SUNFLOWER DISEASES IN EUROPE, THE UNITED STATES, AND AUSTRALIA, 1981—1983

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INTRODUCTION

Three years have passed since the last Consultation of the FAO Research Network on Sunflower held in Pisa, Italia. The meeting gathered sunflower experts from European as well as non-European countries as the problems discussed did not pertain to Europe alone. The latter took an active part in the meeting, helping to solve many of the questions raised, including those related to sunflower disease mapping. Their assistance was quite welcome since all participants in the meeting were fully aware that sunflower diseases recognize neither state borders nor continents. Besides disease mapping, the participants discussed methods of control of the parasites of the sunflower as a means of reducing yield damages which the crop suffers in all sunflower growing countries. It was agreed that breeding has randered admirable results in curbing down the major parasites of sunflower but all people present also conceded that breeding is a long and laborious undertaking. It was concluded that chemical protection should be tried against those parasites for which the sunflower lacks sources of resistance. Accordingly, it was decided to conduct experiments on the possibilities of controlling the most harmful parasites. Representatives of eight European countries decided to join the experimental network. Disease mapping should supply answers which parasites, in each country, should be controlled by breeding resistant varieties and which should be controlled chemically. The choice depends on the available knowledge and facilities, but also on the correct assessment of the problem itself. In that respect we cannot afford to make a mistake. That is why we should not consider disease mapping as a mere technical job but rather as a scientific project of profound significance. A timely observed occurrence of a disease and a correct assessment of its importance means half of the job done. A synchronized vigilance in several countries would bring invaluable benefits to the sunflower production.

In the last decade we witnessed large changes in the global sunflower production. There appeared sunflower hybrids which promoted sunflower growing and increased the acreage far above that under sunflower varieties. These hybrids, high-yielding and high-oil, were as a rule resistant to *Plasmopara helianthi*, alleviating farmers fears of crop failure. Unfortunately, five years have hardly passed since their introduction into the commercial production when *Phomopsis* started to plague sunflower fields in some central European countries. The disease was at first believed to be local, occurring only in Yugoslavia, Romania, and Hungary. It is the unfortunate reality that *Phomopsis* is today found in North America, South America, and Australia, too. In the late seventies, a new race of *Plasmopara helianthi* occurred in the United States. It is much more virulent than the older American and European races.

A new race of *Orobanche cumana* occurred first in the Soviet Union and the neighbouring East European countries and then in Turkey. Again, the new race is more virulent than the previous ones, bringing in question the future of sunflower growing in these countries. This and the problems mentioned before necessitate a joint work on their solution within the frame-work of FAO.

The following pages contain a summary of the work on sunflower disease survey conducted last three years in ten European countries. The report includes also the results of American and Australian colleagues because these results too deserve our unreserved attention.

MATERIALS AND METHODS

The materials discussed in this paper are the reports written by the participants in the FAO subnetwork on sunflower disease map-

ping in the period 1980—1983 and sent to the Novi Sad Liaison Centre. During that period, annual reports on the occurrence of sunflower diseases were sent by :

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

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

— Békési, P., State Institute for Varietal Testing, Budapest, Hungary.

— Virányi, F., Research Institute for Plant Protection, Budapest, Hungary.

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

— Kloczowski, Z., Institut Hodowli i Aklimatyzacji Roslin, Poznan, Poland.

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

— Iliescu, H., Research Institute for Cereals and Industrial Crops, Fundulea, Bucharest, Romania.

— José Maria Malero, V., I.N.I.A. Departamento de Proteccion Vegetal, Cordoba, Espana.

— Yücer, M., Erenköy Regional Plant Protection Research Institute, Kidiköy — Istanbul, Turkey.

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

— Yang, S., Agricultural Research Southern Region, Bushland, Texas, Baumer, I. (Minnesota), Carson, M. (S. Dakota), Gulya, T. (N. Dakota), and Herr, I. L. (Ohio), U.S.A.

