Minufiya J. Agric. Res. Vol.37 No. 3: 517 - 524 (2012) **"http://www.mujar.net"**

STUDIES ON *MONOSPORASCUS CANNONBALLUS* THE CAUSAL ORGANISM OF MONOSPORASCUS ROOT ROT/VINE DECLINE DISEASE

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(Received: Feb. 12 , 2012)

ABSTRACT: *Monosporascus root rot/vine decline disease of cucurbit plants caused by Monosporascus cannonballus (Pollack and Uecker) is very important disease which severely affects roots causing large losses in crop. The pathogenicity tests of M. cannonballus to twenty nine cucurbit and six noncucurbit species and cultivars were evaluated in greenhouse. Percentage of infection was observed in all cucurbit species at frequencies ranged from 6.67-96.67% and M. cannonballus was reisolated from 20-100% of the plants. Rating Monosporascus root rot/vine decline of cucurbit plants, from the most tolerant to the most susceptible were: loofah, pumpkin, snake cucumber, squash, cucumber, cantaloupe and watermelon respectively, Noncucurbit plants included eggplant, tomato, wheat, barley, pea and maize resulted percentage of infection 30.00, 7.71, 38.89, 34.44, 53.33 and 13.13% respectively, while M. cannonballus was reisolated from these noncucurbit plants as 71.11, 0.0, 18.79, 17.79, 63.34 and 33.33%, respectively.*

Key words: *Monosporascus cannonballus, Monosporascus root rot/vine decline, cucurbit, noncucurbit and host range.*

INTRODUCTON

Three genera of cucurbits i.e. *Cucumis* spp. (cucumber and melon), *Citrullus* spp. (watermelon), and *Cucurbi*t spp. (pumpkin and squash) are widely grown in Egypt. They can be grown in different seasons through the year round in Egypt in open fields and protected cultivations.

Monosporascus root rot/vine decline disease of cucurbits, caused by the soilborne ascomycete *Monosporascus cannonballus*, Pollack and Uecker (1974), is responsible of significant yield losses throughout the world. Symptoms of this disease include wilting and sudden death above ground two to three weeks before harvest without previous disease identification or symptoms (Martyn and Miller, 1996).

Monosporascus cannonballus was the causal organism of vine decline disease of numerous cucurbits under greenhouse conditions, the expression of the vine decline symptom typically occurs on the plants near harvest. Martyn *et al.* (1993 a) recorded that there were differences in vine decline disease symptoms among ten cucurbit plants under greenhouse and field conditions. They added that, watermelon, muskmelon, cucumber and gourd were highly susceptible, while zucchini, pumpkin and butternut were more tolerant. Matyn *et al*. (1993 b) examined nine cucurbits eight noncucurbit species in the greenhouse and six of the cucurbit species and under field conditions*. Monosporascus cannonballus* was reisolated from 70-100% of bean, corn, sorghum and sugar beet plants. Aegerter *et al*. (2000) tested that, some of cucurbit plants for their reaction to the pathogen *M. cannonballus.* The fungus infection reduced dry weight and shoot lengths of cucurbit plants by an average of 42.3% - 42.9%. Heo *et al*. (2001) tested the reactions of melon, oriental melon, watermelon and cucumber against *M. cannonballus*. They found that, all cucurbit plants were infected with the pathogen *M. cannonballus*. El-Saiedy (2003**)** tested seven cucumber cultivars and eleven cucurbit plants against *M. cannonballus*. He found that, the cultivar Isna and the cucurbit plants Snake cucumber and Watermelon 1 were the most susceptible to root rot/vine

decline "sudden wilt" disease. Khalifa *et al.* (2008) tested the reaction of different species of cucurbits and different cultivars of cucumber to *M. cannonballus* and tested their susceptibility to the pathogen. Stanghellinia *et al*. (2010) studied the germination of ascospore of the fungus *M. cannonballus* in the rhizosphere of 26 species and cultivars of plants belonging to eight families and 14 genera. They resulted that, ascospore germination occurred only in the rhizosphere of genera, species and cultivars belonging to the cucurbitaceous family.

The aim of this work was to study the difference of the resistance on the host range of the fungus *M. cannonballus* among cucurbit and noncucurbit under greenhouse conditions.

