# RESISTANCE EVALUATION OF INTERSPECIFIC AND CULTIVATED PROGENIES OF SUNFLOWER INFECTED BY *DIAPORTHE HELIANTHI.*

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## SUMMARY

Progenies of interspecific crosses between cultivated sunflower and annual wild ecotypes of the *Helianthus* genus, and families of cultivated types were compared for the damages caused by *Diaporthe helianthi* in 1990 near Toulouse. The plants were contaminated by infected stems. There was a significant but slight effect of the flowering date on the attack level. The progenies of NSH45, DM2, several families descended from *Helianthus argophyllus, H. debilis, H. petiolaris fallax* and *H. exilis* were tolerant to *Diaporthe helianthi*, that means as good as the tolerant control, Agrisol. These results were confirmed in 1991. The most tolerant material was intercrossed in 1991 to initiate a *Diaporthe* resistant gene pool.

## INTRODUCTION

The stem canker caused by *Diaporthe helianthi* is one of the most important disease on Sunflower in many countries (ACIMOVIC and STRASER, 1981, HERR *et al.*, 1983). In France, it occurs mainly in the South-West area, around Toulouse. (CETIOM, 1992) The best way of controlling the fungus is to grow resistant cultivars (MIHALJCEVIC *et al.*, 1982). Tolerant hybrids are available, but one have to enlarge the genetic variability by looking for new sources of resistance. Ecotypes resistant to *Diaporthe* were found in the *Helianthus* genus, both in annual and perennial species (CUK, 1982 in SKORIC, 1985). In this paper, we present some results about the behaviour of cultivated and interspecific families of Sunflower to stem canker.

## MATERIAL AND METHODS

We performed the experiments in 1990 and 1991 at Auzeville, (near Toulouse). In 1990, 87 families and lines were compared to a susceptible control (Viki) and a resistant one (Agrisol),

in a complete randomized block design with two replications. We saw controls at two dates plus a date with covering the soil with a plastic film (P17). The list of the tested material is given in Table 1.

**TABLE 1: MATERIAL EVALUATED FOR RESISTANCE TO *DIAPORTHE* IN 1990**

PROGENIES OF CULTIVATED TYPES

| GENOTYPE CODE | ORIGIN | | NUMBER OF ENTRIES |
|---|---|---|---|
| DM2 | DM2 | American gene pool | 1 |
| NSH | NSH45 | Yugoslavian hybrid | 10 |
| SEL | SELECT | Romanian hybrid | 2 |

PROGENIES OF ANNUAL *HELIANTHUS* SPECIES CROSSED WITH CULTIVATED SUNFLOWER

| GENOTYPE CODE | SPECIES AND SUBSPECIES | NUMBER OF ENTRIES |
|---|---|---|
| 585 | *H. argophyllus* | 1 |
| ARG | *H. argophyllus* | 38 |
| 255 | *H. bolanderi* | 1 |
| 588 | *H. bolanderi* | 1 |
| 291 | *H. debilis* | 1 |
| 90 | *H. debilis* | 2 |
| 218 | *H. debilis cucumerifolius* | 1 |
| 215 | *H. debilis debilis* | 2 |
| 205 | *H. debilis silvestris* | 1 |
| 216 | *H. debilis tardiflorus* | 2 |
| 130 | *H. exilis* | 1 |
| 201 | *H. neglectus* | 3 |
| 197 | *H. niveus canescens* | 2 |
| 213 | *H. niveus tephrodes* | 2 |
| 206 | *H. paradoxus* | 2 |
| 200 | *H. petiolaris fallax* | 2 |
| 738 | *H. petiolaris fallax* | 2 |
| 220 | *H. praecox Runyonii* | 1 |
| 198 | *H. praecox hirtus* | 1 |
| 678 | *H. praecox praecox* | 2 |

** CONTROLS
AGRISOL tolerant
VIKI susceptible

Each plot consisted of two rows of twenty plants. The inoculation was performed by scattering infected stems in the field. The trials were irrigated with sprinklers. We noted the mid-flowering date, the *Diaporthe* attack on stems about twenty days after flowering, and the maturity of heads at that date (from 1= green to 6=brown). Only ten plants in the middle of each row were observed. We defined the notes as follows: 0= no symptom on the stem, 1= one spot on the stem,

2= several spots on the stem, 3= at least one spot surrounding the stem, 4= surrounding spots with lodging. In 1990, we found no relation between flowering date and symptoms on the controls.

In 1991, we evaluated the most tolerant families according the same protocol. The linear regression gave a significant relation between flowering date and symptoms on Viki. We calculated an index for each plot as follows:

$$I = \frac{\text{Mean note of the plot}}{(A+V)/2}$$

where:

A= mean note on Agrisol in the field

V= note on Viki estimated with the regression between the symptoms and the flowering date of the plot.

For 1990, we consider the mean notes per plot

For 1991 and the review of the two years, we consider the index.

## RESULTS AND DISCUSSION

The stem canker notes were strongly related to maturity head:

note = 0.98 * maturity - 0.86, R2= 0.46 p= 0.0001

and slightly related to mid-flowering date:

note = 2.74 -0.048 * day of July, R2= 0.05 p= 0.02

We assumed that *Diaporthe helianthi* caused damages to the vascular system, that speeded up the apparent maturation of heads.