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

Disease intensity evaluation and data processing were conducted after the FAO methodology (Sackston, 1978; Aćimović, 1979; 1980). The methodology was followed in ten European countries : Bulgaria, France, Italy, Hungary, Poland, Portugal, Romania, Spain, Turkey and Yugoslavia.

The report discusses also the results from the United States, 1980—1983 (Yang et al.) and Australia, 1978—1983 (Allen, Brown and Kochman). Besides the written comments on the occurrence of sunflower diseases and their impact on sunflower production in the participating countries, the report includes also a tabular review of the results used.

RESULTS

In the period 1980—1983, *Phomopsis* caused large variation in the sunflower production of Yugoslavia, Romania and Hungary. The yields of sunflower went down and the sunflower acreages were considerably reduced.

The activities within the project "Sunflower diseases mapping" were not equally intensive in all of the participating countries. Annual reports for all three years were received from Bulgaria, Hungary, Italy, Portugal, Romania, Spain and Yugoslavia. Nevertheless we give separate reviews for ten European sunflower growing countries, the United States and Australia.

BULGARIA

Table 1 shows the results of the occurrence of sunflower diseases in Bulgaria.

Eight sunflower parasites were found in Bulgaria in the period 1980—1983. Three of them were of minor importance for the production of sunflower : *Phasmopara helianthi*, *Septoria helianthi*, and *Botrytis cinerea*. The other five *Alternaria helianthi*, *Phoma oleracea* var. *helianthi-tuberosi*, *Sclerotinia sclerotiorum*, *Sclerotium bataticola* and *Orobanche cumana*, were medium important.

Table 1

Sunflower diseases, pathogens, and their importance in Bulgaria

No.	Disease	Pathogen	Importance
1	Downy mildew	*Plasmopara helianthi*	Less important
2	Spot	*Septoria helianthi*	Less important
3		*Alternaria helianthi*	Medium important
4		*Phoma oleracea* var. *helianthi-tuberosi*	Medium important
5	Rot	*Botrytis cinerea*	Less important
6		*Sclerotinia sclerotiorum*	Medium important
7		*Sclerotium bataticola*	Medium important
8	Broom-rape	*Orobanche cumana*	Medium important

Three parasites, *Phomopsis* sp., *Puccinia helianthi* and *Verticillium albo-atrum*, were not found in this period although they had been present in Bulgaria in the previous round of observations.

Some of the parasites changed the intensity of attack. For example, *Plasmopara helianthi* was of major importance in recent years but

now it is a minor parasite. Situation is similar with *Alternaria helianthi, Sclerotinia sclerotiorum* and *Botrytis cinerea*. It may be assumed that the first pathogen lost its importance when the varieties that used to be grown were replaced by new ones. The other three pathogens changed their behaviour due to adverse climatic conditions for their development.

FRANCE

The earlier reports of Regnault (1976), Sackston (1978), and Aćimović (1981) state that nine parasitic fungi were found on sunflower in France. Table 2 lists these pathogens as well as their importance for the sunflower production in France.

Table 2

Sunflower diseases, pathogens, and their importance in France

No.	Disease	Pathogen	Importance
1	Downy mildew	*Plasmopara helianthi*	Less important
2	Spot	*Alternaria* sp.	Less important
3		*Phoma oleracea* var. *helianthi-tuberosi*	Less important
4	Powdery mildew	*Erysiphe cichoracearum*	Less important
5	Rot	*Botrytis cinerea*	Very important
6		*Sclerotinia sclerotiorum*	Very important
7		*Sclerotium bataticola*	Very important
8		*Rhizopus* spp.	Less important
9	Wilt	*Verticillium dahliae*	Less important

Of the nine pathogens listed, six were minor : *Plasmopara helianthi, Alternaria* sp., *Phoma oleracea* var. *helianthi-tuberosi, Erysiphe cichoracearum, Rhizopus* spp. and *Verticillium dahliae*. The other three pathogens, *Botrytis cinerea, Sclerotinia sclerotiorum* and *Sclerotium bataticola*, were of major importance for the sunflower production.

