

SUNFLOWER DISEASES MAPPING IN EUROPE AND SOME COUNTRIES OUTSIDE EUROPE IN THE PERIOD 1984—1986

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INTRODUCTION

Three years passed from the last FAO Consultation of the European Research Network on Sunflower held in Novi Sad, Yugoslavia, in July 1984. That meeting was convened at a critical moment for the sunflower production in Central European countries. *Phomopsis* epiphytotic in Yugoslavia, Romania, and Hungary were causing large yield reductions and the sunflower acreages were consequently cut down. In Yugoslavia, for example, the yield was reduced by 50 % and the acreage by 75 %. This is a good illustration of how a single disease may affect the growing of agricultural crops including sunflower.

Now we may report that the problem has been successfully solved, first by efficient protective measures and then by the development of hybrids resistant to the pathogen. Thanks to these solutions, both susceptible and resistant hybrids may nowadays be grown without risk.

However, this success does not mean at all that all problems in sunflower production are solved for good. Changes in the assortment generate new problems, i.e., minor problems turn into major ones. They can be successfully counteracted only if they are observed well on time.

In the period from 1984 to 1986, there occurred the well-known parasites as well as some new ones. The importance of individual parasites may be estimated on the basis of a sum analysis of the annual reports made by the participants in the FAO subnetwork on sunflower diseases mapping.

I take it as a special privilege to report the results of the sunflower diseases mapping programmes conducted over the last three years in eight European countries. This report will be appended by the results of our colleagues from Pakistan, Argentina, and Australia, hoping that these data will be of interest to all sunflower pathologists.

METHOD AND MATERIAL

The material dealt with in this report are the annual reports on the occurrence of sunflower diseases received by the Liaison Center in Novi Sad in the period 1984—1986. Disease intensity evaluation and data processing were done after the FAO method (Sackston, 1978; Ačimović, 1979, 1981, 1984).

The same method was used in eight European countries, Bulgaria, France, Italy, Hungary, Portugal, Romania, Turkey, and Yugoslavia, and in three countries outside Europe (Pakistan, representing Asia, Argentina, representing South America, and Australia).

The annual reports on the occurrence of sunflower diseases were supplied by:

— Stojanová-Shindrova, P., Institute for Wheat and Sunflower, General Toshevo, Bulgaria;

— Regnault, Y., Cetiom, Service Etudes et Recherches, Section Défense des Cultures, Paris, France;

— Bekesi, P., State Institute for Varietal Testing, Budapest, Hungary;

— Zazzerini A., Istituto di Patologia Vegetale dell'Università degli Studi, Perugia, Italy;

— Barros de Leves, M., Missao de Estudos Agronomicos do Ultramar, Lisbon, Portugal;

— Iliescu, H., Research Centre for Plant Protection, Bucharest, Romania;

— Hüsemogalu, E., Tarim Orman ve Köyisleri Bakanligi Halkali Zirai Arastirma Enstitüsü ve Ziraat Meslek Lisesi Müdürlüğü. Sefatö — Istanbul, Turkey;

— Kiral, B., Directorate of Thrace Agricultural Research Institute, Edirne, Turkey;

— Ačimović, M., Institute of Field and Vegetable Crops, Novi Sad, Yugoslavia;

— Mirza M. S., National Agricultural Research Centre, Islamabad, Pakistan;

— Amellia B. de Romano, CJA, Continental SA, Pellegrini, Yunin, Argentina;

— Kochman, K. J., Queensland Department of Primary Industries, Toowoomba, Australia;

The results on the occurrence of sunflower diseases and their importance for sunflower production in the different countries were tabulated and attached hereafter.

RESULTS

A general statement can be made for the period 1984—1986 that *Phomopsis* subsided and the sunflower production came back to normal in Yugoslavia, Romania, and Hungary while the parasite broke out in France and Bulgaria.

In further text, sunflower diseases mapping programmes in the eight European countries and the three countries outside Europe will be discussed and tables presented. It should be pointed out that the researchers in charge of these programmes worked intensively and successfully in the three years and that they deserve to be congratulated for their efforts.

BULGARIA

Table 1 shows the occurrence of sunflower diseases in Bulgaria.

