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RESPONSES OF SUNFLOWER PLANTS TO DIFFERENT *PHOMOPSIS* ISOLATES. II. FROM WEEDS

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ABSTRACT

A total of 46 weed species belonging mainly to the Asteraceae were investigated for the presence of *Phomopsis* conidiomata and *Diaporthe* ascomata. *Phomopsis* structures were found in 15 weed species, and *Diaporthe* ascomata in 4. Pure cultures were tested for pathogenicity on *Helianthus annuus*. Inoculationswere performed in field and greenhouse conditions, using: 1) non-wounding techniques; 2) insertion of inoculum into the wounded host tissues. Positive reactions were considered as those in which the lesions extended beyond necrosis at the wounded point. Six groups were distinguished according to the reaction intensity. These groups were heterogenous with regard to the host taxa and the mospho-physiologic features of the isolated fungi. Natural host-parasite relationships could not be established between sunflower and the *Phomopsis* found on weeds, since wounding procedures were indispensable to induce pathologic processes. Only in the case of *D. helianthi* ascospores was wounding unnecessary. This corroborates the specificity of *D. helianthi*.

INTRODUCTION

Mihaljcević et al. (5) reported that 10 plant species other than *Helianthus annuus* L. responded negatively to artificial inoculations with the holomorph *Diaporthe helianthi* Munt.-Cvet. et al. The reactions of the sunflower inbred line S-200 (V-8931) to inoculations with other *Phomopsis* taxa isolated from sflw. overwintered debris and from a senescent plant were also investigated (4). The aim of the present study was to report the results obtained when the above-mentioned sunflower line was inoculated with *Phomop[sis]* and/or *Diaporthe* isolated from weeds in the vicinity of the affected sunflower fields.

MATERIAL AND METHODS

A total of 46 weed species belonging mainly to the Asteraceae were investigated for the presence of *Phomopsis* conidiomata and/or *Diaporthe* ascomata during a 4-yr survey.

Fungal isolations were standard. Morpho-physiolog studies of the isolated fungi and their pathogenicity towards the inbred line S-200 (V-8931) were carried out under conditions described in a previous paper (4). A reaction was considered positive if lesions extended beyond necrosis at the wounded point. The lesions were measured every 5 dy. Presence of pycnidia and examination of their contents were followed until 40 dy after inoculation. The following parameters were used in grouping results: rate of pathogenesis, range of lesion dimension, coefficient of variation, abundance of fructifications, and type of conidia produced. The data was statistically processed.

RESULTS

Phomopsis conidiomata (c) were found on 15 of the 46 herbaceous species examined, and Diaporthe ascomata (a) in 2, in addition to H.annuus , where both reproductive structures were found. These species were ; Achillea millefolium L.(c), Amaranthus retroflexus L.(c), Arctium lappa L.(c), Artemisia vulgaris L.(c), Centaurea scabiosa L.(c), Cichorium intybus L.(c), Cirsium arvense (L.) Scob., Daucus carota L.(c), Lactuca serriola L. (c), Solidago gigantea Ait.(c), Tanacetum vulgare L.(c,a), Tripleurospermum maritimum (L.)Koch.(c), Xanthium italicum L.(c), Xanthium strumarium L.(c), Sonchus sp.

The main morphologic features of the isolated fungi are presented in Table 1.

None of the artificial inoculations carried out in the greenhouse by aqueous suspensions of conidia or ascospores on non-wounded pl. yielded positive results, with the exception of those performed with D. helianthi ascospores. In contradistinction, insertion of mycelium from 14 isolates onto wounded sunflower stems provoked various reactions. Six groups were distinguished according to these reactions and were designated A through F (Table 2 and Figs. 1 and 2). These groups were formulated on the basis of the averages of 5-8 tests carried out from May to August 1982 and 1983. They are heterogenous with regard to the characteristics of the fungi gathered in each group, to the host plant taxa from which the fungi were isolated, and to the frequency of these fungi on the examined hosts in nature. This heterogeneity is for instance illustrated by the rather frequent Phomopsis on A. lappa and the rarely found Phomopsis on D. carota , both placed in group C: the hosts are not related and the fungi are not culturally similar. Examples in that sense are also found in group D.

The Phomopsis from X.italicum has not been included in the formulated groups because it was very seldom found and inoculations were carried out with only one isolate, so that no statistical data could be processed. A rapid plant breakage resulted from the inoculations, which was especially evident in greenhouse tests. This represents an exception as compared to the other groups, since the fungi included in them provoked smaller lesions and a slower pathologic course in greenhouse conditions.