HUNGARY

In the previous period, 15 parasitic fungi were found in Hungary (Aćimović, 1981). Table 3 shows the occurrence of sunflower disease in Hungary and the pathogens causing these diseases.

However, the table mentions only 13 pathogens. The two missing ones, *Alternaria helianthi* and *A. zinniae*, are probably classified under *Alternaria* spp. All of these pathogens had also been registered in the previous period.

Table 3

Sunflower diseases, pathogens, and their importance in Hungary

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

Of the 13 parasites listed, 11 are fungi, one is a bacterium, and one is a floriferous parasite. Ten of them were of minor importance : *Plasmopara helianthi, Septoria helianthi, Alternaria* spp., *Phoma oleracea* var. *helianthi-tuberosi, Puccinia helianthi, Erysiphe cichoracearum, Botrytis cinerea, Verticillium* spp., *Erwinia carotovora* and *Orobanche cumana*. *Phomopsis* sp. was of medium importance and *Sclerotinia sclerotiorum* and *Sclerotium bataticola* were major parasites of sunflower.

Plasmopara helianthi and *Botrytis cinerea* were less important but *Phomopsis* sp. and *Sclerotium bataticola* were more important than in the previous research period.

ITALY

Eleven parasites were registered in Italy (Zazzerini, 1981), although we mentioned only 10 in an earlier report (Aćimović, 1981). Table 4 lists the pathogens that occurred in sunflower plots last three years.

Of the 11 parasites registered, 10 were fungi and one was a bacterium. *Sclerotium bataticola* was the only major parasite. *Plasmopara helianthi* was of medium importance and the remaining nine were minor parasites.

In Italy too, *Plasmopara helianthi* was less important for the sunflower production in this than in the previous period.

Table 4

Sunflower diseases, pathogens, and their importance in Italy

No.	Disease	Pathogen	Importance
1	Downy mildew	*Plasmopara helianthi*	Medium importance
2	Spot	*Alternaria alternata*	Less important
3		*Phoma oleracea* var. *helianthi-tuberosi*	Less important
4	Rust	*Puccinia helianthi*	Less important
5	Powdery mildew	*Erysiphe cichoracearum*	Less important
6	Rot	*Botrytis cinerea*	Less important
7		*Sclerotinia sclerotiorum*	Less important
8		*Sclerotium bataticola*	Very important
9		*Rhizopus oryzae*	Less important
10	Wilt	*Fusarium* sp.	Less important
11		*Erwinia carotovora*	Less important

POLAND

In the previous research period, five fungi were found in field (A ć i m o v i ć, 1981). These fungi caused several types of diseases. However, T r u s z k o w s k a (1972) had identified a larger number of fungi on sunflower seed. Table 5 lists sunflower parasites registered in this research period.

Table 5

Sunflower diseases, pathogens, and their importance in Poland

No.	Disease	Pathogen	Importance
1	Downy mildew	*Plasmopara helianthi*	Less important
2	Spot	*Alternaria alternata*	Less important
3		*Alternaria* spp.	Less important
4		*Phoma oleracea* var. *helianthi-tuberosi*	Less important
5	Rot	*Botrytis cinerea*	Very important
6		*Sclerotinia sclerotiorum*	Less important
7		*Rhizopus* sp.	Less important
8	Wilt	*Verticillium dahliae*	Less important
9		*Fusarium culmorum*	Less important

It may be seen in the table that nine parasitic fungi were found in Poland. *Botrytis cinerea* was the only major parasite and the other fungi were less important for the sunflower production.

PORTUGAL

The data on the occurrence of sunflower diseases in Portugal are given in Table 6. Eleven diseases were found, nine of them caused by parasitic fungi and two caused by unknown, probably abiotic agents. *Sclerotium bataticola*, *Fusarium oxysporum* and *Fusarium* sp. were the major parasites of sunflower in Portugal.

