

EFFECT OF AGRICULTURAL PRACTICES ON CHICKPEA WHITE STEM ROT DISEASE INCIDENCE

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ABSTRACT

Susceptibility of some chickpea entries to *Sclerotinia sclerotiorum* infection showed that all tested entries were susceptible. Giza 1 was highly susceptible, while Giza 531 was less susceptible to the fungal infection. Giza 88 and Giza 195 were moderately susceptible. Studying the role of environmental factors on Giza 1 chickpea White stem rot showed that disease incidence was low during early phase, but it was higher in pod bearing stage. Tow ridges planting of the row cleared that percentage of infected plants was higher in the northern ridge than in the southern ones. Also, disease incidence was higher in hills planted with five seeds than that planted with two seeds.

INTRODUCTION

Crop losses attributed to *Sclerotinia sclerotiorum* (Lib.) de Bary ranged from 0 – 100 % and millions of dollars were lost annually as a result of white stem rot disease incidence (Purdy, 1979). There is a great variation in annual losses among different crops, even in the same area because of the scattered nature of the diseases and effect of different weather conditions (Willette and Wong, 1980).

In Egypt, 3.36 % of chickpea (*Cicer arietinum* L.) crop was lost in 1992 due to the infection caused by white stem rot disease and El-Behera Governorate was the highest location of disease incidence (7.1 %) (Mazen, 1995). The extent of damage in India due to this disease was ranged from 21.25 to 46.70 % at pod bearing stage (Sharma *et al.*, 2001).

Rahhal *et al.* (1999) evaluated eight chickpea entries for *S. sclerotiorum* infection and they found that its susceptibility ranged from 3.67 to 13.33 %.

Control practices that have met with varying degrees of success include: protectant chemicals, application of materials that inhibit germination or destroy sclerotia and cultural practices such as crop rotation, sanitation and reduced irrigation.

S. sclerotiorum mycelial growth occurred at relative humidity above 93 % when materials were available, but under 93 % no growth took place and the mycelium survived only for a period of up to one month (Van de Berg and Lentz, 1968). Willis, (1971) found that the optimum temperature for *S. sclerotiorum* growth was 26° C. Data on the critical role of moisture in the microclimate suggest that certain cultural practices can be utilized to reduce disease incidence and development of both stem rot of bean and drop of lettuce (Abawi and Grogan, 1979). Sharma *et al.* (2001) reported that both of maximum and minimum temperature (22.1° C and 5.4°), high relative

humidity (71.84 %) and rainfall between 26.4 – 38.0 mm played a significant role in the development of chickpea white stem rot disease.

MATERIALS AND METHODS

Field experiments were conducted during 2001 and 2002 growing seasons at Etay El-Baroud Agricultural Research Station Farm. The experimental layout was RCBD with three replicates. The experiments were conducted in plots of size 2m in the length and 3 rows, between both of them 0.60 m under natural infection in the open field. Infected plants were calculated based on visible symptoms as described by Purdy, (1979). Disease incidence was calculated as follow :-

$$\text{Percentage of infection} = \frac{\text{No. of infected plants}}{\text{Total No. of plants}} \times 100$$

Reaction of some Chickpea Entries Against *S. sclerotiorum* :

Four chickpea entries, Giza1, Giza 88, Giza 195 and Giza 531 were tested. Seven days after field irrigation, seeds were sown in hills of 5 cm apart in two ridges / row with 2 seeds / hill. The appearance of the first white stem rot symptoms was 115 days after sowing in both seasons. Infected plants and disease incidence were calculated as mentioned above.

Development of Chickpea White Stem Rot Disease in Relation to Environmental Factors :

Chickpea entry Giza 1 was used in this experiment. Seven days after field irrigation, seeds of this entry were sown in hills with a spacing of 10 cm. Disease incidence was recorded 2 times, after 95 days from sowing at the early phase and 125 days after sowing at pod bearing stage. Weather variables : maximum and minimum temperature, rainfall rate and relative humidity were recorded during the seasons. Due to visible symptoms, infected plants were counted and percentage of infection was calculated.

