PHOMOPSIS RESISTANCE ON LEAVES AND STEMS OF *HELIANTHUS PETIOLARIS*

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Abstract

Wild species of sunflower (*Helianthus annuus*) play an important role in the genetic improvement of this oleaginous crop since they have different characters of economic importance to be transferred using interespecific hybridization programs. At present, we carry out a research program in order to preserve and characterize the genetic resources of both naturalized and exotic wild sunflower having an agronomic interest. One of the first steps was to describe different accessions of annual wild species for biotic stress in order to detect potential resistance sources. *H. petiolaris* is one of the wild species of sunflower found in Argentina and we selected before a certain number by their *Sclerotinia sclerotiorum* responses on leaves and stems. This genetic material was then inoculated on leaves and stems but with *Phomopsis helianthi*, a fungus which produce stem canker in sunflower. This work shows the variability of brown necrotic responses after *Phomopsis* inoculations on *H. petiolaris* leaves and stems. Some half-sib families were detected to have good disease performance to *Phomopsis* as well as *Sclerotinia* and they will be backcrossed to sunflower to increase the diversity for this disease resistance in the cultivated germplasm.

Introduction

Breeders make uses of wild species of the *Helianthus* genus to find sources of disease resistance to be employed in cultivated sunflowers (*H. annuus*) (Fick and Miller, 1997). *H. petiolaris* is a wild-species widely distributed and naturalized in Argentina, particularly in the centre-west of cultivated sunflower grown region (Cantamutto and Poverene, 2002). At present, none investigation has been detected to characterize this wild species and to valuate their potential use in breeding programs of cultivated sunflower. Therefore, a description of this abundant genetic resource in our country was considered of interest, particularly against disease resistances.

The stem canker in sunflower is a fungal disease produced by *Phomopsis helianthi* (Gulya et al., 1997). Although sunflower crops with serious attacks of this pathogen have not been still detected in Argentina, the disease produced severe damages in sunflower crops in Uruguay (INIA, 2006) and it is always present in the sunflower crops grown in the Mesopotamia region of our country (Fálico et al., 2003). Thus, the main objective of this work was to evaluate the responses of some *H. petiolaris* populations, naturalized in Argentina, to *P. helianthi* inoculations. The relationship between both *P. helianthi* and *S. sclerotiorum* responses is also showed.

Materials and methods

During 2005, 105 half-sib families of 6 *H. petiolaris* accessions were evaluated by their responses to *S. sclerotiorum* inoculations on leaves and stems (Cáceres et al., 2005). Then, we selected three groups of 5 families each, according to their relative performance (i.e. high, intermediate, and low) to each *Sclerotinia* resistance tests. In 2006, seedlings of 25 days were transplanted in the UIB's experimental field and distributed since a randomized complete block design with two replicates. The sunflower hybrid DK 3881, of well-known performance to *Phomopsis* inoculations (Castaño et al., 1997; Verschoor et al., 1998), was also grown in the adjacent plots of *H. petiolaris*.

A *P. helianthi* isolate (Ph1), obtained from diseased stems of cultivated sunflower at INTA Paraná, Entre Ríos, was used. Only 29 families were inoculated and we used the protocols described by Castaño et al. (1993). Agar disks of 7 mm of diameter, containing the young mycelium of the pathogen were used. Two leaves by plant were inoculated in the 50% plants/plot 70 days after the transplant. One week later, two stems by plant were inoculated in the other plants. The resistance check was inoculated in the same dates that *H. petiolaris* plants. A daily irrigation of around 5 mm/day was made by sprinklers until *Phomopsis* symptoms scored. The brown necrotic lesions through the leaves veins and on stems were measured 12 days after infection. Immediately, inoculated leaves and stems were all destroyed.

Only data higher than 7mm of *Phomopsis* lesions were considered for statistical analyses. A mean by plant and plot was calculated. Analysis of variance and F-test were made to detect genotype effects (Reza-Hoshmand, 1998). The least significance difference test (LSD) was used to differentiate half-sib families by *Phomopsis* responses and three groups with different levels of resistance were then performed. Two of them (e.g. G1 and G2 groups) contained half-sib families with values of brown necrotic lesions statistically similar to either the maximum or the minimum lesion ones, respectively. Conversely, half-sib families placed in the last third G3 group differed from those ones having the maximum and minimum values.

Results and discussion

The 29 half-sib families of *H. petiolaris* showed an average of brown necrotic lesions on leaves and stems of 20 and 24mm, respectively (see Table). The hybrid DK 3881 had a mean of 16 mm on leaves and 47 mm on stems. Estimated coefficients of variability were similar to those ones calculated after *Phomopsis* inoculations on cultivated sunflowers (Castaño et al., 1997; Verschoor et al., 1998; García et al., 2000).

Table. Means of brown necrotic lesions on leaves and stems after *Phomopsis* inoculations on 29 half-sib families of *Helianthus petiolaris* naturalized in Argentina

	Phomopsis **lesions**	
Half-sib family nb.	**Leaves (mm)**	**Stems (mm)**
3	23*	27
9	20	30
11	19	22&
13	22*	27
15	24*	15&
16	20	19&
22	22*	18&
24	21*	28
28	20	28
30	20	23&
32	22*	21&
34	19	16&
36	21*	26
42	20	32*
45	19	29
48	25*	32*
49	22*	21&
50	24*	11&
54	20	23&
57	17&	19&
64	20	16&
68	14&	27
69	20	45*
71	17&	22&
75	17&	19&
79	21*	22&
87	19	27
99	22*	33*
104	16&	-
Mean	**20**	**24**
CV (%)	**12**	**29**
$LSD_{.05}$	**4**	**14**

Note:
Relative resistance level: *low, intermediate, &high.

Analyses of variance detected significant ($\alpha<0.05$) differential responses of half-sib families to both *Phomopsis* resistance tests on leaves and stems.

LSD value for the leaf test was 4mm. Twelve genotypes were placed in G1 and they present the lowest level of resistance in our trial. Five half-sib families (e.g. 57, 71, 75, 104, 68) showed the best performance (G2) and, moreover, similar lesion values than the resistance check. The intermediate G3 had 12 genotypes.

The LSD value was 14 mm for the stem test. Four half-sib families were in G1. In G2, 15 genotypes were grouped (e.g. 30, 54, 79, 11, 71, 32, 49, 16, 57, 75, 22, 64, 34, 15, 50). Meanwhile in G3, 9 genotypes were placed. For this resistance test, all *H. petiolaris* half-sib families showed lower necrotic lesion values than the cultivated DK 3881.

Spearman correlation coefficient of ranks ($r_s=0.02$) was not significant. This result suggests that a general increase of lesion length on leaves was not associated with to either an increase or a decrease of lesions on stems. In spite of this, three half-sib families (e.g. 57, 71, 75) were placed in G2 after both *Phomopsis* inoculations. These genotypes could have common resistance genes controlling both brown necrosis lesions on leaves and stems.

Of those three half-sib families with high performances to *Phomopsis* infections, two of them (e.g. 57, 75) have been included in this experiment given their good performance after *Sclerotinia* inoculations during 2005. Later suggests the possibility to detect genotypes of *H. petiolaris* with adequate level of resistance to both *Phomopsis* and *Sclerotinia* infections.

Further experiments are needed to evaluate the repeatability of results. In spite of this, our sunflower breeding group will multiply next summer some *H. petiolaris* families by sib crosses. Afterwards, they will be crossed with inbred lines of cultivated sunflower in order to valuate the transmissibility of *Phomopsis* resistance to the inter-specific offspring.

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