Thirteen pathogens occurred in Bulgaria over the last three years. Seven of them were minor: *Plasmopara helianthi*, *Septoria helianthi*, *Pucci-*

Table 1

Sunflower diseases, pathogens, and importance in Bulgaria

No.	Disease	Pathogen	Importance
1	Downy mildew	<i>Plasmopara helianthi</i>	Less important
2	Spot	<i>Septoria helianthi</i>	Less important
3		<i>Alternaria</i> sp.	Very important
4		<i>Phoma oleracea</i> var. <i>helianthi tuberosi</i>	Medium important
5		<i>Phomopsis</i> sp.	Medium important
6	Rust	<i>Puccinia helianthi</i>	Less important
7	Powdery mildew	<i>Erysiphe cichoracearum</i>	Less important
8	Rot	<i>Botrytis cinerea</i>	Less important
9		<i>Sclerotinia sclerotiorum</i>	Medium important
10		<i>Sclerotium bataticola</i>	Medium important
11	Wilt	<i>Verticillium</i> sp.	Medium important
12		<i>Fusarium</i> sp.	Less important
13	Broomrape	<i>Orobanche cumana</i>	Less important

nia helianthi, *Erysiphe cichoracearum*, *Botrytis cinerea*, *Fusarium* sp., and *Orobanche cumana*. Five of them were medium important for sunflower production: *Phoma oleracea* var. *helianthi-tuberosi*, *Phomopsis* sp., *Sclerotinia sclerotiorum*, *Sclerotium bataticola*, and *Verticillium* sp. Only one pathogen was very important, *Alternaria* spp. These data indicate that certain pathogens gain importance in Bulgaria.

FRANCE

Table 2 shows the occurrence of sunflower diseases in France.

Seven pathogens were registered in France in the last three years. Six of them were minor: *Plasmopara helianthi*, *Alternaria helianthi*, *Botrytis cinerea*, *Sclerotinia sclerotiorum*, *Sclerotium bataticola*, and *Verticillium dahliae*. All of them are old and well-known pathogens of the sunflower.

Table 2

Sunflower diseases, pathogens, and their importance in France

No	Disease	Pathogen	Importance
1	Downy mildew	<i>Plasmopara helianthi</i>	Less important
2	Spot	<i>Alternaria helianthi</i>	Less important
3		<i>Phomopsis helianthi</i>	Very important
4	Rot	<i>Botrytis cinerea</i>	Less important
5		<i>Sclerotinia sclerotiorum</i>	
6		<i>Sclerotium bataticola</i>	Less important
7	Wilt	<i>Verticillium dahliae</i>	Less important

Phomopsis helianthi is a new pathogen which occurred epiphytotically on 12,000 ha in southern France in 1985. It caused serious damage in the vicinity of Toulouse and Carcassonne. It was the only important sunflower pathogen in France.

HUNGARY

Table 3 shows the occurrence of sunflower diseases in Hungary.

Ten different pathogens infected sunflowers in Hungary: nine parasitic fungi and one bacterium, *Erwinia* spp.

Two of the pathogens were medium important: *Alternaria* spp. and *Sclerotinia sclerotiorum*. The remaining eight pathogens were minor: *Septoria helianthi*, *Phoma oleracea* var. *helianthi-tuberosi*, *Phomopsis helianthi*, *Puccinia heli-*

anthi, *Erysiphe cichoracearum*, *Botrytis cinerea*, *Sclerotinia bataticola*, and *Erwinia* spp.

Table 3

Sunflower diseases, pathogens, and their importance in Hungary

No	Disease	Pathogen	Importance
1	Spot	<i>Septoria helianthi</i>	Less important
2		<i>Alternaria</i> spp.	Medium important
3		<i>Phoma oleracea</i> var. <i>helianthi</i>	Less important
4		<i>Phomopsis helianthi</i> (<i>Diaporthe helianthi</i>)	Less important
5	Rust	<i>Puccinia helianthi</i>	Less important
6	Powdery mildew	<i>Erysiphe cichoracearum</i>	Less important
7	Rot	<i>Botrytis cinerea</i>	Less important
8		<i>Sclerotinia sclerotiorum</i>	Medium important
9		<i>Sclerotinia bataticola</i>	Less important
10	Wilt	<i>Erwinia</i> spp.	Less important

ITALY

Table 4 shows the occurrence of sunflower diseases in Italy.

Only six pathogens were registered in Italy, five parasitic fungi and one floriferous parasite, *Orobanche ramosa*.

Two pathogens were medium important: *Botrytis cinerea* and *Sclerotinia sclerotiorum*. The other four were minor: *Plasmopara helianthi*, *Rhizopus oryzae*, *Fusarium* sp. and *Orobanche ramosa*.