In 1990, the four trial were significant and the seminatural infection by *D. helianthi* discriminated the tolerant and the susceptible controls ( P = 0.0001 on the whole experiment). The minimum, mean and maximum stem canker notes obtained in 1990 for each origin are reported in Figure 1. The experiment revealed both very susceptible and very tolerant progenies. The issues of NSH45, DM2, of the ecotypes 130 (*H. exilis*), 738 (*H. petiolaris fallax*) were as good as Agrisol, the tolerant control. The progenies of *H. debilis* (90 and 215), *H. argophyllus* (ARG, 585), *H. niveus canescens* (197) presented a large range of notes with susceptible and tolerant progenies. The progenies of ecotypes 218 and 213 were partly intermediate. Other material behaved mostly as susceptible. The review of results on 1990 and 1991 on the best families is summarized in Table 2. Progenies of *H. argophyllus, H. debilis, H. exilis, H. petiolaris fallax*, NSH45 and DM2 behaved as good as Agrisol.

The progenies of NSH45 and DM2 have been selected for their tolerance to stem canker. Their good reaction in 1990 and 1991 assessed the efficiency of selection for this trait with

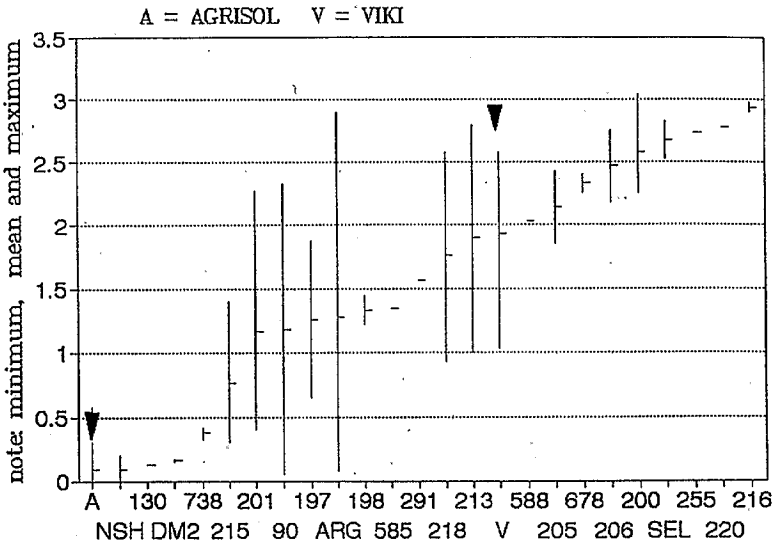


FIGURE 1: TOLERANCE TO STEM CANKER
in cultivated and interspecific progenies

TABLE 2: COMPARISON OF PROGENIES TOLERANT TO *DIAPORTHE* IN 1990 AND 1991

| | F | Pr > F |
|---|---|---|
| YEAR | 3.44 | 0.0680 |
| GENOTYPE | 8.84 | 0.0001 |
| YEAR*GENOTYPE | 0.55 | 0.8611 |

| GENOTYPE | ORIGIN | *DIAPORTHE* INDEX | GROUPING P=0.05 |
|---|---|---|---|
| AGRISOL-P17 | | 0.019 | A |
| 89-1385 | 90 | 0.038 | A |
| 89-1392 | 130 | 0.065 | A |
| 90(H)R17 | NSH | 0.087 | A |
| 90(H)R20 | NSH | 0.087 | A |
| AGRISOL | | 0.088 | A |
| DM2.1 | DM2 | 0.183 | A |
| 89-1471 | 215 | 0.200 | A |
| 89-1383 | 738 | 0.209 | A |
| 89-1423 | ARG | 0.268 | A |
| VIKI-P17 | | 1.507 | B |
| VIKI | | 1.705 | B |

objects with the same letter are not significantly different (Student-Newman-Keuls multiple range test)

seminatural infections. The lines descended from Select appeared very susceptible, that revealed an important disjunction in the progeny of this tolerant hybrid.

In all crosses, the cultivated parent was a susceptible line. We suggest that the resistance genes came from the wild parent. The polymorphysm observed between the families issued from the same ecotype was due both to the disjunction in the progeny of crosses with susceptible cultivated lines and to intra-ecotype genetic variability. The main part of the interspecific families studied descended from *H. argophyllus* and *H. debilis*. CUK (1982 *in* SKORIC 1985) found resistance to *Diaporthe* in these wild species. Resistance genes seem also brought by 738 (*H. petiolaris fallax*) and *H. exilis*. On the opposite, some other ecotypes, such as 200 (*H. petiolaris fallax*), may give high susceptibility to their progeny. Resistance genes revealed in annual Helianthus species, the most crossable with cultivated sunflower, are transmitted to interspecific progenies.

Many sources of resistance to *Diaporthe* are now available. We can envisage to accumulate these favourable genes trough to recombination. Most tolerant families in cultivated an interspecific families have also to be improved for agronomical traits: mainly oil content, also resistance to lodging (DM2 issues), 1000 seed weight (*H. debilis* issues) or earliness (*H. argophyllus* issues). For recombination of resistance genes and for improvement of agronomical value, we intercrossed the most tolerant families to get a *Diaporthe* resistant gene pool. This one will be selected and intercrossed after each selection cycle.

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