Table 6

Sunflower diseases, pathogens, and their importance in Portugal

No.	Disease	Pathogen	Importance
1	Spot	*Alternaria* sp.	Less important
2		*Epicoccum purpuracens*	Less important
3	Rust	*Puccinia helianthi*	Less important
4	Rot	*Botrytis cinerea*	Less important
5		*Sclerotinia sclerotiorum*	Less important
6		*Sclerotium bataticola*	Very important
7		*Rhizopus arrhizus*	Less important
8	Wilt	*Fusarium oxysporum*	Medium important
9		*Fusarium* sp.	Medium important
10	Roots anomaly	undetermined	Less important
11	Head drop	undetermined	Less important

ROMANIA

Ten parasites had been registered in the previous research period (A ć i m o v i ć, 1981). Table 7 lists sunflower parasites found in the period 1981—1983.

It may be seen that in Romania, sunflower was attacked by 19 parasites which caused different types of diseases. Sixteen diseases were caused by fungi, one by a bacterium *(Erwinia carotovora)*, and two by floriferous parasites *(Orobanche cumana* and *Orobanche ramosa)*. Twelve diseases were less important, two were medium important, and five were very important. *Plasmopara helianthi* was less important in this than in the previous period.

Table 7

Sunflower diseases, pathogens, and their importance in Romania

No.	Disease	Pathogen	Importance
1	Downy mildew	*Plasmopara helianthi*	Less important
2	Spot	*Septoria helianthi*	Less important
3		*Alternaria alternata*	Less important
4		*Alternaria helianthi*	Medium important
5		*Alternaria zinniae*	Less important
6		*Alternaria* spp.	Very important
7		*Drechslera helianthi*	Less important
8		*Phoma oleracea* var. *helianthi-tuberosi*	Very important
9		*Phomopsis* sp.	Very important
10	Rust	*Puccinia helianthi*	Less important
11	Rot	*Botrytis cinerea*	Less important
12		*Sclerotinia sclerotiorum*	Very important
13		*Sclerotium bataticola*	Medium important
14		*Rhizopus nigricans*	Less important
15		*Erwinia carotovora*	Less important
16	Wilt	*Verticillium dahliae*	Less important
17		*Fusarium* spp.	Less important
18	Broom-rape	*Orobanche cumana*	Very important
19		*Orobanche ramosa*	Less important

SPAIN

Nine parasites had been known to attack sunflower in Spain before the commencement of this project (Aćimović, 1981). Table 8 lists sunflower diseases that occurred in Spain in the last three years.

Fourteen parasites were found in this research period, ten caused by fungi, one by a bacterium *(Erwinia carotovora)*, one by a floriferous parasite *(Orobanche cumana)*, and two of abiotic nature, caused by a shortage of microelements in the soil.

The major parasites were *Plasmopara helianthi, Sclerotium bataticola* and *Orobanche cumana*. Boron insufficiency was probably the most important abiotic factor.

Table 8

Sunflower diseases, pathogens, and their importance in Spain

No.	Disease	Pathogen	Importance
1	Downy mildew	*Plasmopara helianthi*	Very important
2	Spot	*Alternaria* sp.	Medium important
3	Rust	*Puccinia helianthi*	Less important
4	Powdery mildew	*Erysiphe cichoracearum*	Very important
5	Rot	*Botrytis cinerea*	Less important
6		*Sclerotinia sclerotiorum*	Less important
7		*Sclerotium bataticola*	Very important
8		*Sclerotium rolfsii*	Less important
9		*Rhizopus* sp.	Less important
10		*Erwinia carotovora*	Less important
11	Wilt	*Verticillium dahliae*	Less important
12	Broom-rape	*Orobanche cumana*	Very important
13	Bract necrosis	Associated to drought	Medium important
14	Head drop	Probably born deficiency	Very important

TURKEY

In this research period, ten parasites were found to attack sunflower in Turkey (Table 9). This is the same number of parasites as in the previous research period. Of the ten parasites, nine were fungi and one was a floriferous parasite *(Orobanche cumana)*. There were eight minor parasites and two major ones *(Puccinia helianthi* and *Orobanche cumana)*.