Effect of Agricultural Practices on Chickpea White Stem Rot Disease Incidence :

A- Two ridges planting :

Four chickpea entries : Giza 1, Giza 88, Giza 195 and Giza 531 were used. Seven days after field irrigation, seeds were planted in the two ridges, southern ridge and northern one. Infected plants were counted and percentage of infection was calculated.

B- Plant Density :

Seven days after irrigation, seeds of Giza 195 were sown in rates of : two seeds / hill (as a common method of chickpea planting) and five seeds / hill, of 5 cm apart in two ridges / row. Infected plants were counted and percentage of infection was calculated.

Statistical analysis :

The obtained data were statistically analysed according to the method of Gomez and Gomez, (1984) at the Costat computer program. Means were compared using LSD test at the 0.05 level of probability.

RESULTS AND DISCUSSION

Reaction of some chickpea Entries Against *S. sclerotiorum* :-

All tested chickpea entries were susceptible to *S. sclerotiorum*, and significant differences among them were recorded. Susceptibility arrangement was Giza 1, Giza 88, Giza 195 and Giza 531 with disease incidence averages of 7.54, 6.89, 5.73 and 5.1 % respectively in both seasons of 2001 and 2002, Fig (1). Variation among chickpea entries in susceptibility to white stem rot disease could be due to breeding for sclerotinia stem rot resistance. On the other hand, variation in disease incidence between the two growing seasons may be due to the presence of genotype – environment interactions that play a critical role on susceptibility and resistance of chickpea plants to white rot disease. These findings are in agreement with Gurdip *et al.* (1989), Bastawisy *et al.* (1999) and Rahhal *et al.* (1999).

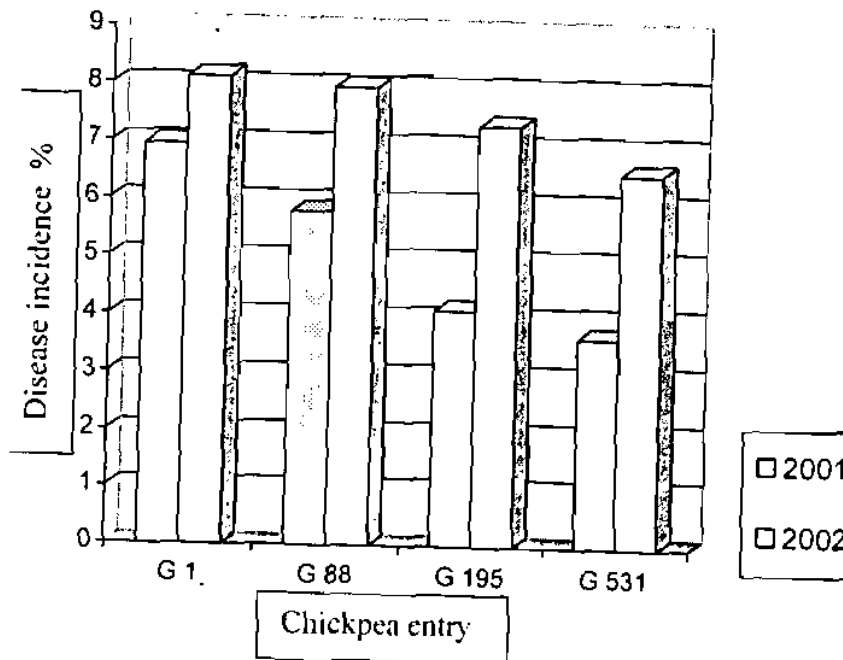


Fig. (1) : (%) Disease incidence of *Sclerotinia sclerotiorum* on the four chickpea entries during 2001 and 2002 growing seasons.

Development of White Stem Rot Disease in Relation to Environmental Factors :

Data in Table (1) show that low percentage of white rot disease incidence (3.12 %) was found during the early phase of crop. However, it increased in the pod bearing stage of the crop and got to 13.68 %. The increasing of disease incidence was correlated with high rainfall rate, high relative humidity and moderate temperature. These results are in agreement with Sharma et al. (2001) and Langston et al. (2002) who reported that high disease incidence correlated with the suitable environmental factors.

