J.Agric.Chem.and Biotechn., Mansoura Univ.Vol. 8 (6): 163 – 165, 2017

Effect of Previous Crop on Susceptibility of Flax to *Rhizoctonia solani*

Hussein, E. M.[1] ; A. A. Aly[1] ; Ola G. H. EL-Hawary[1]; A. A. Mosa[2]; M. H. Mostafa[2] and Amal A. Asran[1]

[1]Plant Pathology Research Institute, Agricultural Research Center, Giza, Egypt.

[2]Department of Plant Pathology,Faculty of Agriculture,Ain Shams Univ,Cairo, Egypt.

ABSTRACT

Effect of *Rhizoctonia solani* AG group,previous crop, flax cultivar,and their interactions on the incidence of flax seedling blight were studied under greenhouse conditions in autoclaved soil.All the main effects of AG group,previous crop,and cultivar were highly significant sources of variation in survival. Of the first order interactions, AG group x previous crop was the only significant source of variation. The second order interaction of AG group x previous crop x cultivar was a nonsignificant source of variation. All the previous crops significantly reduced survival within each AG; however,the magnitude of reduction varied from one AG to another. Thus, within AG-2,corn,rice, and cotton reduced survival by 32.42,16.69, and 6.82% respectively, while withinAG-4, con, rice, and cotton reduced survival by 4.68,11.55, and 11.55%, respectively.

INTRODUCTION

Rhizoctonia solani **Kühn(teleomorph:***Thanateophorus cucumerise*(Frank)Donk) is one of the more primitive Basidomycetes.*R.solani* exists in its vegetative form in nearly all agricultural soils. In this non-spore-producing phase, the fungus lives saprophytically on dead plant remains,but it can become vigorously parasitic when roots or other parts of a susceptible host penetrate the infested zone(Watkins, 1981).

Current classification of *R.solani* is based largely on grouping of isolates into anastomosis groups (AGs). Anastomosis,or the fusion of hyphae between different individuals, may result in the sharing of genetic material without sexual reproduction, but it also serves to isolate individuals from other members of the same species that do not share the alleles for somatic compatability (Agrios,2005).

R.solani attacks flax at early stage of development, destroying the root and causing thinning or in severe infection, death the of seedlings(Krylova,1981). *R.solani* also causes root rot symptoms, which appear in plants after flowering stage (Hartman,1996).

Susceptibility of flax to *R.solani* is markedly affected by previous crop and such an effect is documented in the literature. For example, Ligocka *et al*.(2002)indicated that crop rotation was responsible for significant differences in the quantitative and qualitative composition of microorganisms population.The flax infection index values for the cultivation in monoculture and a six-field crop rotation(flax, rye, faba bean ,winter triticale, potato, and oats)showed an unfavorable effect of monoculture on the fibrous flax growth especially over emergence. It was observed that over emergence the crop root infection was greater than over flowering, both in monoculture and in crop rotation. The crop rotation showed a high decrease in the occurrence of the root pathogens by 16.82% over emergence and by 20.17% over flowering. Clear-cut changes were observed for both flax development phases in monoculture, which was considerably responsible for the accumulation of pathogenic fungi, including *Rhizoctonia* but *Fusarium* mainly. As for other pathogenic fungi ,it was noted that, irrespective of the crop rotation, their greater population was recorded over flowering ..

Flax does well after legume crops, but Rhizoctonia disease may be a problem. Flax does not do well after potatoes or sugar beets as the soil may be too loose and Rhizoctonia disease could also be a problem(Anonymous,2006).

However, due to the lack of studies, the effects of previous crop on susceptibility of flax to *R.solani* under Egyptian conditions are unclear. Therefore, the objective of the present study was to evaluate the effects of some previous crops on susceptibility of flax to *R.solani.* Rice ,corn,and cotton were chosen as previous crops because they are the most common summer crops, which are cultivated before flax,and representative isolates of AG-2 and AG-4 were used for soil infestation because all isolates of *R.solani* from flax roots belong to these AGs(EL-Hawary *et al.*,2008)

MATERIALS AND METHODS

Production of *R.solani* inoculum used in soil infestation

Isolates of *R.solani* used in the present study for soil infestation were obtained from the fungal collection of Cotton and Fiber Crops Diseases Rresearch Section, Plant Pathology Research Institute, Agric. Res. Cent., Giza, Egypt. These isolates were originally isolated from flax roots.

Substrate for growth of the isolates was prepared in 500-ml glass bottles, each bottle contained 50 g of barley grains and 40 ml of tap water. Contents . of each bottle were autoclaved for 30 minutes. Isolate inoculums, taken from one –week old culture on PDA, was aseptically into the bottle and allowed to colonize barley for three weeks . The mixture of barley and *R.solani* was used for soil infestation.