Table 9

Sunflower diseases, pathogens, and their importance in Turkey

No.	Disease	Pathogen	Importance
1	Downy mildew	*Plasmopara helianthi*	Less important
2	Spot	*Septoria helianthi*	Less important
3		*Alternaria* sp.	Less important
4		*Helmintho-sporium* sp.	Less important
5	Rust	*Puccinia helianthi*	Very important
6	Rot	*Botrytis cinerea*	Less important
7		*Sclerotinia sclerotiorum*	Less important
8		*Sclerotium bataticola*	Less important
9		*Rhizopus* sp.	Less important
10	Broom-rape	*Orobanche cumana*	Very important

YUGOSLAVIA

In the previous research period, 22 sunflower parasites were found in Yugoslavia (Aćimović, 1981). In this period, there were 25 parasites (Table 10) : 23 pathogenic fungi, one bacterium *(Erwinia carotovora),* and one floriferous parasite *(Orobanche cumana).* Most of the parasites have been present for quite some time but we also found several new parasites in this research period : *Acremoniella atra, Epicoccum neglectum, Sordaria fimicola* (Aćimović, 1983 *a* ; 1983 *b*), *Pleospora herbarum, Ophiobolus* sp., *Verticillium* sp. and *Alternaria* sp. The last parasite was incorrectly determined as *Alternaria crassa* in the previous report (Aćimović, 1981).

Table 10

Sunflower diseases, pathogens, and their importance in Yugoslavia

No.	Disease	Pathogen	Importance
1	Downy mildew	*Plasmopara helianthi*	Less important
2	Spot	*Septoria helianthi*	Less important
3		*Alternaria alternata*	Less important
4		*Alternaria helianthi*	Very important
5		*Alternaria zinniae*	Less important
6		*Alternaria* sp.	Less important
7		*Phoma oleracea* var. *helianthi-tuberosi*	Medium important
8		*Phomopsis* sp.	Very important
9		*Epicoccum neglectum*	Less important
10		*Sordaria fimicola*	Less important
11		*Pleospora herbarum*	Less important
12	Rust	*Puccinia helianthi*	Less important
13	Powdery mildew	*Erysiphe cichoracearum*	Less important
14	Rot	*Botrytis cinerea*	Less important
15		*Sclerotinia sclerotiorum*	Less important
16		*Sclerotium bataticola*	Very important
17		*Rhizopus arrhizus*	Less important
18		*Ophiobolus* sp.	Less important
19		*Acremoniella atra*	Less important
20		*Erwinia carotovora*	Less important
21	Wilt	*Verticillium albo-atrum*	Less important
22		*Verticillium dahliae*	Less important
23		*Verticillium sp.*	Less important
24		*Fusarium* sp.	Less important
25	Broom-rape	*Orobanche cumana*	Less important

Of the 25 sunflower parasites found, 21 were minor, one was medium (*Phoma oleracea* var. *helianthi-tuberosi*), and three were major pathogens (*Alternaria helianthi, Phomopsis* sp. and *Sclerotium bataticola*). The first two fungi were dominant in humid years and *Sclerotium bataticola* was dominant in dry and warm years.

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A general review of the distribution of sunflower diseases in Europe is given in Table 11.

In Europe, sunflower was attacked by 35 parasites : 32 parasitic fungi, one bacterium, and two floriferous parasites. Six new fungi were identified in the last three years, five of them in Yugoslavia. *Acremoniella atra, Epicoccum neglectum, Ophiobolus* sp., *Pleospora herbarum, Sordaria fimicola* and *Verticillium* sp. were found in Yugoslavia and *Epicoccum purpuracens* in Portugal.