Table (1) : Disease development on early growth phase and pod bearing stage of chickpea plants correlated with environmental factors.#

Period	Temperature °C		Rainfall rate (mm)	Relative humidity %	Disease incidence %
	Maximum	Minimum			
Early phase*	18	9	24.5	64.38	3.12 @
Pod bearing stage**	24	12	34.2	70.2	13.68

@ Data are average of three replicates

*95 days after sowing

**125 days after sowing

LSD at 0.05 = 0.0226

Effect of Agricultural Practices on Chickpea White Stem Rot Disease Incidence :-

A- Two ridges planting :

Results showed that white stem rot disease incidence was higher in the northern ridge than in the southern ridge, Table (2). Variation in disease incidence between the two ridges may be due to the differences between the two ridges in soil temperature and soil moisture. This result is in agreement with Phillips, (1990) who reported that increasing temperature by solarization reduced the population of sclerotia of *S. sclerotiorum* in soil.

B-Plant density :

Significant differences were found in disease incidence as a result of the plant density / hill. Data in Table (3) show significant decrease in white stem rot disease incidence on chickpea plants of hills planted with two seeds compared with hills planted with five seeds. These results may be due to that the plots with higher plant density have thick canopies which remain soil wet for extended periods. This result is in agreement with Ferraz et al., (1999) who reported that more apothecia and diseased plants were observed in the plants with higher moisture level.

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Table (2): Effect of planting the northern ridge and southern ridge of the row on chickpea white stem rot disease incidence (%) during 2001 and 2002 growing seasons.

Tested entries	Tested ridge		Mean
	Northern	Southern	
Giza1 A	* 5.90 Ⓞ	4.18	5.04
B	10.73	7.99	9.36
Giza 88 A	5.87	4.03	4.95
B	10.11	7.64	8.87
Giza195 A	5.16	3.97	4.56
B	9.91	7.13	8.52
Giza 531 A	4.89	3.71	4.30
B	9.77	6.63	8.20
Mean A	5.45	3.97	
B	10.13	7.34	

A 2001 growing season

B 2002 growing season

* (%) Disease incidence Ⓞ Data are average of three replicates

LSD at 0.05

Entries (E) = 0.0187

Seasons (S) = 0.0132

Ridges (R) = 0.0132

E × S = 0.0264

E × R = 0.0264

S × R = 0.0187

E × S × R = 0.0374

Table (3) : Effect of chickpea plant density / hill on white stem rot disease incidence (%).

Tested entry	Season	Seeds / hill		Mean
		2 seeds	5 seeds	
Giza 195	2001	*3.18 Ⓞ	7.12	5.15
	2002	6.79	10.26	8.52
Mean		4.98	8.69	

*Disease incidence (%)

Ⓞ Data are average of three replicates

LSD at 0.05

Seasons (S) = 0.007

Density (D) = 0.007

S × D = 0.0315

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" دراسة تأثير بعض العمليات الزراعية على الإصابة بمرض عفن الساق الأبيض في الحمص "

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أظهرت النتائج المتحصل عليها في هذا البحث أن جميع أصناف الحمص المختبرة قابلة للإصابة بمرض عفن الساق الأبيض ، وكان الصنف جيزة ١ الأكثر قابلية للإصابة بينما كان الصنف جيزة ٥٣١ أقل الأصناف المختبرة قابلية للإصابة ، أما الصنفين جيزة ٨٨ ، وجيزة ١٩٥ فكانا متوسطا القابلية للإصابة . أظهرت دراسة بعض العوامل البيئية على إصابة الصنف جيزة ١ أن نسبة الإصابة بمرض عفن الساق الأبيض منخفضة خلال مرحلة النمو المبكرة وكانت مرتفعة خلال مرحلة امتلاء القرون . كما أظهرت النتائج أيضا أن زراعة نباتات الحمص على الريشتين أدت إلى زيادة نسبة النباتات المصابة في الريشة البحرية عنها في الريشة القبلية . وأن نسبة النباتات المصابة في الجور عالية الكثافة النباتية (٥ بذرة / جورة) أعلى من نسبة النباتات المصابة في الجور منخفضة الكثافة النباتية (٢ بذرة / جورة) .