*
Road Kermanshah -Sarab NilooFar	Cucumber	Root and Crown	Rain-Fed	*P. drechsleri*
Road Kermanshah -Sarab NilooFar	Honeydew melon	Root	Rain-Fed	*F. oxysporum*
Sarab NilooFar	Cucumber	Stem	Rain-Fed	*M. phaseolina*
Road Koozaran -Boor Boor	Cucumber	Stem and Crown	Flooding irrigation	*M. phaseolina*
Road Koozaran - Chehar Zabar	Honeydew melon	Root and Crown	Furrow irrigation	*P. melonis*
Road Paveh -Qeshlaq	Cucumber	Crown	Flooding irrigation	*P. melonis*
Road Paveh - Qeshlaq	Cucumber	Crown	Flooding irrigation	*P. drechsleri*
Road Paveh -Ravansar	Cucumber	Root and Crown	Flooding irrigation	*P. drechsleri*
Paveh - Shemshir	Cucumber	Root and Crown	Flooding irrigation	*P. melonis*
Paveh - Shemshir	Cucumber	Stem	Flooding irrigation	*F. solani*
Miandarband -JaFar Abad	Honeydew melon	Stem	Rain-Fed	*F. solani*
Bisotun - Barnaj	Cucumber	Stemand Crown	Rain-Fed	*F. solani*
Qazanchi - Ahmad Abad	Watermelon	Stem	Rain-Fed	*F. solani*

Pathogenicity assay of *Fusarium* sp. and *M. phaseolina* on cucurbits

All the identified *Fusarium* and *Macrophomina* species were tested for their pathogenicity on apparently healthy cucumber (*C. sativum*) and honeydew melon (*C. melon*) plants. For pathogenicity tests the root and stems of the cucumber and honeydew melon were washed and surface sterilized before inoculation. For inoculation, each strain of *Fusarium* spp. were grown on PDA plates as described by Salleh and Sulaiman (1984). Conidial suspension of each individual strain was prepared by scrapping the mycelium with sterile distilled water onto 7 day-old cultures, shaken thoroughly, and the concentration was adjusted to 2×10^6 conidia/ml using haemocytometer. Twenty (20) days old seedlings of cucumber and honeydew melon were brought to the laboratory and their roots were soaked in 20 ml conidial suspension for 20 min for root experiments. For stem experiments twenty milliliter of the conidial suspension of each *Fusarium* species and *M. phaseolina* were sprayed on the stems. The control plants were inoculated with 20 ml of sterile distilled water. Three replications were maintained for each strain and the experiment was repeated twice. All the inoculated and controls seedlings of different cucumber plants were placed in the plant house with day and night temperatures of 30 - 35 and 23 - 30°C, respectively. Development of symptoms on plants inoculated by fungi and controls were observed continuously every 2 days for 4 weeks. The inoculated fungi were re-isolated from the infected plants to prove the Koch's postulates.

RESULTS

In this study, a total of 101 fungal strains were isolated from 101 diseased cucurbit plants. Most of the *Phytophthora* and *Pythium* strains were recovered from irrigated fields and *Fusarium* and *Macrophomina* strains from rain-fed fields. Based on their morphological characteristics, these strains were identified as *P. melonis*, *P. drechsleri*, *Pythium aphanidermatum*, *F. oxysporum, F. solani* and *M. phaseolina*. Differentiation of *P. melonis* and *P. drechsleri* based on morphological characterization (homothallism, amphigynous antheridia, semipapillate sporangia and the production of chlamydospores) is not easy. These two species were discriminated by use of the reaction on potato. *P. aphanidermatum* were identified based on morphological characterization by daily growth rate on V-8 juice agar at 30°C. Main hyphae up to 7.5 µm wide and oospores aplerotic, spherical, smooth, average 41 µm in diameter. Sporangia consisting of terminal complexes of swollen hyphal branches of various length and germinated by extension of long exit tube and vesicle formation and zoospore discharge. Vesicles average 41 µm in diameter. Oogonia globose, terminal, smooth, average 28 µm in diameter, with straight oogonial stalks. Antheridia typically intercalary, usually diclinous and average 14 µm long and 11 µm wide, commonly 1 per oogonium. *F. oxysporum* strains were identified based on their morphological characterization. This species showed floccose growth, abundant and pale violet aerial mycelia. Pigmentation of reverse colony is pale violet, short monophialides conidiogenous cells, macroconidia usually 3-septate and thin walled, the apical cell is short and basal cell is notch to foot shape, microconidia usually are no septate oval to elliptical, chlamydospores usually singly or in pair (Figure 2).