Botrytis cinerea and *Sclerotinia sclerotiorum* had the widest distribution. They were present in all 10 countries. *Plasmopara helianthi* and *Sclerotium bataticola* were found in nine countries. *Alternaria* spp. in eight. *Phoma oleracea* var. *helianthi-tuberosi* and *Puccinia helianthi* in seven. *Erwinia carotovora, Erysiphe cichoracearum, Orobanche cumana, Septoria helianthi,* and *Verticillium dahliae* in five. The other pathogens were found in less than five countries.

SUNFLOWER DISEASES IN THE UNITED STATES AND AUSTRALIA

Although these two countries are not members of the FAO subnetwork for sunflower disease mapping, sunflower experts from these countries tock interest in and joined the subnetwork. In the last three years they wrote exhaustive reports which are the basis for the following brief reviews of sunflower parasites in the United States and Australia.

THE UNITED STATES OF AMERICA

In 1980, we received the first report on sunflower diseases in the United States. It was written by Yang. The report surveyed the occurrence and importance of sunflower diseases in six states : North Dakota, Minnesota, Mississippi, Texas, Florida, and California. *Puccinia helianthi* and *Phoma oleracea* var. *helianthi-tuberosi* were major parasites in North Dakota and Minnesota, *Alternaria helianthi* in *Mississippi* and Florida, and *Macrophomina phaseoli* in Texas. Other parasites were less important.

Table 11

Summary of sunflower pathogens and their importance in Europe

No.	Pathogen	Country									
		Bulgaria	France	Hungary	Italy	Poland	Portugal	Romania	Spain	Turkey	Yugoslavia
1	2	3	4	5	6	7	8	9	10	11	12
1	*Acremoniella atra*	—	—	—	—	—	—	—	—	—	*
2	*Alternaria alternata*	—	—	—	*	*	—	*	—	—	*
3	*Alternaria helianthi*	**	—	—	—	—	—	**	—	—	***
4	*Alternaria zinniae*	—	—	—	—	—	—	*	—	—	*
5	*Alternaria* spp.	—	*	*	—	*	*	***	**	*	*
6	*Botrytis cinerea*	*	***	*	*	***	*	*	*	*	*
7	*Drechshera helianthi*	—	—	—	—	—	—	*	—	—	—
8	*Epicoccum neglectum*	—	—	—	—	—	—	—	—	—	*
9	*Epicoccum purpuracens*	—	—	—	—	—	*	—	—	—	—
10	*Erwinia carotovora*	—	—	*	*	—	—	*	*	—	*
11	*Erysiphe cichoracearum*	—	*	*	*	—	—	—	***	—	*
12	*Fusarium culmorum*	—	—	—	—	*	—	—	—	—	—
13	*Fusarium oxysporum*	—	—	—	—	—	**	—	—	—	—
14	*Fusarium* spp.	—	—	—	*	—	**	*	—	—	*
15	*Helminthosporium* sp.	—	—	—	—	—	—	—	—	*	—
16	*Ophiobolus* sp.	—	—	—	—	—	—	—	—	—	*
17	*Orobanche cumana*	**	—	—	—	—	—	***	***	***	*
18	*Orobanche ramosa*	—	—	—	—	—	—	*	—	—	—
19	*Phoma oleracea* var. *helianthi-tuberosi*	**	*	*	*	*	—	***	—	—	**
20	*Phomopsis* sp.	—	—	**	—	—	—	***	—	—	***
21	*Plasmopara helianthi*	*	*	*	**	*	—	*	***	*	*
22	*Pleospora herbarum*	—	—	—	—	—	—	—	—	—	*
23	*Puccinia helianthi*	—	—	*	*	—	*	*	*	***	*
24	*Rhizopus arrhizus*	—	—	—	—	—	*	—	—	—	*
25	*Rhizopus nigricans*	—	—	—	—	—	—	*	—	—	—
26	*Rhizopus oryzae*	—	—	—	*	—	—	—	—	—	—
27	*Rhizopus* spp.	—	*	—	—	*	—	—	*	*	—
28	*Sclerotinia sclerotiorum*	**	***	***	*	*	*	***	*	*	*
29	*Sclerotium bataticola*	**	***	***	***	—	***	**	***	*	***
30	*Sclerotium rolfsii*	—	—	—	—	—	—	—	*	—	—
31	*Septoria helianthi*	*	—	*	—	—	—	*	—	*	*
32	*Sordaria fimicola*	—	—	—	—	—	—	—	—	—	*
33	*Verticillium albo-atrum*	—	—	—	—	—	—	—	—	—	*
34	*Verticillium dahliae*	—	*	—	—	*	—	*	*	—	*
35	*Verticillium* sp.	—	—	*	—	—	—	—	—	—	*

