J. Crop Prot. 2015, 4 (Supplementary): 705-709

Short Paper

Reaction of different *Cucurbita* species to *Phytophthora capsici*, *P. melonis* and *P. drechsleri* under greenhouse conditions

Zahra Nemati and Zia Banihashemi*

Department of Plant Protection, College of Agriculture, Shiraz University, Shiraz, Iran.

Abstract: The reaction of nineteen different cultivars of *Cucurbita* spp. including *Cucurbita pepo*, *Cucurbita maxima* and *Lagenaria siceraria* to *Phytophthora capsici*, *Phytophthora melonis* and *Phytophthora drechsleri* was studied under greenhouse conditions. Plants were grown in steam sterilized soil. One-month-old plants were inoculated with vermiculate hempseed extract inocula of *Phytophthora* and were flooded for 24 hours. The activity of the pathogens was monitored during the experiment by using citrus leaf discs. Seedling mortality was monitored two months after inoculation. None of the species were infected with *P. drechsleri* or *P. melonis*. *Cucurbita maxima* cultivars Hamedan and ACE South Korea, *C. pepo* cultivar Shabestar and *Lagenaria siceraria* were not infected with *P. capcisi*. The possibility of using these cultivars as root stocks for grafting against *Phytophthora* species is discussed.

Keywords: *Cucurbita pepo, C. maxima, Lagenaria siceraria*,grafting, root stock

Introduction

The genus *Cucurbita* in the gourd family is very susceptible to Phytophthora root rots. Although most of the Cucurbita species are highly resistant to *P. melonis*, they are very susceptible to *P. capsici* (Mansoori and Banihashemi, 1982; Banihashemi and Fatehi, 1989). Because *P. capsici* can attack cucurbits at any growth stage and lead to intense yield losses, disease management strategies are very essential. One of the best strategies would be grafting on interspecific hybrid of *Cucurbita* species. Grafting is a traditional technique that has been used in vegetables in Asia for many years, for example grafting watermelon plants onto squash or gourd reduced wilting of Fusarium species (King *et al*., 2008, 2010; Mohamed *et al*., 2012). More than 95% of watermelons and oriental melons are produced on grafted plants in Japan and Korea (Rivero *et al*., 2003). Root rot and vine decline of muskmelon were controlled by grafting them on watermelon, wax gourd and or squash (Su and Lin, 2008). The primary purpose of grafting on cucurbits has been to provide resistance to soilborne diseases worldwide.

The objective of the present study was to identify resistant rootstocks of *Cucurbita* species and cultivars to manage Phytophthora root rots under field and or greenhouse conditions. The preliminary results have been presented earlier (Nemati and Banihashemi, 2010).

Materials and Methods

Three species of *Phytophthora* including *P. melonis* (PH-6.8.81), *P. drechsleri* (PH-17.19.05) and *P. capsici* (2.15.92) originally isolated respectively, from *Cucumis melo*, *Beta vulgaris* and *Capsicum annuum* were selected for

Handling Editor: Vahe Minassian

* **Corresponding author**, e-mail: zia1937@gmail.com
Received: 15 October 2014, Accepted: 16 September 2015
Published online: 02 November 2015
A portion of MSc. thesis presented by the first author to Shiraz University.

inoculation. These isolates were identified based on colony morphology, mycelial characteristics, cardinal growth temperatures, and morphology, and dimensions of sporangia, oogonia, and antheridia. The two species of *P. melonis* and *P. drechsleri* were confirmed by reaction to safflower seedlings (Banihashemi and Mirtalebi, 2008). Three plugs of isolates of a young colony of *P. melonis, P. drechsleri* and *P. capsici* were inoculated into sterilized vermiculite amended with hemp seed extract (Banihashemi and Fatehi, 1989). The growing medium consisted of 200ml of vermiculite amended with 120ml of hemp seed extract (extract of 60g of hemp seeds per 1l of distilled water) and incubated at 25 °C in the dark for 4 weeks. Iranian cultivars of *Cucurbita* spp. including, Hamedan (four landraces), Kiashahr (two landraces), Shabestar, Bijar (three landraces), Mazandaran, Gorgan (two landraces), Lahijan and two South Korean cultivars ACE and Shinto (kindly donated By Dr. Salehi, Tehran University) and bottle gourd (pumpkin hooka) (two landraces), were grown at 25 °C in greenhouse. Steam sterilized soil containing a mixture of autoclaved silty clay loam soil and sand (3:1 w/w), were used in the experiments each in 20cm diameter pot (3 seeds /pot). After two weeks of growth, 30 ml of the inoculum was spread on the soil surface per pot. Pots were flooded over night. The activity of the pathogens was monitored during the experiment by using citrus leaf discs (Banihashemi, 2004). Plants were examined daily to observe the symptoms. Controls were inoculated with vermiculite hemp seed extract. Seedling mortality was monitored two months after inoculation. Roots and crown regions of infected plants were completely washed and plated on PARP medium and confirmed the reisolation of the pathogen.