Table 4

Sunflower diseases, pathogens, and their importance in Italy

No	Disease	Pathogen	Importance
1	Downy mildew	<i>Plasmopara helianthi</i>	Less important
2	Rot	<i>Botrytis cinerea</i>	Medium important
3		<i>Sclerotinia sclerotiorum</i>	Medium important
4		<i>Rhizopus oryzae</i>	Less important
5		<i>Fusarium</i> sp.	Less important
6	Broomrape	<i>Orobanche ramosa</i>	Less important

PORTUGAL

Table 5 shows the occurrence of sunflower diseases in Portugal.

Eleven diseases were registered on sunflower in Portugal. Ten of them were caused by parasitic fungi, one (head drop) by an unknown agent.

Table 5

Sunflower diseases, pathogens, and their importance in Portugal

No	Disease	Pathogen	Importance
1	Spot	<i>Alternaria alternata</i>	Less important
2		<i>Alternaria</i> sp.	Less important
3		<i>Epicoccum purpurascens</i>	Less important
4	Rust	<i>Puccinia helianthi</i>	Less important
5	Rot	<i>Botrytis cinerea</i>	Less important
6		<i>Sclerotinia sclerotiorum</i>	Less important
7		<i>Sclerotium bataticola</i>	Very important
8		<i>Rhizopus arrhizus</i>	Less important
9	Wilt	<i>Fusarium oxysporum</i>	Medium important
10		<i>Fusarium</i> sp.	Medium important
11	Head drop	Undetermined	Less important

The registered pathogens differed regarding their importance for the sunflower production in Portugal. *Sclerotium bataticola* was important, *Fusarium oxysporum* and *Fusarium* sp. were medium important, and *Alternaria alternata*, *Alternaria* sp., *Epicoccum purpurascens*, *Puccinia helianthi*, *Botrytis cinerea*, *Sclerotinia sclerotiorum*, *Rhizopus arrhizus*, and head drop were minor.

ROMANIA

Table 6 shows the occurrence of sunflower diseases in Romania.

The data in Table 6 show that many diseases occurred in Romania over the last three years. They were caused by 17 pathogens: 12 parasitic fungi, two parasitic bacteria, and three floriferous parasites. The registered pathogens varied in importance for sunflower production. Five of them were important: *Phoma oleracea* var. *helianthi-tuberosi*, *Phomopsis* sp., *Sclerotinia sclerotiorum*, *Sclerotium bataticola*, and *Orobanche* spp. *Alternaria* spp. was medium important while the remaining 11 pathogens were minor: *Plasmopara helianthi*, *Septoria helianthi*,

Table 6

Sunflower diseases, pathogens,
and their importance in Romania

No	Disease	Pathogen	Importance
1	Downy mildew	<i>Plasmopara helianthi</i>	Less important
2	Spot	<i>Septoria helianthi</i>	Less important
3		<i>Alternaria</i> spp.	Medium important
4		<i>Drechslera helianthi</i>	Less important
5		<i>Phoma oleracea</i> var. <i>helianthi-tuberosi</i>	Very important
6		<i>Phomopsis</i> sp.	Very important
7	Rust	<i>Puccinia helianthi</i>	Less important
8	Powdery mildew	<i>Erysiphe cichoracearum</i>	Less important
9	Rot	<i>Botrytis cinerea</i>	Less important
10		<i>Sclerotinia sclerotiorum</i>	Very important
11		<i>Sclerotinia bataticola</i>	Very important
12		<i>Erwinia carotovora</i>	Less important
13	Wilt	<i>Verticillium dahliae</i>	Less important
14	Bacterial blight	<i>Pseudomonas syringae</i> var. <i>helianthi</i>	Less important
15	Broomrape	<i>Orobanche</i> ssp. <i>Orobanche ramosa</i> <i>Orobanche cumana</i>	Very important Less important Less important

Drechslera helianthi, *Puccinia helianthi*, *Erysiphe cichoracearum*, *Botrytis cinerea*, *Erwinia carotovora*, *Verticillium dahliae*, *Pseudomonas syringae* var. *helianthi* and *Orobanche cumana*.

TURKEY

Table 7 shows the occurrence of sunflower diseases in Turkey.