MATERIALS AND METHODS

Isolation and identification:

Isolation of the causal organism was done from the diseased watermelon, cucumber and melon plants showing Monosporascus root rot/vine decline symptoms. The infected parts of roots were washed thoroughly with running tap water. Surface sterilized by immersing them in (0.25%) sodium hypochlorite solution for (2 minutes), and then transferred to Petri dishes containing Potato Dextrose Agar (PDA) medium supplemented with (150 ppm) streptomycin sulfate. Plates were incubated at (28°C) for (3 days). The isolated fungi were then purified using the hyphal-tip technique to slants of (PDA) and incubated at (28°C for 5 days).

Production of inoculum:

Three isolates *i. e.* MC-C6 (isolated from cucumber plants), MC-M1 and MC-M8 (isolated from melon plants) were grown on a sand/oat hull medium. The medium consists of 3 L of sand, 275 gm of dried oat hulls and 450 ml of distilled water (v:w:v) that were mixed thoroughly and autoclaved, then inoculated and incubated for 40 days at 30ºC. Black plastic pots (25 cm in diameter) were filled with a mixture of sand and field soil (1:1, v:v) and infested in bulk at the rate of 3% of soil weight, (Mertely *et al*. 1993). Six seeds were sown in each pot with five replicates for each treatment and five pots of non-infested soil were used as control. Pots were kept in greenhouse, irrigated and fertilized as usual. Disease incidence assessment in different experiments were carried out through, where percentage of sudden wilt plants, reisolation (%) and disease severity index DI (were rated for disease severity according to (Aegrter *et al*. 2000) as following :- 0 : no symptoms, 1: few tan lesions, 2: extensive tan lesions and necrosis of small roots, 3: extensive tan lesions, perithecia, necrosis of small and medium roots, 4: completely withered, necrotic, dead roots). Data were recorded after 70 days from planting tabulated and statistically analyzed.

All the experiments were carried out in greenhouse of the Fac. of Agriculture, Minoufiya University.

Host range:

Reaction of twenty nine species and cultivar of cucurbitaceous plants *i.e*., watermelon: Nasa, Suger baby, Cremson, Hollar king, Aswan, Giza, White super and Scata, Squash: (Eskandrany 156, Suha, New Eskandrany, Sama, Top Kapi, Tala), Cucumber: (Azaeem, Conqueror, Medina, Saso and Bit Alpha), Cantaloupe: (Shahd El-Dokki, Ananas "Egypt" 1, Sun Gold, Ananas "U.S.A." 2), Loofah: (c.v Baldy), Pumpakin: (c.v Local) and Snake cucumber: (c.v Napolci) and six species cultivar out of noncucurbitaceous plants *i.e*., Eggplant, Tomato, Wheat, Barley, Pea and Maize were evaluated to infection with three isolates of the fungus *M. cannonballus i.e*., MC-C6, MC-M1 and MC-M8.

RESULTS AND DISCUSSION

1. Host range of cucurbit plants:

1. a- watermelon genotypes:

Eight watermelon cultivars were tested under greenhouse conditions. Data in Table (1) indicate that, the tested isolates MC-C6, MC-M1 and MC-M8 of the fungus *M. cannonballus* infected all watermelon genotypes; isolate MC-M1 recorded the highest sudden wilt plants rate (96.67 %) on

Giza 1 cultivar. Disease severity was the highest (87.10 %) on Giza 1 inoculated with the isolate MC-M8, while the maximum reisolation was noticed on White super cultivar inoculated with isolate MC-M8 (100%) and the minimum reisolation was recorded on Aswan (50.0 %) plants infected with the isolate MC-C1. These results are confirmed with those
obtained by Lobo-Ruana (1990), Wolff and Miller (1998), Biernacki and Bruton (2001), Crosby (2001), El-Saiedy (2003) and Khalifa *et al.* (2008).

Table (1): Susceptibility of watermelon cultivars of *Monosporascus cannonballus* the causal organism of Monosporascus root rot/vine decline of watermelon under greenhouse conditions.

Cultivars	MC-C6			MC-M1			MC-M8		
	Disease parameters %			Disease parameters %			Disease parameters %		
	*S.W.P.	**D.I.	Reisolation	S.W.P.	D.I.	Reisolation	S.W.P.	D.I.	Reisolation
Nasa	33.33	35.40	90.00	50.00	56.00	70.00	40.00	45.00	96.67
Suger baby	43.33	45.50	90.00	60.00	77.50	80.00	50.00	60.29	70.00
Crmson	50.00	54.00	60.00	33.33	30.70	80.00	30.00	29.30	80.00
Hollar king	66.67	77.10	70.00	40.00	25.00	80.00	46.67	77.80	90.00
Aswan	16.67	14.10	50.00	6.67	10.50	60.00	20.00	22.50	90.00
Giza 1	76.67	77.80	90.00	96.67	87.10	70.00	70.00	80.60	60.00
White supe	23.33	33.30	90.00	16.67	16.50	90.00	30.00	27.10	100.0
Scata	33.67	35.40	70.00	50.00	60.00	60.00	36.67	51.10	90.00

