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INFLUENCE OF SUNFLOWER STEM CANKER (*Diaporthe helianthi*) ON SEED QUALITY AND YIELD DURING SEED DEVELOPMENT

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SUMMARY

Sunflower stem canker caused by *Diaporthe helianthi* Munt.-Cvet. et al., is an important disease in the state of Tamaulipas, where more than 50% of infected plants have been observed. A field study was undertaken to determine the influence of stem canker on oil content and weight of seed and yield, at different stages of seed development. The lowest percentage of diseased plants was registered during flowering. Oil content, seed weight and yield were significantly reduced when stem canker occurred at any stage of seed development. These effects became progressively less pronounced with later disease appearance.

Key words: ***Diaporthe helianthi*, sunflower (*Helianthus annuus*), seed quality, yield, *phomopsis*.**

INTRODUCTION

Sunflower (*Helianthus annuus* L.) stem canker, also known as *phomopsis*, is a fungal disease caused by *Diaporthe helianthi* Munt.-Cvet. *el al.*, (asexual stage *Phomopsis helianthi* Munt.-Cvet. et al.). The disease has been spreading in the producing sunflower areas (Škorić, 1985; Mihaljčević and Vukojević, 1994), and in the last decade it has had a preponderant place regarding sunflower diseases. In México, first stem canker symptoms were observed in the state of Tamaulipas at the beginning of the eighties and no resistant regional cultivars were known. Until 1990 the disease was present in Tamaulipas and Nuevo León (Díaz, 1993); there are no recent information since commercial plantings of sunflower are few, because of the local limited market demand. Stem canker severity was associated with high humidity (Aćimović and Štraser, 1981; Díaz, 1993; McMullen, 1985).

Reports of estimated field infected plants ranges from 5% to more than 50% (Aćimović and Štraser, 1981; Díaz, 1993; Marić *et al.*, 1982; Yang *et al.*, 1984). Limited accurate data are available about the impact of stem canker on seed yield in México and no information have been found regarding the effect on seed quality of plants infected at different stages of development. Experimental studies demonstrated that sunflower plants become susceptible to the pathogen starting from flowering (Maric *et al.*, 1982). Under field conditions, first disease symptoms were also observed at flowering (Marić *et al.*, 1982; Díaz, 1993; McMullen, 1985). This study was conducted to determine the influence of stem canker on oil content, seed weight and seed yield at different stages of plant development.

MATERIALS AND METHODS

A naturally infested field with *D. helianthi* was selected at Río Bravo Experimental Station, INIFAP, near Río Bravo, Tamaulipas. Hybrid 'GH-382' was planted on 18 August 1993 in five plots (blocks) with four rows 0.8 m apart and 60 m long, in a completely random design into blocks. Seed quantity in each plot was 170 g and plants were thinned to obtain a population of approximately 45,000 plants/ha. In order to induce favorable conditions for the pathogen, two successive irrigations were applied, one at pre-flowering and the other during flowering, 45 and 52 days after planting, respectively. Recommended agronomic and pest management practices were followed (Ortegón *et al.*, 1993).

Plants were observed for symptoms of stem canker each 10 days, starting on 8 October until 7 November. This corresponded to mid flowering (50% of plants flowering) and before the latter stage due to interference with other diseases and normal senescence. Temperature and air humidity were registered during that period. Once each ten days all diseased (wilted) plants were marked per plot. At harvest, abnormally large or small heads were discarded and representative samples of 30 heads per plot were selected. A sample of 30 heads from visually healthy plants were marked from each plot to serve as control. Heads were air dried, threshed, and the resulting seed bulked, cleaned and weighed. The seed was then subsampled for the determination of oil content, 1000 seed weight and seed yield. Oil content was determined by the nuclear magnetic resonance method. Data were subjected to analysis of variance with mean separations by Tukey's test at $p = 0.05$, and correlation analysis was used to determine the relationship between variables (SAS, Cary, N.C.).

RESULTS AND DISCUSSION

The first readings at mid flowering yielded an average of 9% of diseased plants, then increased to 26.1% in the second ten days, until 75.2% of plants were infected with stem canker 30 days after mid flowering (Table 1); percentages of diseased plants in each period of samples date were 17.1%, 22.4% and 26.7% on 8, 18, 28 October and 7 November, respectively. Means of temperature and air humidity from flowering to mature were 23-25°C/58-69%, respectively. Drying of the leaves and development of stem lesions caused infected plants to die within a few days after the onset of wilting. The low percentage of diseased plants during flowering observed in this study coincide with those reports which indicated that the first symptoms of sunflower stem canker occurred at flowering (Díaz, 1993; Marić *et al.*, 1982; McMullen, 1985).