* Less important.

** Medium important.

*** Very important.

Table 12 lists sunflower diseases that occurred in the period 1981—1983. Sixteen parasites were found in Minnesota, North Dakota, South Dakota, Ohio and Texas. Most of them were less important for the sunflower production in these states. Only two of them, *Macrophomina phaseoli* and *Erysiphe cichoracearum*, created more serious problems in Texas.

Of the 16 parasites, 13 were pathogenic fungi and three were bacteria. The sunflower parasites found in the United States are similar to those found in Europe.

Table 12

Sunflower diseases, pathogens, and their importance in U.S.A.

No.	Disease	Pathogen	Importance
1	Downy mildew	*Plasmopara helianthi*	Less important
2	Spot	*Septoria helianthi*	Less important
3		*Alternaria helianthi*	Less important
4		*Alternaria alternata*	Less important
5		*Alternaria zinniae*	Less important
6		*Phoma oleracea* var. *helianthi-tuberosi*	Less important
7		*Phomopsis* sp.	Less important
8		*Pseudomonas* sp.	Less important
9	Rust	*Puccinia helianthi*	Less important
10	Powdery mildew	*Erysiphe cichoracearum*	Less important
11	Rot	*Sclerotinia sclerotiorum*	Less important
12		*Sclerotium bataticola*	Less important
13		*Rhizopus* sp.	Less important
14		*Erwinia carotovora*	Less important
15	Wilt	*Verticillium dahliae*	Less important
16		*Pseudomonas solanacearum*	Less important

AUSTRALIA

The first report we received from Australia was written by a group of authors (Allen, Brown and Kochman, 1980) and it covered the period 1978—1979. The authors determined 14 parasites of the sunflower, 13 phytopathogenic fungi and one bacterium (*Pseudomonas syringae*).

Table 13 lists sunflower parasites which occurred in the period 1982—1983. Twenty-two parasites were found during that period : 21 pathogenic fungi and one bacterium. Only four of them were of major importance for the sunflower production (*Alternaria helianthi, Puccinia helianthi, Sclerotium bataticola,* and *Rhizopus* sp.), two were medium important (*Albugo tragopogonis* and *Sclerotinia sclerotiorum*), and the remaining 16 were less important.

* * *

If we compare the sunflower parasites registered in Europe, the United States, and Australia, we may see certain similarities and certain differences. It may be noticed at first