In morphotype I of *F. solani,* pigmentation of reverse colony is red, macroconidia mostly 5 septate and thick walls. Apical cell is tapered and basal cell foot shape.

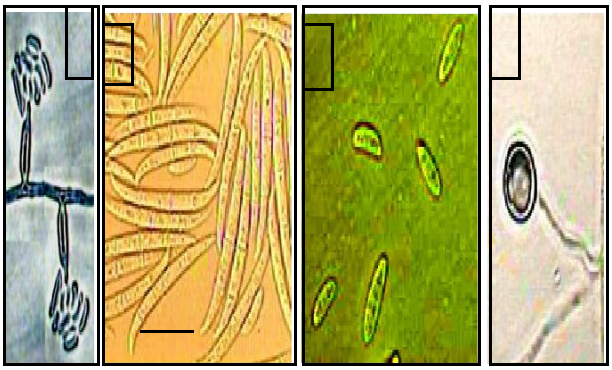

Figure 2. Morphological characters of *F. oxysporum*. a= Conidiophores, b= Macroconidia, c= Microconidia, d= Chlamydospore (scale bar= 20 µm).

Microconidia are ellipsoid to truncate and clavate 0 - 2 septate. Chlamydospores are with smooth outer walls (Figure 3). In morphotype II of *F. solani,* pigmentations of reverse colony are white to yellow, macroconidia 3 - 4 septate but mostly 3 septate. Apical cell is round curve and short, basal cell is notch to foot shape. Microconidia are mostly 0 - 1 septate and rainy form shape. Chlamydospores usually rough outer walls (Figure 4). In *M. phaseolina* isolates, shape of colony varied from radial to irregular, mycelium production was intermediate in the most of isolates and colour of mycelium is white to dark brown. Pycnidium is in black colour and pycnospores are no septate.

The results of the pathogenicity test revealed that 34 strains of *P. melonis*, 19 strains of *P. drechsleri*, 25 strains of *F. oxysporum* and seven strains of *P. aphanidermatum* were the major causal agents of cucumber and honeydew melon root rot. Eight strains of each *M. phaseolina* and *F. solani* species complex (FSSC) were the main causal agents of cucurbit crown and stem rot, respectively. *P. melonis*, *P. drechsleri*, *F. oxysporum* and *P. aphanidermatum* strains were shown that cucumber and honeydew melon seedlings were damped-off in the infested soil within 10 - 20 days. This survey revealed that the mentioned strains caused root rots, water- soaked lesions on stems, and damping-off of both plants tested. Their initial symptoms were observed on the 4th day after inoculation. *F. solani* and *M. phaseolina* caused stem rot on both plants tested. Their initial symptoms were observed on seven (7) days after inoculation on water-soaked lesions on stems. The inoculated fungi were consistently isolated from the diseased plants again to prove Koch's postulates, but not from control plants.

DISCUSSION

Soil borne plant pathogens such as *Phytophthora* and *Fusarium* sp. can significantly reduce yield and quality in cucurbit crops (Matuo and Snyder, 1973; Ho, 1986; Esmaili-Shirazifard and Banihashemi, 2008). Most of the pathogens identified in this study have ability to grow on a wide range of substrates and have efficient mecha-nisms for dispersal. Also some of the *Phytophthora* and *Fusarium* sp. often survive in soil in the form of chlamydospores for many years and may cause diseases to cucurbit plants when the environmental conditions favors fro pathogen (Burgess, 1981; Zheng, 1997). Therefore, accurate identification of pathogenic fungi is very important to develop proper management practices. The results of this revealed that *Phytophthora*, *Pythium* and *F. oxysporum* species are pathogenic to cucurbits. Two other species, *F. solani* and *M. phaseolina* were also pathogenic on stem rot of cucurbits.