DISCUSSION

During this 4-yr survey Phomopsis structures were found on several plant species without visible pathological symptoms or signs on the hosts during their vegetative period. This is in contrast to the process provoked by P. helianthi on sunflower, where disease symptoms in vivo are always associated with the asexual stage. The frequent field epiphytotic Phomopsis attacks on L. serriola , and, to a lesser extent, on T. maritimum , were exceptions. On these two hosts the pathogenic course on leaves and stems, and the timing of pycnidial appearance (by the end of the host vegetative period), was similar to the pathogenic process on sunflowers inoculated with

Table 1. Main morphologic features of the tested *Phomopsis* isolates obtained from the following hosts:

1. Achillea millefolium; 2. Amaranthus retroflexus; 3. Arctium lappa; 4. Artemisia vulgaris; 5. Centaurea scabiosa; 6. Cichorium intybus; 7. Cirsium arvense; 8. Daucus carota; 9. Lactuca serriola; 10. Solidago gigantea; 11. Sonchus sp.; 12. Tanacetum vulgare; 13. Tripleurospermum maritimum; 14. Xanthium italicum; 15. Xanthium strumarium.

Features	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Green or olivaceous shades on MA	+	-	+	+	-	(+)	yellowish	-	+	+	+	+	-	+	+
Pycnidia on cult.:								rare	rare	rare			rare	rare	rare
-globose	-	+	(+)	-	+	+	+	+	+	+	+	-	(+)	(+)	(+)
-rostrate	+	-	+	+	+ (OA)	+ (CA)	+(OA)	-	-	-	(+)	+	-	(+)	(+)
Pycnidial discharge:															
-drops	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
-cirrus	-	-	(+)	-	-	-	-	-	-	-	-	-	-	-	-
Conidia ★															
- α	+	+	(+)	+	+	+	(+)	(+)	+	+	+	+	+	(+)	+
- β	(+)	-	+	(+)	-	+(VNm)	+	-	(+)	C	+	(+)	+	-	-
Perithecia:															
-on nat. host	-	-	-	+	+	-	-	-	-	+	-	+	-	-	-
-on ntr. media	-	-	-	+	+	-	-	-	-	+	-	+	-	-	-

+ = present; (+)= present to a lesser extent; - = absent; CA=Carrot Agar, MA=Malt Agar; OA =Oatmeal Agar; ★ All for natural hosts unless otherwise noted; VNm = Various Nutrient media

Table 2. Reactions of the susceptible sunflower inbred line S-200 (V-8931) to various *Phomopsis* isolates from weeds. Results from field tests, 30 dy after inoculations

Group	Source	Parameters				Pycnidia	Conidia
		Range *	$\bar{x}$	σx	Cv		
A	H. annuus	125-180	151.0	20.5	13.5	abundant	only β-
B	L. serriola	60-120	84.8	19.1	22.5	very rare	β > α
C	A. lappa D. carota	25-70	41.6	12.8	30.8	very rare -	α > β -
D	A.retroflexus C. intybus Sonchus sp. X.stromarium	16-30	16.2	4.4	30.2	- - - very rare	- - - α > β
E	A.millefolium A. vulgaris C. scabiosa S. gigantea T. maritimum T. vulgare	2-5	2.9	0.9	31.0	- very rare very rare - - -	- α- α > β - - -
F	C. arvense	-	-	-	-	-	-
Controls	Ster.water or nutrient media	-	-	-	-	-	-

* Range of the lesion length in mm; $\bar{x}$ = average;
σx = standard deviation; Cv = Coefficient of variation