There were 12 pathogens causing sunflower diseases in Turkey. Most of the diseases were minor and caused by parasitic fungi: *Plasmopara helianthi*, *Septoria helianthi*, *Alternaria* spp., *Helminthosporium* spp., *Phoma oleracea* var. *helianthi-tuberosi*, *Puccinia helianthi*, *Botrytis cinerea*, *Sclerotinia sclerotiorum*, *Rhizopus* spp., and *Verticillium* spp. Only *Sclerotium bataticola* was important for the sunflower production in Turkey while the floriferous parasite *Orobanche cumana* was medium important.

Table 7

Sunflower diseases, pathogens,
and their importance in Turkey

No	Disease	Pathogen	Importance
1	Downy mildew	<i>Plasmopara helianthi</i>	Less important
2	Spot	<i>Septoria helianthi</i>	Less important
3		<i>Alternaria</i> spp.	Less important
4		<i>Helminthosporium</i> spp.	Less important
5		<i>Phoma oleracea</i> var. <i>helianthi-tuberosi</i>	
6	Rust	<i>Puccinia helianthi</i>	Less important
7	Rot	<i>Botrytis cinerea</i>	Less important
8		<i>Sclerotinia sclerotiorum</i>	Less important
9		<i>Sclerotium bataticola</i>	Very important
10		<i>Rhizopus</i> spp.	Less important
11	Wilt	<i>Verticillium</i> spp.	Less important
12	Broomrape	<i>Orobanche cumana</i>	Medium important

YUGOSLAVIA

Table 8 shows the occurrence of sunflower diseases in Yugoslavia.

Twenty two pathogens were registered in Yugoslavia over the last three years, 19 parasitic fungi, one bacterium, and two floriferous parasites. Fortunately, most of them were not important for the sunflower production. The only important pathogen was *Sclerotium bataticola* while *Alternaria helianthi* and *Sclerotinia sclerotiorum* were medium important. There occurred some new parasites which have not been registered before: *Stemphylium* sp., *Verticillium lateritium*, and *Cuscuta* sp. Although they were minor parasites of the sunflower, they should be kept under surveillance in order to monitor their further development. It should be mentioned for *Verticillium lateritium* that it attacks sunflowers not only in Yugoslavia but also in Hungary and Bulgaria. I observed them on sunflower in these two countries some eight years ago. It is difficult to assess its importance but it seems to be on the level of the known species, *Verticillium albo-atrum* and *Verticillium dahliae*. *V. lateritium* was registered on wilted plants and there is no doubt that it occurs in the second half of the sunflower growing season.

Stemphylium sp. occurred regularly on the stem and leaves, in the form of reddish-brown spots. It was less important for the sunflower production.

Cuscuta sp. occurred seldom, in a few plots

Table 8

**Sunflower diseases, pathogens,
and their importance in Yugoslavia**

No	Disease	Pathogen	Importance
1	Downy mildew	<i>Plasmopara helianthi</i>	Less important
2	Spot	<i>Septoria helianthi</i>	Less important
3		<i>Alternaria alternata</i>	Less important
4		<i>Alternaria helianthi</i>	Medium important
5		<i>Alternaria zinniae</i>	Less important
6		<i>Phoma oleracea</i> var. <i>helianthi-tuberosi</i>	Less important
7		<i>Phomopsis helianthi</i>	Less important
8		<i>Epicoccum neglectum</i>	Less important
9		<i>Stemphylium</i> sp.	Less important
10	Rust	<i>Puccinia helianthi</i>	Less important
11	Powdery mildew	<i>Erysiphe cichoracearum</i>	Less important
12	Rot	<i>Botrytis cinerea</i>	Less important
13		<i>Sclerotinia sclerotiorum</i>	Medium important
14		<i>Sclerotium bataticola</i>	Very important
15		<i>Ophiobolus</i> sp.	Less important
16		<i>Erwinia carotovora</i>	Less important
17	Wilt	<i>Verticillium albo-atrum</i>	Less important
18		<i>Verticillium dahliae</i>	Less important
19		<i>Verticillium lateritium</i>	Less important
20		<i>Fusarium</i> sp.	Less important
21	Broomrape	<i>Orobanche cumana</i>	Less important
22	Dodder	<i>Cuscuta</i> sp.	Less important

only. Its intensity was as a rule low but it did occur intensively in several instances, at the stages of budding and flowering when it caused a severe damage (Aćimović, 1981).

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* *

The sum data on the distribution of sunflower diseases in Europe and on their importance for sunflower production are presented in Table 9.

In the period 1984—1986, sunflowers in Europe were attacked by 37 pathogens: 30 parasitic fungi, three parasitic bacteria, and four floriferous parasites.