L.S.D. at 5%: 1- Isolates N.S. 2- Watermelon cultivars 4.1 1 X 2- N.S.
*S.W.P. = Sudden wilt plants **D.I. = Disease index

1. b. cucumber genotypes:

Data in Table (2) clear that, significant differences were noticed between all tested cucumber genotypes. Regarding to isolate MC-M1, Conqueror genotype was recorded as the most susceptible one in percentage of sudden wilt plants, (70.00 %). Disease severity index showed the highest value by Conqueror genotype (56.67 %). Maximum reisolation was obtained from Conqueror (90.0 %). The highest values of DI (50.0 and 45.0%) were observed in Conqueror genotype that infected with the isolates MC-M8 and MC-C6 respectively.

Reisolation of the pathogen were at higher percentages from Azaeem, Conqueror and Saso genotypes that infected with the isolate MC-M1, (90.0, 90.0 and 80.0% respectively), but it was at least percentage on Medina (23.33 %) plants infected with isolate MC-M8. The above results are in agreement with Martyn *et al.* (1993 a), Martyn and Miller (1996).

1. c- Squash genotypes:

Data in Table (3) indicate that, the highly sudden wilt plants rate and Disease severity index were noticed in Top kapi genotype (76.67 and 75.5 % respectively) while the highly reisolation was recorded on Eskandrani (156) squash genotype (80 %) plants infected with isolate MC-M8. The highest infection was noticed in Top kapi and Tala squash genotypes (70.0 & 66.67% respectively), while the highest disease severity index was noticed in Top kapi and Tala genotypes (75.5 & 52.5 % respectively), the least percentage of reisoltion was notice in Bottle gourd genotype when plants were infected with the isolate MC-M1. These are in accordance with Martyn and Miller (1996).

Table (2): Effect of three aggressive isolates of *M. cannonballus* on Monosporascus root rot/vine decline disease incidence of some cucumber genotypes under greenhouse conditions.

Cucumber genotype	MC-C6			MC-M1			MC-M8		
	Disease parameters %			Disease parameters %			Disease parameters %		
	*S.W.P.	**D.I.	Reisolation	S.W.P.	D.I.	Reisolation	S.W.P.	D.I.	Reisolation
Azaeem	33.33	38.46	80.00	50.00	56.00	90.00	46.67	65.45	80.00
Conqueror	60.00	72.50	90.00	70.00	80.00	90.00	63.33	77.14	76.67
Medina	6.67	12.63	46.67	16.67	23.53	33.33	13.33	18.82	23.33
Saso	40.00	45.00	70.00	23.33	40.00	80.00	16.67	22.35	66.67
Biet Alpha	10.00	12.22	36.67	20.00	31.25	50.55	10.00	11.11	30.00

L.S.D. at 5%: 1- Isolates N.S. 2- Cucumber genotypes 4.36 1 X 2- N.S.
*S.W.P. = Sudden wilt plants **D.I. = Disease index

Table (3): Effect of three aggressive isolates of *M. cannonballus* on Monosporascus root rot/vine decline incidence disease of different squash genotypes under greenhouse conditions.

Squash genotype	MC-C6			MC-M1			MC-M8		
	Disease parameters %			Disease parameters %			Disease parameters %		
	*S.W.P.	*D.I.	Reisolation	S.W.P.	D.I.	Reisolation	S.W.P.	D.I.	Reisolation
Bottle gourd	10.00	8.33	6.67	0.00	6.67	00.00	16.67	26.67	3.33
Eskandrani 156	20.00	15.56	30.00	10.00	8.33	60.00	26.67	43.33	80.00
Soha	46.67	53.38	50.00	30.00	30.00	50.00	23.33	43.33	60.00
New Eskandrani	13.33	13.13	20.00	20.00	33.33	30.00	10.00	13.33	60.00
Sama	50.00	40.83	40.00	30.00	50.00	30.00	70.00	60.83	50.00
Top kapi	43.33	31.67	60.00	70.00	75.50	70.00	76.67	75.50	70.00
Tala	40.00	28.33	40.00	66.67	52.50	30.00	43.33	34.17	20.00

L.S.D. at 5%: 1- Isolates N.S. 2- Squash genotypes 4.26 1 X 2- 7.38
*S.W.P. = Sudden wilt plants **D.I. = Disease index

1. d- Cantaloupe genotypes:

Data in Table (4) show that, tested cantaloupe genotypes differed in their resistance to *M. cannonballus*. Regarding to the isolate MC-M1, Ananas (1) genotype reacted as the most susceptible one in percentage of sudden wilt plants and disease severity index. (63.33 and 56.67% respectively). Reisolation of the pathogen showed at all the highest value from Sun Gold genotype (86.67%).

