LATEST RESULTS OF THE CHEMICAL CONTROL AGAINST DIAPORTHE HELIANTHI Munt. Cvet. (PHOMOPSIS HELIANTHI)

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SUMMARY

The fungus *Phomopsis helianthi*, which was discovered and described by Muntanola-Cvetkovic et al. in 1981, is presently observed in several French regions where it can bring about considerable yield losses. The development of a specific chemical control started in 1985.

Following the presentation of the first interesting results a couple of years ago (Peres et al., 1988), a synthesis of studies carried out at the Center of Applied Biology in SAINT PATHUS since 1989 allows us to classify a lot of chemical products for their efficiency against the fungus.

INTRODUCTION

In 1984, a new sunflower-disease appeared in the South-West of France, brought about by *Diaporthe helianthi*, the asexual form being *Phomopsis helianthi*.

Since then, a yearly mapping of the contaminated region has allowed us to observe that it has been developing toward the Lot and Ariège departments ; some contaminated areas could also be noticed in the Cher and Indre departments.

Several factors are presently being studied and recommended to eradicate this disease: take prophylactic measures (ploughing in sunflower stems following harvest), use tolerant varieties as well as chemical treatments.

The Center of Applied Biology of CETIOM is studying particularly the chemical control by screening fungicides in the framework of experiments under controlled conditions : dammage in the field caused by this disease being stem-attacks following a systematic passage through the leaves, it will be interesting to look for an efficiency of products on leaves and on stems.

MATERIEL AND METHODS

Experiments were carried out in the green-house where conditions of temperatures, environmental hygrometry and light were controlled. Mirasol was the variety used in all experiments. Plants were cultivated in pots with water-reserves, with one plant per pot. Experimental devices were Fischer-blocks with 10 replications.

Plants at the budding stage were contaminated artificially with 3 or 4 successive sprayings with an interval of 24 hours, using a suspension of *Diaporthe helianthi* ascospores titrating 1.5*10E5 spores/ml. For the whole experiment, we maintained a saturating level of hygrometry favouring the fungus presence and its development through the plant-tissues. Tested fungicides (see table 1 and 2) were applied following the 3 or 4 successive contaminations, but before the apparition of symptoms (5 to 9 days after contamination), or as soon as symptoms appeared (14, 23 or 31 dayus after contamination). These products were quantified on the basis of 350 l/ha of spraying mixture applied with a hand-sprayer.

The study of products is based on several criterias : the number of leaves attacked, the number of stems attacked and the attack-intensity on stems according to the following scales of notations :

0 = heathy plant
1 = spot on the stem surrounding the petiole until 5 cm of diameter
2 = spot on the stem surrounding the petiole and greater than 5cm of diameter
3 = attack sleeves on the stem separated from green areas on the stem
4 = totaly brown stem
5 = brocken plant at the spot level

RESULTS

Experiment 1989 (Table 1) :The first symptoms appeared on december 19 (14 days following contamination) and treatments were applied on december 14, following contamination, but before the development of symptoms.

Following the kinetics of the number of attacked leaves (see Figure 1), some treatments slowed down the progress of leaf symptoms without stopping it completely : They are more particularly treatments tebuconazole (6) - procymidone+carbendazim (7) - manebe+thiophanate-methyl (9) - flutriafol+carbendazim (5). Other products are more performing, for they prevent all developments of symptoms for at least the 50 first days after their application (case of iprodione+carbendazim (3) - fenpropimorphe (8) - flusilazol+carbendazim (2) - prochloraz+carbendazim (4)).

Later notations carried out on stems confirmed the efficiency of these different products : whereas stems were attacked with a mean intensity of 2.9 in the control at T+63, plants treated with the mixture iprodione+carbendazim(3) or with the mixture prochloraz+carbendazim (4) have only an intensity attack of 0.2 and treatments with fenpropimorph (8) or flusilazol+carbendazim (2) prevented attacks on stems totally. These same products offered the best efficiency on leaves.