Table 1: Effect of growth stage on sunflower plants diseased by *Diaporthe helianthi* on oil content and weight of seed and yield

		Seed		
Samples (decennal/date)	Plants with stem canker (%)	Oil (%)	1000-seed weight (g)	Yield (kg/ha)
51[y]/8 Oct	9.0	30.9 e[z]	23.0 e	342 d
61/18 Oct	26.1	34.7 d	23.7 de	762 c
71/28 Oct	48.5	36.9 c	25.6 cd	1050 b
81/7 Nov	75.2	39.1 b	28.3 b	1112 b
Control	-	41.6 a	31.2 a	1322 a

y Days after planting; first sample at mid flowering

z Means followed by the same letter are not significantly different at p=0.05 in Tukey's test

Oil content, 1000-seed weight and seed yield were significantly reduced when wilting occurred at any stage of seed development. In these three variables, disease effects became progressively less pronunced. Oil content decreased from a maximum of 41.6% in healthy plants to 30.9% when wilting ocurred at mid flowering. The lowest oil seed percentage registered in this study at mid flowering was 14.4% lower than when *Sclerotinia sclerotiorum* (Lib.) de Bary was present a week after sunflower flowering (Dorrell and Huang, 1978). Seed weight followed a similar response as oil content. Plants wilting at mid flowering showed severe depression in seed weight. On the other hand, oil content followed a positive relationship to that observed for 1000-seed weight (r= 0.96**) (Table 1).

Estimated yield in this trail, based on yield from healthy control plants, was 1322 kg/ha. Yields from diseased plants observed 20 to 30 days after mid flowering were not significantly different (mean, 1081 kg/ha) (Table 1). Seed yield was significantly correlated with oil content (r= 0.79**) and 1000-seed weight (r= 0.81**). The actual yield, assuming that all plants in the plot were wilted, calculated by summing the product of the number of plants wilted at each 10-day stage from mid flowering and their respective plants yields, plus the final yield on non-diesased plants, was 917.6 kg/ha, an overall reduction in seed yield of 30.5%. Similar sunflower yield losses were obtained with infected plants by *S. sclerotiorum* (Dorrell and Huang, 1978).

The results of this study have demonstrated that plants infected by *D. helianthi* and wilted at any stage from mid flowering to near maturity have significantly reduced oil content, 1000-seed weight and yield. The reductions observed were due to the rapid wilting and loss of leaf tissue, somewhat similar to reports from defoliation. Cordinali *et al.* (1982) and Cholaky *et al.* (1988) showed that when foliar area was reduced, all yield components were also reduced, according to the physiological sunflower stage in which the defoliation took place. Losses were progressively decreased from start of anthesis to maturity. Also, we cannot exclude the possibility of 'phytotoxic effects' of this pathogen on the main physiological functions of the plant.

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INFLUENCIA DE CANCRO DE TALLO *(Diaporthe helianthi)* SOBRE LA CALIDAD DE SEMILLA Y RENDIMIENTO DURANTE EL DESARROLLO DE LA SEMILLA

RESUMEN

El chancro del tallo del girasol causado por *Diaporthe helianthi* Munt.-Cvet et al., es una enfermedad importante en el estado de Tamaulipas, donde se han observado más del 50% de plantas infectadas. Se realizó un estudio de campo donde se determinó la influencia del chancro del tallo, desde el estado de floración al de madurez fisiológica, sobre el contenido de aceite de la semilla, el peso de semilla y el rendimiento. El menor porcentaje de plantas enfermas se registró durante el estado de floración. El contenido de aceite, el peso de la semilla y el rendimiento decrecieron significativamente cuando la enfermedad apareció en cualquier estado del desarrollo de la semilla. El efecto del chancro del tallo se tornó gradualamente menos pronunciado conforme más tardío fue su aparición.

INFLUENCE DU *Phomopsis (Diaporthe helianthi)* DURANT LE DÉVELOPPEMENT DE LA GRAINE, SUR LA QUALITÉ DE LA SEMENCE ET LE RENDEMENT

RÉSUMÉ

Le *Phomopsis* causé par *Diaporthe helianthi* Munt.-Cvet. et al., est une maladie importante dans l'état de Tamaulipas, où on a observé plus de 50% de plantes infectées. Une étude conduite au champ a été entreprise pour déterminer l'influence du *Phomopsis* sur la teneur en huile, le poids du grain et le rendement à différents stades de développement de la graine. Le pourcentage le plus faible de plantes malades est noté durant la floraison. La teneur en huile, le poids du grain et le rendement sont significativement réduits quel que soit le stade de développement de la graine au moment de l'attaque de *Phomopsis*. Ces effets deviennent progressivement plus faibles avec l'apparition tardive de la maladie.