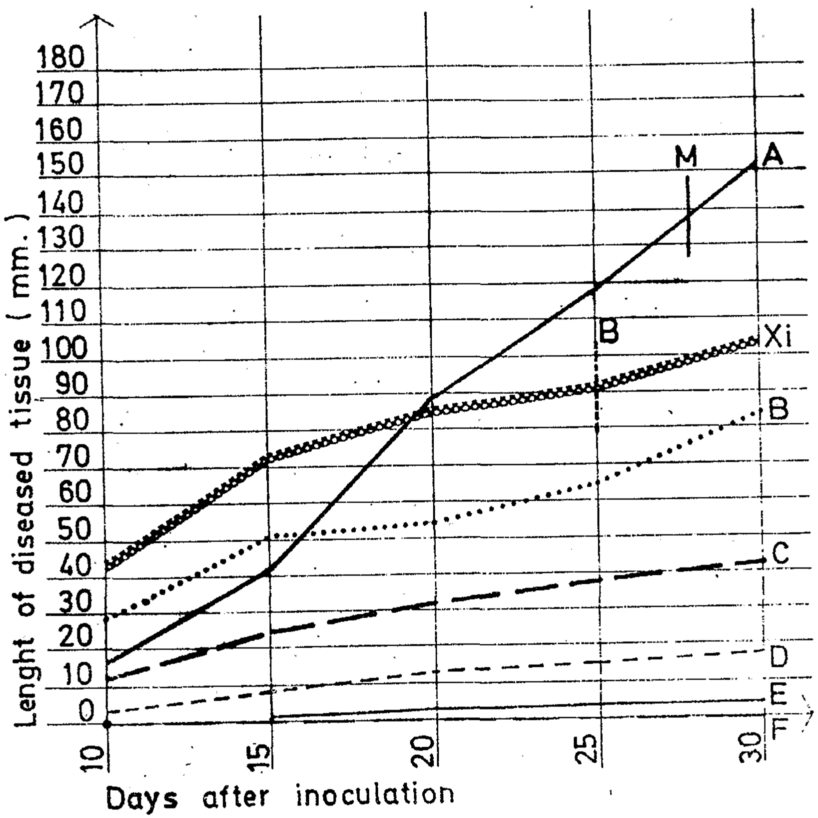

Fig. 1

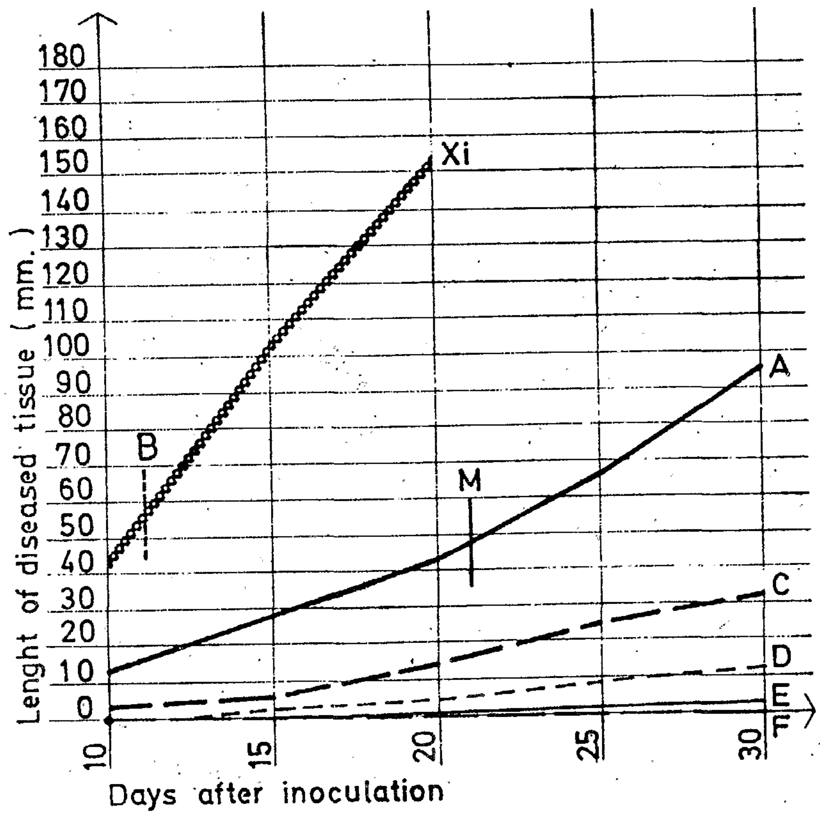

Fig. 2

Figs. 1 and 2. Rate of lesion extension after wounding inoculation of sunflower stems under field and greenhouse conditions, respectively. A-F: groups which were distinguished among the tested fungi according to the reactions produced on the sunflower inbred line S-200 (V-8931) when inoculated by wounding techniques. Group B did not develop lesions when tested in the greenhouse. Xi= X. italicum . B= plant breakage due to tissue disintegration at the inoculation point. M= plants become moribund.

The fungi examined in this study have been described as separate species, and, in some cases, more than one *Phomopsis* species has been noted on a given host (1, 2, 6). On the other hand, *Diaporthe* structures found on most of these plants have been collectively designated as *D. arctii* (Lasch.) Nit., or as *D. arctii* var. *achilleae* (Auers.) Wehm. (7).

Without a complex morph-physiologic and phytopathologic study of all these fungi and their anamorph-teleomorph connections, it is difficult to reliably identify the isolates studied here. This was not the principal intention of the present report, which was, instead, to point out the phytopathologic relationships of these fungi to *H. annuus*.

Natural host-parasite relationships could not be established between *H. annuus* and the *Phomopsis* found on weeds, since wounding techniques, which are a rather unnatural way to demonstrate the pathogenicity of a fungus (3), were necessary to induce pathologic processes on sunflower.

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