Table 1 : List of chemical products (experiment 1989)

Number of product	Active compounds	Conc./l	Quantity/ha
(1)	Control		
(2)	Flusilazol+ Carbendazim	250 g/l 125 g/l	0.8 l
(3)	Iprodione+ Carbendazim	175 g/l 87.5 g/l	3 l
(4)	Prochloraz+ Carbendazim	300 g/l 80 g/l	2 l
(5)	Flutriafol+ Carbendazim	117.5 g/l 250 g/l	1 l
(6)	Tebuconazole	250 g/l	1 l
(7)	Procymidone+ Carbendazim	250 g/l 166 g/l	1.5 l
(8)	Fenpropimorphe	750 g/l	0.8 l
(9)	Maneb+ Thiophanate-methyl	300 g/l 150 g/l	7 l

Table 2 : List of chemical products (preventive experiment 1990)

Number of product	Active compounds	Conc./l	Quantity/ha
(1)	Control		
(2)	Prochloraz+ Carbendazim	300 g/l 80 g/l	1.5 l
(3)	Iprodione+ Carbendazim	175 g/l 87.5 g/l	3 l
(4)	Difenoconazole+ Carbendazim	62.5 g/l 125 g/l	2 l
(5)	Flusilazol+ Fenpropimorphe	160 g/l 375 g/l	0.8 l

Experiment 1990 (Table 2) : preventive application towards the occurence of symptoms :

Treatments were carried out 5 days after the contamination, therefore in a preventive mode with regard to the development of symptoms (same case as the experiment 1989).

Figure 1 : Evolution of the number of attacked leaves : experiment 1989

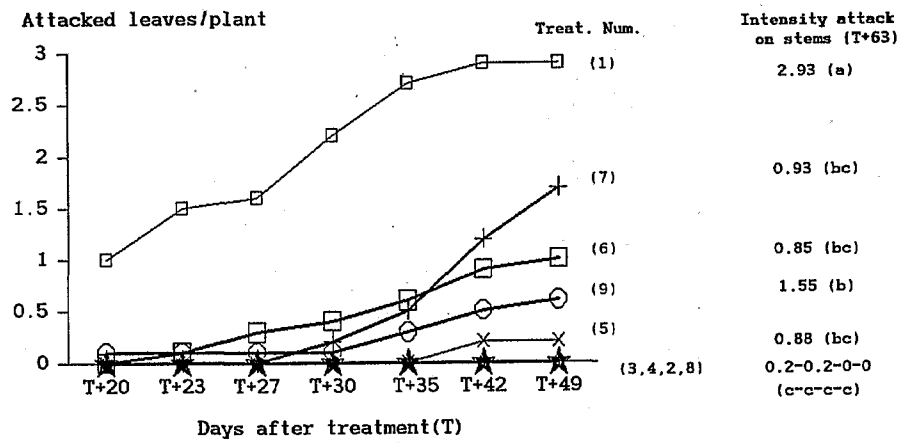


Figure 2 : Evolution of the number of attacked leaves : preventive experiment 1990

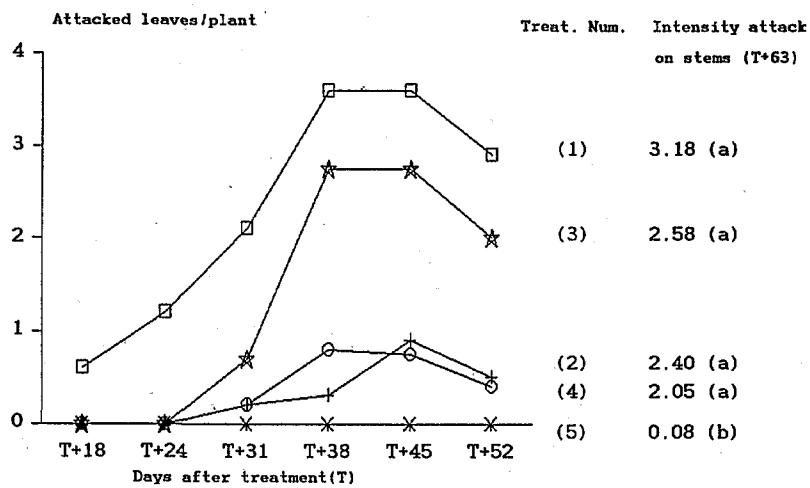
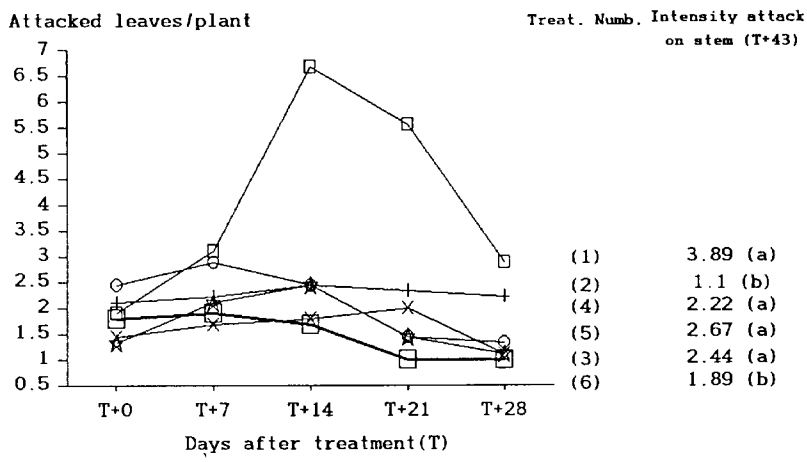