Results and Discussion

The reactions of 19 Cucurbita cultivars to *P. melonis, P. drechsleri* and *P. capsici* are shown in Table 1. None of the landraces of the cultivars were infected by *P. melonis* and *P. drechsleri* despite high inoculum potential, but some cultivars were infected by *P. capsici* within 7 days. Wilt and dry shoot, damping off, severe root and crown rot were symptoms observed in susceptible cultivars. Infected plants had severe lateral root rot and rotted tissue was tan to brown color. Only two landraces of bottle gourd, South Korean cultivars ACE, two landraces of Hamedan, a landrace of Shabestar and a landrace of Bijar were not infected by *P. capsici*. Resistant cultivars such as bottle gourd, Shabestar and ACE from South Korea were not infected by any of the *Phytophthora* species. As a result, these cultivars could be used for grafting to manage Phytophthora root rot in greenhouse and under field conditions. The experiment was repeated twice with the same results.

Previous studies showed that most cultivars of *Cucurbita pepo* were highly resistant to *P. melonis* and it has never been observed to cause root rot in squash or pumpkin under field conditions, but root rot due to infection by *P. capsici* under field conditions was reported in squash in Fars Province (Mansoori and Banihashemi, 1982). Melon cultivars were very susceptible and Cucurbita cultivars were moderately resistant to *P. melonis* compared with other species of Cucurbitaceae (Banihashemi and Fatehi, 1989). In pathogenicity studies it was shown that isolates of *P. capsici* infected butternut squash but these were less pathogenic on squash (Sholberg *et al*., 2007). *Cucurbita* species are important crops in the world and are prone to infection by *P. capsici* (Tian and Babadoost, 2004). Since the pathogen is more difficult to control by conventional methods, grafting is another alternative for disease management. Resistant cultivars of *Cucurbita* species and grafting on interspecific hybrids are very important for control of Phytophthora root rots. Bottle gourd (*Lagenaria siceraria*) was a resistance base for infected commercial watermelon to *P. capsici*. Crown rot resistant bottle gourd rootstocks may be a useful candidate, because all *Cucurbita* inter-specific hybrid rootstocks and a watermelon rootstock were highly susceptible to crown rot by *P. capsici* (Kousik *et al*., 2012). Many years ago interspecific hybrid rootstocks were used for grafted vegetables in Asia, specially Japan and Korea. This method increased yield in the presence of the pathogen and caused resistance to certain soil borne plant pathogens.

Table 1 Incidence of root rot in cultivars of *Cucurbita* species inoculated with *Phytophthora capsici, P. melonis and P. drechsleri* under greenhouse conditions.

Cucurbita species	Cultivar	Number of Landrace	Mortality (%)		
			P. capsici	*P. melonis*	*P. drechsleri*
Lagenaria siceraria	Bottle gourd	1	0	0	0
		2	0	0	0
Cucurbita maxima	Hamedan	1	0	0	0
		2	0	0	0
		3	55	0	0
		4	88	0	0
Cucurbita pepo	Kiashahr	1	0	0	0
		2	99	0	0
Cucurbita pepo	Shabestar	1	0	0	0
Cucurbita maxima	Bijar	1	0	0	0
		2	56	0	0
		3	80	0	0
Cucurbita pepo	Guilan	1	99	0	0
Cucurbita maxima	Gorgan	1	44	0	0
		2	50	0	0
Cucurbita maxima	Lahijan	1	99	0	0
Cucurbita pepo	ACE South Korean	1	0	0	0
Cucurbita pepo	Shinto South Korean	1	33	0	0
Cucurbita maxima	Local pumpkin	1	50	0	0

Acknowledgment

The authors are grateful to Dr. Salehi, Department of Horticulture, College of Agriculture, Tehran University for donating seeds of some cultivars of *Cucurbita* species.

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واکنش گونه‌های مختلف کدو به *Phytophthora drechsleri*، *P. melonis* و *P. capcisi* در شرایط گلخانه

زهرا نعمتی و ضیاالدین بنی‌هاشمی*

بخش گیاهپزشکی، دانشکده کشاورزی، دانشگاه شیراز، شیراز، ایران.
* پست الکترونیکی نویسنده مسئول مکاتبه: zia1937@gmail.com
دریافت: ۲۳ مهر ۱۳۹۳؛ پذیرش: ۲۵ شهریور ۱۳۹۴

چکیده: واکنش ۱۹ رقم مختلف گونه‌های کدو شامل کدو حلوایی *Cucurbta pepo*، کدو خورشی *C. maxima* و کدو قلیانی *Lagenaria siceraria* به بیمارگرهای *Phytophthora drechsleri* ، *P. melonis* و *P. capcisi* در شرایط گلخانه بررسی شد. گیاهان در خاک ضدعفونی شده با بخار آب کشت شدند. گیاهان یک‌ماهه با مایه فیتوفتورا رشد داده شده روی ورمیکولیت حاوی عصاره دانه شاهدانه مایه‌زنی گردید و گلدان‌ها به‌مدت ۲۴ ساعت غرقاب شدند. فعالیت بیمارگر با روش قطعات برگ مرکبات در طول آزمایش پایش گردید. مرگ گیاهان دو ماه پس از مایه‌زنی بررسی شد. هیچ‌کدام از گونه‌های کدو به دو بیمارگر *P. melonis* و *P. drechsleri* آلوده نشدند. کدو خورشی رقم‌های همدان و ACE کره جنوبی، کدو حلوایی رقم شبستر و کدو قلیانی رقم مازندران با قارچ *P. capcisi* آلوده نشدند. لذا امکان استفاده از این ارقام به‌عنوان پایه جهت پیوند ارقام تجارتی گیاهان جالیزی علیه گونه‌های فیتوفتورا مورد بحث قرار گرفته است.

واژگان کلیدی: کدو حلوایی، کدو خورشی، کدو قلیانی، پایه پیوندی