Effects of some previous crops on susceptibility of flax to *R.solani*.

Autoclaved clay loam soil was artificially infested at a rate of 1g/kg of soil,and dispensed in 30-cm-diameter clay pots. In the last week of March 2006 , three summer (pervious) crops were planted in the infested pots. The tested summer crops were rice (*Oryza sativa* L.,cv. Sakha101) Corn (*Zea mays* L.,cv.SC.10),and Cotton (*Gossypium barbadense* L.,cv.Giza89).In the control treatments (infested and non-infested), pots were left without planting, there were three pots for each treatment.

Pots were randomly distributed outdoors. In the end of October, summer crops were uprooted and all pots were planted with five flax cultivars (Sakha1, Sakha2, Marlin, Electra, and Elona) at a rate of 50 seeds per pot. Preemergence damping- off was recored 20 day after sowing, while postemergence damping- off and suevival were recorded two months after sowing. The temperature regime during flax- growing period ranged from 16±2 to 22± 2.5oC.

Statistical analysis of the data.

The present study was carried out in a randomized complete block design of three replicates. Percentage data were transformed into arcsine angles to produce approximately constant variance before carrying out the analysis of variance (ANOVA).Least significant difference (LSD) was used to compare between treatment means. ANOVA was carried out by MSTAT-C statistical package

RESULTS AND DISCUSSION

All the main effects of A Ggroup, previous crop, and cultivar were highly significant sources of variations in survival. Of the first order interactions, AG group x previous crop was the only significant source of variation. The second order interaction was a non significant source of variation (Table1).

Of the significant sources of variation, cultivar was the most important one, while AGgroup x previous crop interaction was the least important one (Table2).

Table 1. Analysis of variance of the effect of AGgroup,previous crop, flax cultivar and their interactions on survival of flax seedlings under greenhouse conditions.

Source of variation[a]	D.F[b]	M.S[c]	F.value	P>F[d]
Replication[a]	2	0.689	0.0555	0.0000
AG group (A)	1	1919.561	154.4217	0.0000
Previous crop(B)	3	496.678	40.0185	0.0000
AxB	3	382.810	30.8439	0.0000
Cultivars (C)	4	707.043	56.9681	0.0000
AxC	4	19.061	1.5358	0.3610
BxC	12	13.830	1.1143	0.3020
AxBxC	12	14.826	1.1946	
Error	78	12.411		

[a]**Replication is random, while each of cultivar, previous crop, and AG group is fixed.**
[b]**D.F= Degrees of freedom.**
[c]**M.s.= Mean of squars.**
[d]**P >F= Probability of greater F. value.**

Table 2. Relative contributions of anastomosis group, previous crop, flax cultivar, and their interactions to variation in survival of flax seedlings under greenhouse conditions.

Source of variation	Relative contribution to variation in survival[a]
Anastomosis group(A)	24.59
Previous crop (B)	19.08
Ax B	14.71
Cultivar(C)	36.22
Ax C	0.98
B x C	2.13
A x B x C	2.28

[a] **calculated as percentage of sum of squares of the explained (model) variation.**

Due to the significant interaction of AGgroup x previous crop, an interaction LSD was calculated to compare between previous crops within each AG. These comparisons showed that all the previous crops significantly reduced survival within each AG; however, the magnitude of reduction varied from one AG to another. Thus, within AG-2,corn, rice, and cotton reduced survival by 32.42, 15.69, and 6.82 %, respectively, while within G-4, corn, rice, and cotton reduced survival by 4.68,11.55,and 11.55%, respectively (Table3).

The comparisons among the general means of cultivars revealed that the introductions were more resistant to infection than the local cultivars Sakh1 and sakh2 regardles of the AGgroup and the previous crop.

In general, previous crop can induce disease by allowing inoculums levels to increase in the absence of the host, directly activating the pathogen by producing stimulating compounds, suppressing specific antagonists that inhibit the pathogen, or by decreasing general microbial populations that compete with the pathogen (Van Bruggen *et al*., 1996). It seems reasonable to assume that survival of R.solani in root debris of the previous crops and its subsequent increases in inoculums density may contribute to the observed increases in disease incidence. Since the present study was carried out in autoclaved soil, it is unlikely that soil microbial populations were implicated in the observed increases in disease incidence. Further research is needed to elucidate the reason(s) of such increases.

Table 3. Effects of AG group ,previous crop, flax cultivar and their interactions on survival of flax seedlings under greenhouse conditions.