In this investigation we observed that rain- fed cucurbit fields in Kermanshah province showed that severity of the disease is high under certain environmental conditions in median of summer due to moisture stress, and also in irrigated field, the severity of the disease is high due to flooding, and furrow irrigation (Gholam-gardeshy). Because many species of *Fusarium* can act as opportunistic or weak pathogens that are capable of attack plants only when they are weakened previously by some other stress. Certainly, stresses such as those induced by drought, hail and insects are known to affect the disease (Palmer and Kommedahl, 1969). Generally, *Phytophthora* and *Pythium* species produces sporangia on leaves and these sporangia may be fallen on surface of irrigation water especially under flooding and furrow irrigation (Duniway, 1974; Zentmayer and Erwin, 1970) and may attack other plants.

The plant pathogenic fungi can survive in the soil and in host debris for months to years (Zheng, 1997). So the control of *Phytophthora* sp. is often very difficult and the best means of control is to prevent the occurrence of the disease in the initial stages. It is thus essential to know the distribution of mentioned genus and their species on the each region such as Kermanshah province. Also using of cultivation controls means following a proper irrigation schedule, on the other hand, prevalence of dry stress to host and improvement methods of irrigation can controlled the components favorable environment. *Phytophthora* has been recorded from several parts of the world and pathogenic to many plants, especially to seedlings. In Iran, this fungus has been reported to cause root rot on cucurbits but not in Kermanshah province (Esmaili-Shirazifard and Banihashemi, 2008). Our patho-genicity assay also revealed that *Phytophthora* can cause root rot to cucurbit plants. This study demonstrates the occurrence of pathogenic fungi in cucurbit fields and can cause diseases to cucurbit plants at any stages. As far as we know, this is the first comprehensive report on identification of several pathogenic species and their pathogenicity on cucurbits from Kermanshah province, Iran.

Figure 3. Morphological characters of *F. solani* (morphotype I); a = Conidiophores, b= Macroconidia, c = Microconidia, d = Sporodochia conidiophores, e = Chlamydospore (scale bar = 25 µm).

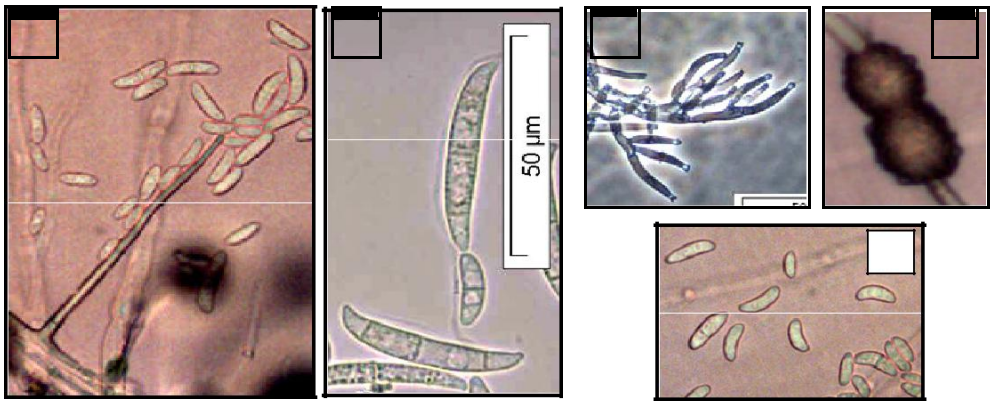

Figure 4. Morphological characters of *F. solani* (morphotype II); a = Conidiophores, b= Macroconidia, c= Sporodochia conidiophores, d= Chlamydospores, e= Microconidia.

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