On the other hand disease severity index gave the maximum results from Ananas (1) genotype (56.67 and 45.5%) when the plants were infected by the isolates MC-M8 and MC-C6 respectively. Maximum percentage of reisolation was noticed in Sun

Gold and Shahd El-Dokki genotypes (100%) that infected by the isolates of MC-C6 and MC-M8, respectively these results are in accordance with those Champaco *et al.* (1988), Lobo-Ruana (1990) and Stanghellinia *et al*. (2010).

1. e- Other cucurbit plants:

Data in Table (5) indicate that Pumpkin cv. Local was susceptible to the tested three isolates. Percentage of sudden wilt plants was lower in all isolates i.e., MC-C6, MC-M1 and MC-M8 (6.67, 20.00 and 10.00 % respectively), disease severity index was (13.13, 33.33 and 13.13 % respectively). Reisolation of the pathogen was at the highest value in Pumpkin plants infected with MC-C6 (30.0 %). Loofah cv. Balady was susceptible to all tested isolates in various levels of infection. Disease severity index and reisolation were at the same trend of Pumpkin plants. Snack cucumber cv. Napolci was highly susceptible.

Percentage of sudden wilt plants reached to (26.67, 46.67 and 20.0%) that infected with isolates MC-C6, MC-M1 and MC-M8 respectively. The same trend was noticed in percentage of reisolation and disease severity index. Above results are in agreement with Tsay and Tung (1997), El-Saiedy (2003) and Lin *et al*. (2007)**.**

2. Non-cucurbit plants:

Data in Table (6) indicate that, all non-cucurbit plants were considered as susceptible crops. Pea was the highly susceptible one where it recorded percentage of sudden wilt plants (50.00 %), while tomato and maize were the least susceptible (13.33 and 16.67 % respectively). Disease severity index showed the higher values in pea crop (46.67%) while the least D.I. was noticed in tomato and maize (13.13 %), infected with the isolate MC-C6. Maximum reisolation percentage was noticed in eggplant, while the least was noticed in tomato (70.0 and 0.0 % respectively).

However isolate MC-M8 was more aggressive to non-cucurbit plants than isolate MC-M1. Percentage of infection was higher on pea that infected with isolate MC-M8 and MC-M1 (60.00 and 50.00 % respectively), disease severity index gave the maximum value on eggplant (46.67 %). Maximum percentage of reisolation was noticed in eggplant (86.67 %) was infected by isolate MC-M1, whereas minimum percentage of reisolation noticed in tomato (00.0 %) infected by isolate MC-M1 such results were also reported by Martyn *et al*. (1993 b) and Mertely *et al.* (1993).

Table (4): Effect of three aggressive isolates of *M. cannonballus* on Monosporascus root rot/vine decline disease incidence of four cantaloupe genotypes under green house conditions.

Cantaloupe genotypes	MC-C6			MC-M1			MC-M8		
	Disease parameters %			Disease parameters %			Disease parameters %		
	*S.W.P.	**D.I.	Reisolation	S.W.P.	D.I.	Reisolation	S.W.P.	D.I.	Reisolation
Shahd El-Dokki	23.33	26.67	80.00	36.67	51.67	70.00	40.00	31.67	100.0
Ananas 1	50.00	42.50	70.00	63.33	56.67	83.33	46.67	33.33	80.00
Sun Gold	16.67	26.67	90.00	10.00	13.13	86.67	20.00	16.67	90.00
Ananas 2	33.33	23.33	100.0	60.00	48.33	80.00	53.33	45.83	70.00

L.S.D. at 5%: 1- Isolates N.S. 2- Cantaloupe genotypes 1.24 1 X 2- 2.14

*S.W.P. = Sudden wilt plants **D.I. = Disease index

Table (5). Effect of three aggressive isolates of *M. cannonballus* on Monosporascus root rot/vine decline disease incidence of some cucurbit plants under greenhouse conditions.

