Sclerotinia MID-STALK ROT OF SUNFLOWER: EFFECT ON YIELD COMPONENTS AND OIL CONTENT

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SUMMARY

The objectives of this study were: (a) to quantify yield losses of plants under natural conditions of infection by *Sclerotinia* mid-stalk rot, and (b) to determine if there is any relation between the magnitude of such losses and the length of the lesion caused by the disease.

Mid-stalk rot infected plants (N=120) showed an average reduction of 35% in seed yield, a lower number of seeds per head (24%); a decrease in 1000-seed weight (15%) and lower oil percent (8.1 points) as compared wiht healthy control plants (p<0.0001).

The reductions in seed yield, seed number, seed weight, and oil content in seed were very significantly correlated with the lesion length of the mid-stalk rot infected plants. Lesion length can be utilized as a predictor of such decreases and as a valuable tool in screening genetic materials for tolerance to this disease.

Key words: Sunflower, *Helianthus annuus* L., *Sclerotinia sclerotiorum* (Lib.) de Bary, yield loss assessment, tolerance breeding.

INTRODUCTION

Sclerotinia sclerotiorum (Lib.) de Bary can produce three differents diseases on sunflower: head rot, basal stalk rot and mid-stalk rot (see Sackston, 1992; Maširević and Gulya, 1992).

Mid-stalk rot typically infects plants from the late vegetative stage until maturity. Ascospores land on wounded leaf tissue and colonize the leaf, with the infection progressing down the petiole, ultimately producing a stem lesion and hollowing of the stem. Foliage above the lesion wilts, and plants with mid-stalk rot often break over at the point of the lesion (Maširević and Gulya, 1992). In addition to lodging, this disease seems to drastically affect the yield. In this sense, the objectives of this study were: (a) to quantify yield losses of sunflower plants under natural conditions of infection by mid-stalk rot, and, (b) to determine if there is any relation between the magnitude of such losses and the length of the lesion caused by the disease.

MATERIALS AND METHODS

A field trial was conducted at Baigorrita (Buenos Aires), where severe mid-stalk rot was detected in the 92/93 growing season. Six experimental sunflower hybrids from the

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breeding program of Nidera S. A. were used: H219206, H219214, H219215, H219221, H219233, H219234, in a completely randomized block design with 3 replications.

Five to 10 well-spaced plants with mid-stalk rot symptoms were chosen at random from each hybrid and replicate.

The data recorded for each plant were: number of seeds per head, 1000-seed weight, and percent oil in the seed. The data were compared with those recorded for 18 healthy well-spaced plants per hybrid and replication through pairwise comparisons (Steel and Torrie, 1980). These comparisons were made on a mean plot basis (N=18).

To determine if the length of the lesion was related to yield loss, the variables below were calculated on a per plant basis and correlation and linear regression coefficients (model y=b*x) were estimated between such variables and the lesion length on each plant (N=120).

The calculated variables were:

1. – Percent seed yield reduction over the healthy control

$$= 100 - \frac{\text{Yield of diseased plants}}{\text{Average plot yield of healthy control}} \cdot 100 \ .$$

2. – Decrease in oil percent with respect to healthy control

= oil percent of each diseased plant – average plot oil percent of healthy control.

3. – Percent reduction in the number of seeds per head

$$= 100 - \frac{\text{Number of seeds per head of diseased plants}}{\text{Average number of seed per head of healthy control}} \cdot 100 \ .$$

4. – Percent reduction of 1000-seed weight

$$= 100 - \frac{1000 - \text{seed weight of diseased plants}}{\text{Average plot } 1000 - \text{seed weight of healthy control}} \cdot 100 \ .$$

RESULTS AND DISCUSSION

The length of lesions on the diseased plants ranged from 22 to 115 cm, with an average of 54 cm, and with a standard deviation of 16.7 cm.

The differences between the diseased plants and the healthy controls are listed in Table 1. As can be seen, mid-stalk rot caused large losses in seed and oil yield losses were atributable to fewer seeds per head and to a lower 1000-seed weight (see also Table 2).

Table 1 – Pairwise comparisons between mid-stalk infected and healthy plants for seed yield, number of seed perhead, 1000-seed weight and oil percent (N=18) (1).

Variable	Mean healthy control	Difference healthy-diseased	Prob. > |T|
Seed yield (2)	58.4	20.4	0.0001
Number of seeds (2)	1351	324	0.0001
1000-seed weight	43.2	6.4	0.0001
Oil percent	46.4	8.1	0.0001
(1) All comparisons were done on a mean plot basis.			
(2) Per capitulum.			