It means that there occurred some new parasites which had not been registered in the period 1981—1983. Those were: *Verticillium lateritium*, *Stemphylium* sp., and *Cuscuta* sp., registered in Yugoslavia, and *Orobanche* spp., registered in Romania.

Botrytis cinerea and *Sclerotinia sclerotiorum* were the most widely spread pathogens. They were registered in all eight European countries. *Sclerotium bataticola* was found in seven countries, *Plasmopara helianthi* and *Puccinia helianthi* in six countries, and *Phoma oleracea* var. *helianthi-tuberosi*, *Phomopsis helianthi*, and *Septoria helianthi* in five countries. The other pathogens were found in four, three, two, or only one country. The intensity of occurrence of the pathogens varied from one country to another.

**SUNFLOWER DISEASES IN PAKISTAN,
ARGENTINA AND AUSTRALIA**

The researchers from these countries have contributed actively to the FAO subnetwork for sunflower diseases mapping. Their interest may be illustrated by the three-year reports submitted by phytopathologists from these countries. The reports from Pakistan and Argentina are first of their kind to be reported of at the meeting of our group. Sunflower diseases in Australia were mentioned at the 1984 meeting in Novi Sad, but the report sent for this meeting deserves attention for its original approach and novel subjects.

Table 9

Summary of sunflower pathogens and their importance in Europe

No	Pathogen	Bul-garia	Fran-ce	Hun-gary	Ita-ly	Por-tugal	Roma-nia	Tur-key	Yugo-slavia
1	2	3	4	5	6	7	8	9	10
1	<i>Alternaria alternata</i>	—	—	—	—	—	—	—	+
2	<i>Alternaria helianthi</i>	—	+	—	—	—	—	—	++
3	<i>Alternaria zinniae</i>	—	—	—	—	—	—	—	+
4	<i>Alternaria</i> sp.	+++	—	—	—	+	—	—	—
5	<i>Alternaria</i> spp.	—	—	++	—	—	++	++	—

No	Pathogen	Bul-garia	Fran-ce	Hun-gary	Ita-ly	Por-tugal	Roma-nia	Tur-key	Yugo-slavia
1	2	3	4	5	6	7	8	9	10
6	<i>Botrytis cinerea</i>	+	+	+	++	+	+	+	+
7	<i>Cuscuta</i> sp.	—	—	—	—	—	—	—	+
8	<i>Drechslera helianthi</i>	—	—	—	—	—	+	—	—
9	<i>Epicoccum neglectum</i>	—	—	—	—	—	—	—	+
10	<i>Epicoccum purpurascens</i>	—	—	—	—	+	—	—	+
11	<i>Erwinia carotovora</i>	—	—	—	—	—	+	—	+
12	<i>Erwinia</i> spp.	—	—	+	—	—	—	—	—
13	<i>Erysiphe cichoracearum</i>	+	—	+	—	—	+	—	+
14	<i>Fusarium oxysporum</i>	—	—	—	—	++	—	—	—
15	<i>Fusarium</i> sp.	+	—	—	+	++	—	—	+
16	<i>Helminthosporium</i> sp.	—	—	—	—	—	—	+	—
17	<i>Ophiobolus</i> sp.	—	—	—	—	—	—	—	+
18	<i>Orobanche cumana</i>	+	—	—	—	—	+	++	+
19	<i>Orobanche ramosa</i>	—	—	—	+	—	+	—	—
20	<i>Orobanche</i> spp.	—	—	—	—	—	+++	—	—
21	<i>Phoma oleracea</i> var. <i>helianthi-tuberosi</i>	++	—	+	—	—	+++	+	+
22	<i>Phomopsis helianthi</i>	++	+++	+	—	—	+++	—	+
23	<i>Plasmopara helianthi</i>	+	+	—	+	—	+	+	+
24	<i>Pseudomonas syringae</i> var. <i>helianthi</i>	—	—	—	—	—	+	—	—
25	<i>Puccinia helianthi</i>	+	—	+	—	+	+	+	+
26	<i>Rhizopus arrhizus</i>	—	—	+	—	—	—	—	—
27	<i>Rhizopus oryzae</i>	—	—	—	+	—	—	—	—
28	<i>Rhizopus</i> spp.	—	—	—	—	—	—	+	—
29	<i>Sclerotinia sclerotiorum</i>	++	+	++	++	+	+++	+	++
30	<i>Sclerotium bataticola</i>	++	+	+	—	+++	+++	+++	+++
31	<i>Septoria helianthi</i>	+	—	+	—	—	+	+	+
32	<i>Stemphylium</i> sp.	—	—	—	—	—	—	—	+
33	<i>Verticillium albo-atrum</i>	—	—	—	—	—	—	—	+
34	<i>Verticillium dahliae</i>	—	+	—	—	—	+	—	+
35	<i>Verticillium lateritium</i>	—	—	—	—	—	—	—	+
36	<i>Verticillium</i> sp.	++	—	—	—	—	—	—	—
37	<i>Verticillium</i> spp.	—	—	—	—	—	—	+	—