Table 3 : List of products (curative experiment 1990) :

Number of product	Active Compounds	Conc./l	Quantity/ha
(1)	Control		
(2)	Diniconazole+ Iprodione+ Carbendazim	24 g/l 160 g/l 80 g/l	2.5 l
(3)	Difenoconazole+ Carbendazim	62.5 g/l 125 g/l	2 l
(4)	Fenpropimorphe+ Carbendazim	375 g/l 125 g/l	1.6 l
(5)	Prochloraze+ Carbendazim	300 g/l 80 g/l	1.5 l
(6)	Iprodione+ Carbendazim	300g/l 80g/l	3 l

Figure 3 : Evolution of the number of attacked leaves : curative experiment 1990



The first symptoms appeared 23 days following the contamination. The latency period was therefore longer than in the previous experiment (14 days) ; the difference in temperatures could explain this gap.

The four tested products put off the apparition of symptoms for at least 10 days. Beyond these 10 days, both products prochloraz+carbendazim (2) and difenoconazole+carbendazim (4) did not prevent any longer the disease-extension on leaves, but slowed it down rather well in comparison with the evolution observed in controls (see Figure 2). The application of flusilazol+fenpropimorph prevented apparition of symptoms. Therefore, the fungus could be stopped before invading leaf tissues.

Despite differences in the evolution rate of symptoms on the leaves of plants treated with the three following treatments : prochloraz+carbendazim (2) - iprodione+carbendazim (3) - difenoconazole+carbendazim (4), all stems were attacked in these three cases, and their attack-rates were not significantly different between treatments and in the comparison with the untreated control.
The flusilazol+fenpropimorph association was the only one to give an excellent protection of stems.

Experiment 1990 (table 3) curative application at the apparition of symptoms :
These treatments were applied the day when symptoms appeared, i.e. 31 days after contamination (long period of latency).
The evolution of these symptoms was very quick on leaves of untreated controls with a maximum of 45 days after contamination. Later on, the number of attacked leaves dropped, (when the disease went from leaf to stem) fell and could not be counted any more.
The number of attacked leaves at the time of treatment was relatively homogenous in all conditions.
All product-applications cut down the evolution of attacks on leaves, but no significant differences were observed between products (figure 3).

If we consider the evolution on stems, treated plants had an attack-rate significantly lower than that of control, and here again, no significant difference appeared between treatments.

The diniconazole+iprodione+carbendazim association (2) was the only one which leads to a significant difference on stems. This low attack-rate was the consequence of a sharp stop in the evolution on leaves, which could not be confirmed for any other product.

DISCUSSION AND CONCLUSION

According to those results, several products seem to be quite interesting for a chemical control against *Phomopsis* as a preventive application, or just when symptoms appear.

Whereas some products such as tebuconazole - procymidone+carbendazim - maneb+thiophanate-methyl - flutriafol+carbendazim or difenoconazole+carbendazim only slowed down the progression-rate of this fungus, others arrested its evolution in a more clearly way : - That was the case of flusilazol+fenpropimorph, a mixture studied in the preventive experiment of 1990. Both molecules applied separately or each in association

with carbendazim had an excellent efficiency, which was greater when applied together, mixed. - Then, that was the case of the prochloraz+carbendazim association, which showed a total efficacy on leaves and stems in the 1989's experiment, whereas in both experiments of 1990 (preventive and curative), it reduced the evolution on leaves, but it was less efficient against the passage on stems.

An association of carbendazim+iprodione is also an efficient mixture, arresting the evolution of symptoms on leaves, and bringing about a considerable reduction of attacks on stems. To this result could be added that of the coupled mixture with diniconazole leading to a reduction of the attack rate on stems of 72%. These results concerning the carbendazim+iprodione - carbendazim+iprodione+diniconazole associations were confirmed following a second experiment carried out in 1990.

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