		Cultivar											
AG group	Previous crop	Sakha1 %[a]	Sakha1 Arc sine	Sakha1 %	Sakha1 Arc sine	Marlin %	Marlin Arc sine	Electra %	Electra Arc sine	Elona %	Elona Arc sine	Mean %	Mean Arc sine
AG2-2	corn	55.33	(48.07)	32.00	(34.45)	70.00	(56.85)	46.67	(43.11)	60.00	(50.77)	52.80	(46.65)
	Rice	61.33	(51.56)	53.33	(46.90)	76.00	(60.70)	72.67	(58.56)	66.00	(54.33)	65.87	(54.41)
	Cotton	67.33	(55.15)	64.00	(53.13)	82.00	(64.92)	78.67	(62.50)	72.00	(58.09)	72.80	(58.76)
	Control	74.00	(59.38)	68.66	(55.96)	88.00	(69.77)	83.33	(65.91)	76.67	(61.15)	78.13	(62.44)
	Mean	64.49	(53.54)	54.49	(47.61)	79.00	(63.06)	70.34	(57.52)	68.67	(56.09)	67.40	(55.57)
AG-4	corn	76.00	(60.72)	72.67	(58.54)	90.67	(72.47)	87.33	(69.21)	80.67	(63.93)	81.47	(64.97)
	Rice	70.67	(57.30)	66.67	(54.81)	84.67	(67.07)	81.33	(64.43)	74.67	(59.79)	75.60	(60.68)
	Cotton	70.67	(57.27)	66.67	(54.77)	84.67	(67.02)	81.33	(64.43)	74.67	(59.78)	75.60	(60.66)
	Control	80.00	(63.58)	76.67	(61.27)	92.67	(74.32)	90.67	(72.29)	87.33	(68.13)	85.47	(67.92)
	Mean	74.34	(59.72)	70.67	(57.35)	88.17	(70.22)	85.17	(67.59)	79.34	(62.91)	79.54	(63.56)
	Overalmean	69.41	(56.63)	62.58	(52.48)	83.59	(66.64)	77.75	(62.56)	74.00	(59.49)	73.47	(59.57)
Mean of	Previous crop												
	corn	67.14	(55.81)										
	Rice	70.74	(57.55)										
	Cotton	74.20	(59.71)										
	Control	81.80	(65.18)										

[a] percentage data were transformed into arc sine angles before carrying out ANOVA to produce constant variance.
LSD (transformed) data for AG x previous crop interaction= 2.56 (p (0.05 >or 3.40) p.(0.01 >
LSD for Cultivar = 2.03) p (0.05 >or 2.69)p .(0.01 >

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تأثير المحصول السابق علي قابلية الكتان للإصابة بفطر ريزوكتونيا سولاني

عزت محمد حسين[1]،علي عبد الهادي علي[1]، علا حسن جميل الهواري[1]، أحمد أحمد موسي[2] ، مصطفي حلمي مصطفي[2] و أمل عبد المنجي عسران[1].

[1] معهد بحوث امراض النباتات , مركز البحوث الزراعية , الجيزة , مصر.

[2] قسم امراض النبات , كلية الزراعة , جامعة عين شمس , القاهرة , مصر.

درست المجموعة إلالتحامية لفطر الريزوكتونيا سولاني والمحصول السابق وصنف الكتان وتفاعلاتها المختلفة من حيث تأثيرها علي حدوث مرض لفحة بادرات الكتان, وذلك تحت ظروف الصوبة , في تربة معقمة, أظهرت الدراسة أن كل من المجموعة إلالتحامية والمحصول السابق والصنف كان مصدرا معنويا للتباين في نسبة البادرات الباقية علي قيد الحياة. كان تفاعل المجموعة إلالتحامية X المحصول السابق هو التفاعل الوحيد المعنوي من بين جميع تفاعلات الدرجة الاولي. تفاعل الدرجة الثانية للمجموعة إلالتحامية X المحصول السابق X الصنف كان مصدرا غير معنويا" للتباين. جميع المحاصيل السابقة المختبرة قللت معنويا من نسبة البادرات الباقية علي قيد الحياة داخل كل مجموعة التحامية , إلا أن حجم الانخفاض اختلف من مجموعة التحامية لآخري, وعلي ذلك فأن زراعة الكتان بعد الذرة أو الأرز أو القطن قلل من نسبة البادرات الباقية علي قيد الحياة بنسب 42و32 أو 69و15 أو 82و6 % , علي التوالي في حالة المجموعة إلالتحامية الثانية , في حين انخفضت البادرات الباقية علي قيد الحياة بنسبة 68و4 أو 5و11% أو 5و11% بعد الذرة أو الأرز أو القطن, علي التوالي , في حالة المجموعة إلالتحامية الرابعة.