+ Less important
++ Medium important
+++ Very important

These three countries are the representatives of three continents. They are diverse mutually but all of them are nevertheless suitable for sunflower production and, at the same time, for occurrence of various sunflower diseases.

PAKISTAN

Table 10 shows the occurrence of sunflower diseases in Pakistan.

Fourteen parasitic fungi were registered in Pakistan. They differed in their impact on the sunflower production: *Alternaria helianthi* and *Sclerotium bataticola* were important, *Septoria helianthi*, *Phomopsis* sp., *Phoma oleracea* var. *helianthi-tuberosi*, *Puccinia helianthi*, *Rhizopus* sp., and *Verticillium dahliae* were medium important, while *Alternaria tenuissima*, *Colletotrichum* sp., *Erysiphe cichoracearum*, *Botrytis cinerea*, *Sclerotinia sclerotiorum*, and *Sclerotium rolfsii* were minor.

Table 10

Sunflower diseases, pathogens and their importance in Pakistan

No	Disease	Pathogen	Importance
1	Spot	<i>Septoria helianthi</i>	Less important
2		<i>Alternaria helianthi</i>	Very important
3		<i>Alternaria tenuissima</i>	Less important
4		<i>Phomopsis</i> sp.	Medium important
5		<i>Phoma oleracea</i> , var. <i>helianthi-tuberosi</i>	Medium important
6	Rust	<i>Colletotrichum</i> sp.	Less important
7		<i>Puccinia helianthi</i>	Medium important
8		<i>Erysiphe cichoracearum</i>	Less important
9		<i>Botrytis cinerea</i>	Less important
10	Rot	<i>Sclerotinia sclerotiorum</i>	Less important
11		<i>Sclerotium bataticola</i>	Very important
12		<i>Sclerotium rolfsii</i>	Less important
13	<i>Rhizopus</i> sp.	<i>Rhizopus</i> sp.	Medium important
14	Wilt	<i>Verticillium dahliae</i>	Medium important

This is the first report of the occurrence of *Phomopsis* sp. on sunflowers in an Asian country.

ARGENTINA

Table 11 shows the occurrence of sunflower diseases in Argentina.

Eleven well-known parasitic fungi were registered in Argentina. Three of them were important: *Sclerotinia sclerotiorum*, *Sclerotium bataticola*, and *Verticillium dahliae*, four were medium important: *Alternaria helianthi*, *Phoma oleracea* var. *helianthi-tuberosi*, *Albugo tragopogonis*, and *Puccinia helianthi*, and four were minor: *Plasmopara helianthi*, *Septoria helianthi*, *Alternaria zinniae*, and *Botrytis cinerea*.

In recent years, *Phomopsis* sp. (A c i m o v i c, 1984) and *Erwinia carotovora* (personal correspondence) have started to attack sunflowers in Argentina.

AUSTRALIA

Our previous report (A c i m o v i c, 1984) contains a detailed report on the occurrence and importance of sunflower diseases in Australia. Some data in that report were new as compared with the European data for the sunflower. Table 12 shows the occurrence of sunflower diseases in Australia.

Table 11

Sunflower diseases, pathogens and their importance in Argentina

No	Disease	Pathogen	Importance
1	Downy mildew	<i>Plasmopara helianthi</i>	Less important
2	Spot	<i>Septoria helianthi</i>	Less important
3		<i>Alternaria helianthi</i>	Medium important
4	Rust	<i>Alternaria zinniae</i>	Less important
5		<i>Phoma oleracea</i> var. <i>helianthi-tuberosi</i>	Medium important
6		<i>Albugo tragopogonis</i>	Medium important
7	Rot	<i>Puccinia helianthi</i>	Medium important
8		<i>Botrytis cinerea</i>	Less important
9	Wilt	<i>Sclerotinia sclerotiorum</i>	Very important
10		<i>Sclerotium bataticola</i>	Very important
11		<i>Verticillium dahliae</i>	Very important