Table 2 – Means, standard deviations, and ranges for percent seed yield reduction (PSYR), decrease in oil percent (DOP), percent reduction in the number of seeds per head (PRNS), and percent reduction of 1000-seed weight (PRSW) of mid-stalk infected plants compared with healthy controls.

Variable	Mean	Standard deviation	Range
PSYR	41.5	26.9	0.9 – 98.1
DOP	8.6	6.3	0 – 23.5
PRNS	32.5	23.7	1.4 – 92.8
PRSW	21.4	13.8	0 – 57.5

The correlation between percent seed yield reduction of diseased plants and lesion length was 0.56 (P < 0.0001). The linear regression coefficient for the variables was 0.77 (P<0,0001, R^2 = 0.80). This indicates that each 10 cm increase in length of the lesion reduces the seed yield of the diseased plants by 7.7%.

The correlation between oil percent reduction and lesion length was 0.64 (P < 0.0001). The regression for the variables was 0.18 (P < 0.0001, R^2 = 0.78), which suggests that for each 10 cm increase in length of the lesion there would be a 1.8 point decrease in the oil percent of the diseased plants as compared with the controls.

Percent reduction in the number of seeds per head was positively correlated with the length of lesion (r = 0.58, p<0.0001). The linear regression coeficient for the variables (b = 0.62, P < 0.0001; R^2 = 0.76) indicates that there would be a 6.2% reduction in the number of seeds per head for each 10 cm increase of the length of the lesion.

Percent reduction in 1000-seed weight of the diseased plants showed a positive association with the length of the lesion (r = 0,31, p < 0.0008). Linear regression of the variables (b = 0.38, p < 0.0001, R^2 = 0.73) indicates that for each 10 cm of lesion there would be a 3.8% decrease of 1000-seed weight as compared with the healthy control.

The results obtained indicate that Sclerotinia mid-stalk rot of sunflower can cause large decreases in oil percent, seed number, seed weight, and therefore seed yield. The length of the lesion can be used as a predictor of such losses and as a valuable tool for screening genetic materials for tolerance to this disease.

ACKNOWLEDGMENTS

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PODREDUMBRE DE TALLO CAUSADA POR *Sclerotinia* **EN GIRASOL: EFECTO SOBRE LOS COMPONENTES DE RENDIMIENTO Y CONTENIDO DE ACEITE**

RESUMEN:

Los objetivos de este estudio son: (a) cuantificación de pérdidas rendimiento en condiciones naturales de infección por podredumbre causada por *Sclerotinia* (b) determinar si hay alguna relación entre la magnitud de tales pérdidas y la longitud de la lesión causada por esta enfermedad.

Las plantas infectadas (N-120) mostraron una reducción media del 35% en rendimiento un nmero más bajo de semillas por capítulo (24%) una disminución un peso de 1000 semillas del 15% y contenido más bajo de aceite 8-1 puntos que las plantas sanas (p>0.001).

La reducción en nmero de semillas, peso de semillas y contenido de aceite de la semillas de las plantas enfermas estuvieron correlacionadas significativamente con la longitud de las lesiones en las plantas infectadas. La longitud de la lesión puede ser utilizada como un predictor de tales decrecimientos y una valiosa herramienta en el cribado de material vegetal para tolerancia a esta enfermedad.

Sclerotinia **AGENT CAUSAL DE LA POURRITURE MOLLE DE LA TIGE : EFFET SUR LES COMPOSANTES DU RENDEMENT ET SUR LA TENEUR EN HUILE**

RÉSUMÉ:

Les objectifs de cette étude étaient les suivants : a) la quantification des pertes de rendement pour des plantes soumises à une attaque de *Sclerotinia*, b) la détermination d'éventuelles relations entre l'importance de telles pertes et la longueur de la lésion causée par cette maladie.

Les plantes infectées (N=120) ont montré une reduction moyenne du rendement en grain de 35%, une diminution du nombre d'akènes par capitule de 24%, une réduction du poids de mille grains de 15% et une teneur en huile inférieure de 8.1 points par rapport aux témoins sains (p<0.0001).

La réduction du rendement en grain, du nombre d'akène, du PMG et de la teneur en huile des graines issues de plantes infectées était hautement et significativement corrélée à la longueur des lésions sur tiges. La longueur des nécroses peut tre utilisée comme prédicteur de la diminution de ces différents paramétres et constitue un outil vaiable pour la sélection de matériel tolérant à cette maladie.