Host	MC-C6			MC-M1			MC-M8		
	Disease parameters %			Disease parameters %			Disease parameters %		
	*S.W.P.	**D.I.	Reisolation	S.W.P.	D.I.	Reisolation	S.W.P.	D.I.	Reisolation
Loofah	10.00	13.13	60.00	10.00	13.33	90.00	13.33	16.67	80.00
Pumpkin	6.67	13.33	30.00	20.00	33.33	20.00	10.00	13.33	50.00
Snake cucumber	26.67	56.67	73.33	46.67	35.83	90.00	20.00	40.00	70.00

L.S.D. at 5%: 1- Isolates 2.58 2- Host 2.6 1 X 2- 4.47

*S.W.P. = Sudden wilt plants **D.I. = Disease index

Table (6): Response of some non-cucurbit plants to Monosporascus root rot/vine decline disease incidence by three aggressive isolates of *M. cannonballus* under greenhouse conditions.

Host	MC-C6			MC-M1			MC-M8		
	Disease parameters %			Disease parameters %			Disease parameters %		
	*S.W.P.	**D.I.	Reisolation	S.W.P.	D.I.	Reisolation	S.W.P.	D.I.	Reisolation
Eggplant	33.33	22.5	70.00	30.00	46.67	86.67	26.67	23.33	56.67
Tomato	13.33	13.13	00.00	00.00	10.00	00.00	10.00	10.00	00.00
Wheat	40.00	25.83	23.33	36.67	55.00	13.33	40.00	29.17	20.00
Barley	40.00	32.50	16.67	30.00	53.33	20.00	33.33	25.00	16.67
Pea	50.00	46.67	56.67	50.00	44.17	66.67	60.00	55.58	66.67
Maize	16.67	13.13	33.33	10.00	10.00	23.33	13.33	20.00	43.33

L.S.D. at 5%: 1- Isolates N.S. 2- Host range 3.64 1 X 2- N.S.

*S.W.P. = Sudden wilt plants **D.I. = Disease index

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دراسات على الفطر مونوسبوراسكس كانونبولس المسبب لمرض عفن الجذور وتهدل العرش المونوسبوراسكى

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الملخص العربي

يعتبر مرض عفن الجذور وتهدل العرش المونوسبوراسكى فى القرعيات من الأمراض الهامة حيث يصيب الفطر مونوسبوراسكس كانونبولس المسبب للمرض جذور النباتات فى المراحل المتأخرة من عمر النبات وقبل جمع المحصول مباشرة ويسبب خسائر إقتصادية كبيرة. وقد اجريت هذه الدراسة لإختبار المدى العوائلى للفطر المسبب حيث تم إجراء إختبارات العدوى لتسعة وعشرين صنفا ونوعا من نباتات تنتمى للعائلة القرعية ؛ وكذا ستة أصناف تنتمى لعائلات نباتية أخرى لدراسة مدى قابليتها جميعا للإصابة بالمرض، وقد إستخدمت فى إجراء العدوى ثلاث عزلات قوية من الفطراحداها تم عزله من نباتات خيار وعزلتان من نباتات الشمام مصابة بالمرض وقد تراوحت متوسطات الإصابة للقرعيات من ٦.٦٧ الى ٩٦.٦٧% وكانت النسبة المؤية لإعادة عزل الفطر مونوسبوراسكس كانونبولس تتروح بين ٢٠ الى ١٠٠% من جذور النباتات المصابة. وتختلف نباتات العائلة القرعية فى مدى مقاومتها لمرض عفن الجذور وتهدل العرش المونوسبوراسكى بحيث يمكن تدريجها من الأكثر مقاومة الى الأقل كالأتى: اللوف، القرع العسلى، القثاء، الكوسة، الخيار، الكانتلوب و البطيخ. وبدراسة قابلية بعض المحاصيل خارج العائلة القرعية للإصابة بالمرض وهى الباذنجان، الطماطم، القمح، الشعير، البسلة والذرة الشامية كانت نسبة الإصابة ٣٠.٠؛ ٧.٧١؛ ٣٨.٨٩؛ ٣٤.٤٤؛ ٥٣.٣٣ و١٣.١٣% على التوالى ؛ فى حين كانت النسبة المؤية لإعادة عزل الفطر هى ٧١.١١ ؛ ٠٠.٠؛ ١٨.٦٩؛ ١٧.٧٩؛ ٦٣.٣٤ و٣٣.٣٣% على التولى.