Table 12

Sunflower diseases, pathogens, and their importance in Australia

No	Disease	Pathogen	Importance
1	Spot	<i>Septoria helianthi</i>	Less important
2		<i>Alternaria helianthi</i>	Medium important
3	Rust	<i>Phoma</i> sp.	Less important
4		<i>Albugo tragopogonis</i>	Medium important
5	Powdery mildew	<i>Puccinia helianthi</i>	Medium important
6		<i>Puccinia xanthii</i>	Less important
7		<i>Oidium</i> sp. (<i>Erysiphe cichoracearum</i>)	Less important
8	Rot	<i>Sclerotinia sclerotiorum</i>	Medium important
9		<i>Sclerotinia minor</i>	Very important
10	Wilt	<i>Sclerotium bataticola</i>	Medium important
11		<i>Sclerotium rolfsii</i>	Less important
12	Wilt	<i>Rhizopus</i> spp.	Medium important
13		<i>Verticillium dahliae</i>	Less important

Sunflower diseases in Australia were caused by 13 parasitic fungi. Only one of them was important, *Sclerotinia minor*, in northern Victoria.

It is the first report of an intensive occurrence of that pathogen in sunflowers. *S. minor* is seldom mentioned in literature as a parasite of the sunflower. The above report includes also a recommendation for the control of the parasite which increases considerably its value (Lamarque et al., 1986).

Six fungi were medium important: *Alternaria helianthi*, *Albugo tragopogonis*, *Puccinia helianthi*, *Sclerotinia sclerotiorum*, *Sclerotium bataticola*, and *Rhizopus* sp., and six fungi were minor: *Septoria helianthi*, *Phoma* sp., *Puccinia xanthii*, *Oidium* sp., *Sclerotium rolfsii*, and *Verticillium dahliae*.

DISCUSSION

The data on the occurrence of sunflower diseases in Europe in the period 1984—1986 presented above show that the number of registered diseases varied from one country to another, from six in Italy to 22 in Yugoslavia. Parasitic fungi were dominant: 37 of them were registered in the eight European countries — participants in the subnetwork, four were registered in Pakistan, 11 in Argentina, and 13 in Australia.

Considering the ten European countries, 29 pathogens were registered in sunflower in the period 1978—1980, 35 pathogens in the period 1981—1983, and 37 pathogens in the period 1984—1986. It is evident that the number of pathogens increases annually by two or three, in Europe as well as in countries outside Europe. However, we should distinguish two kinds of pathogens.

The first kind are well-known pathogens registered for the first time in a certain country, e.g., *Phomopsis* in Bulgaria and Pakistan, *Orobanche cumana* in Italy, and *Pseudomonas syringae* in Romania.

The second kind are pathogens reported for the first time to attack the sunflower, e.g., *Verticillium lateritium* and *Stemphylium* sp. in Yugoslavia and *Sclerotinia minor* in Australia.

Botrytis cinerea and *Sclerotinia sclerotiorum* were the most widely distributed pathogens. They were registered in all eight European countries. Nevertheless, *Sclerotium bataticola* was undoubtedly the most harmful pathogen. It was registered in seven countries: it was important in four countries, medium important in one country, and minor in two countries.

The above data emphasize the importance of this pathogen in Europe as well as outside Europe. Attempts to counteract the detrimental effects of the pathogen, by developing resistant varieties and hybrids, should be intensified at any cost.

A comparative analysis of the sunflower pathogens registered in Europe, Pakistan (Asia), Argentina (South America), and Au-

stralia showed similarities but also some differences which deserve to be pointed out the same way it was done before (Aćimović, 1984).

Two parasitic fungi registered in Pakistan, *Colletotrichum* sp., and *Sclerotium rolfsii*, and one fungus registered in Argentina, *Albugo tragopogonis*, were not registered in Europe in the period 1984—1986. The differences between Europe and Australia were discussed earlier (Aćimović, 1984).

CONCLUSIONS

The following conclusions were drawn on the occurrence and importance of sunflower diseases in the eight European countries, Pakistan, Argentina, and Australia in the period 1984—1986.

In the eight European countries — participants in the FAO subnetwork on sunflower diseases mapping, 37 different pathogens of the sunflower were registered: 13 in Bulgaria, seven in France, 10 in Hungary, 6 in Italy, 11 in Portugal, 17 in Romania, 12 in Turkey, and 22 in Yugoslavia; 14 pathogens were registered in Pakistan, 11 in Argentina, and 11 in Australia.

Botrytis cinerea and *Sclerotinia sclerotiorum* were the most widely spread pathogens. They were registered in all eight European countries. *Sclerotium bataticola* was registered in seven countries, *Plasmopara helianthi* and *Puccinia helianthi* in six, *Phoma oleracea* var. *helianthi-tuberosi*, *Phomopsis helianthi*, and *Septoria helianthi* in five. The remaining 28 pathogens were found in a smaller number of countries.

According to the severity of the attack however, *Sclerotium bataticola* was the most harmful pathogen in Europe. It occurred in seven countries: it was important in four countries, medium important in one country, and minor in two countries. *Sclerotinia sclerotiorum* was in the second place according to the severity of the attack, *Botrytis cinerea* in the third, and *Phomopsis helianthi* in the fourth.

The eight European countries, Pakistan (Asia), Argentina (South America), and Australia were similar in the array of the sunflower pathogens but there also existed some differences. Two fungi registered in Pakistan, *Colletotrichum* sp. and *Sclerotium rolfsii*, one fungus registered in Argentina, *Albugo tragopogonis*, and three fungi registered in Australia, *Albugo tragopogonis*, *Puccinia xanthii*, and *Sclerotinia minor*, were not found in Europe.

Phomopsis sp. was registered in sunflower in Pakistan. This is the first report on the existence of this pathogen in Asia.

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LA CARTE DES MALADIES DU TOURNESOL EN EUROPE ET DANS QUELQUES PAYS EN DEHORS DE L'EUROPE DANS LA PERIODE 1984—1986

Résumé

Un nombre de 37 agents pathogènes du tournesol a été dépisté dans 8 pays européens : 13 en Bulgarie, 7 en France, 10 en Hongrie, 6 en Italie, 11 en Portugal, 17 en Roumanie, 12 en Turquie et 22 en Yougoslavie. Au Pakistan on a dépisté 14 agents pathogènes, 11 en Argentine et 11 en Australie.

Les pathogènes les plus répandus sont *Botrytis cinerea* et *Sclerotinia sclerotiorum*, suivent *Sclerotium bataticola*, *Plasmopara helianthi*, *Puccinia helianthi*, *Phoma oleracea*,

Phomopsis helianthi et *Septoria helianthi*. Les autres pathogènes n'ont été trouvés que dans un petit nombre de pays. Cependant, selon la sévérité de l'infection en Europe, le plus dangereux pathogène a été *Sclerotium bataticola* suivi par *Sclerotinia sclerotiorum*, *Botrytis cinerea* et *Phomopsis helianthi*.

Certains champignons tels que *Colletotrichum* sp., *Sclerotium rolfsii*, *Albugo tragopogonis*, *Puccinia xanthii* et *Sclerotinia minor* n'ont pas été signalés en Europe. Le *Phomopsis* sp. a été enregistré chez le tournesol au Pakistan. Cela représente le premier rapport concernant ce pathogène en Asie.

MAPA DE ENFERMEDADES DEL GIRASOL EN EUROPA Y OTROS PAISES FUERA DE EUROPA EN EL PERIODO 1984—1986

Resumen

Treinta y siete patógenos diferentes de girasol fueron detectados en ocho países europeos : 13 en Bulgaria, 7 en Francia, 10 en Hungría, 6 en Italia, 11 en Portugal, 17 en Rumanía, 12 en Turquía y 22 en Yugoslavia. Catorce patógenos fueron registrados en Pakistán, 11 en Argentina y 11 en Australia.

Botrytis cinerea y *Sclerotinia sclerotiorum* fueron los patógenos más ampliamente estudiados, seguidos por *Sclerotium bataticola*, *Plasmopara helianthi*, *Puccinia helianthi*, *Phoma oleracea*, *Phomopsis helianthi* y *Septoria helianthi*. El resto de los patógenos fueron detectados en un número menor de países. Sin embargo, de acuerdo con la severidad del ataque, *Sclerotium bataticola* fue el patógeno más dañino en Europa, seguida por *Sclerotinia sclerotiorum*, *Botrytis cinerea* y *Phomopsis helianthi*.

Ciertos hongos como *Colletotrichum* sp., *Sclerotium rolfsii*, *Albugo tragopogonis*, *Puccinia xanthii* y *Sclerotinia minor* no fueron detectados en Europa. *Phomopsis* sp. fue registrada en girasol en Pakistán. Esta es la primera noticia sobre la existencia de este patógeno en Asia.