Table 13

Sunflower diseases, pathogens, and their importance in Australia

No.	Disease	Pathogen	Importance
1	Spot	*Septoria helianthi*	Less important
2		*Alternaria helianthi*	Very important
3		*Alternaria zinniae*	Less important
4		*Phoma oleracea* var. *helianthi-tuberosi*	Less important
5		*Phomopsis* sp.	Less important
6		*Colletotrichum coccodes*	Less important
7		*Pseudomonas syringae*	Less important
8	Rust	*Albugo tragopogonis*	Medium important
9		*Puccinia helianthi*	Very important
10		*Puccinia xanthii*	Less important
11	Powdery mildew	*Erysiphe cichoracearum*	Less important
12	Rot	*Botrytis cinerea*	Less important
13		*Sclerotinia sclerotiorum*	Medium important
14		*Sclerotinia minor*	Less important
15		*Sclerotium bataticola*	Very important
16		*Sclerotium rolfsii*	Less important
17		*Rhizopus* sp.	Very important
18		*Phytophthora drechsleri*	Less important
19		*Pythium irregulare*	Less important
20		*Aspergillus* sp.	Less important
21	Wilt	*Verticillium dahliae*	Less important
22		*Fusarium* sp.	Less important

right that the compositions of parasites are similar in Europe and the United States while the composition in Australia differs from them to some extent. In fact, similarities exist in the major parasites but the less important ones are different.

Plasmopara helianthi is distributed in Europe and the United States but it is absent in Australia. *Orobanche cumana* is widely spread in Europe but it is not present in the United States and Australia. *Colletotrichum coccodes* is specific for Australia and another species, *Colletotrichum helianthicolum, was* registered only in Portugal. Neither species was found in the United States.

Albugo tragopogonis is present in Australia and it may be found in the Soviet Union ; it has not been found in the United States.

The following fungi are specific for Australia: *Puccinia xanthii, Sclerotinia minor, Phytophthora drechsleri, Pythium irregulare* and *Colletotrichum coccodes.*

DISCUSSION

The number of sunflower parasites differed in the participating European countries. The lowest number of parasites was registered in Bulgaria and the highest in Yugoslavia — 8 and 25, respectively. Fungi were dominant parasites everywhere. Thirty-five diseases were found to be present in the ten European countries, 16 in the United States, and 22 in Australia. The majority of the parasites are common for Europe, the United States and Australia. However, some parasitic fungi are specific for Australia alone : *Colletotrichum coccodes, Albugo tragopogonis, Puccinia xanthii, Phytophthora drechsleri* and *Pythium irregulare.* Caution must be exercised in seed trade in order to prevent the spreading of these parasites to Europe and the United States.

Twenty-nine sunflower parasites were registered in Europe in the period 1978—1980, 35 in the period 1981—1983. Five new fungi on sunflower were found in Yugoslavia and one in Portugal. Four of them cause sports, one causes wilting, and one causes rotting. The occurrence of these parasites confirms the statement made in the previous report saying that the agents of spot and wilt are not paid due attention as well as that we are not aware of their importance for sunflower production (Aćimović, 1981).

Botrytis cinerea and *Sclerotinia sclerotiorum* were the most frequent parasites in Europe in the period 1981—1983. They were found in all ten countries. *Plasmopara helianthi* and *Sclerotium bataticola* were found in nine countries, *Alternaria* spp. in eight, *Phoma oleracea* var. *helianthi-tuberosi* and *Puccinia helianthi* in seven, *Erwinia carotovora, Erysiphe cichoracearum, Orobanche cumana, Septoria helianthi* and *Verticillium dahliae* in five. The other parasites were found in a few countries only.

Sclerotium bataticola was the most important parasite of sunflower in Europe. It was found in nine countries and it was classified as major parasite in eight countries. Other parasites which were distributed in many countries were classified as major in only one, two, or three countries at the most. On the other side, *Phomopsis* was found only in Hungary, Romania and Yugoslavia but it was the major parasite there. That pathogen has recently been found in the United States, Australia, and Argentina but it was estimated to be of minor importance for the sunflower production in these countries.

Some fungi lost their importance for sunflower production. *Plasmopara helianthi* offers a typical example. It retained some degree of importance only in several regions of Spain where sunflower varieties susceptible to the fungus are still grown commercially. The fungus lost its importance in the other countries on account of two reasons : susceptible varieties were replaced by resistant hybrids in many countries or the seed of susceptible varieties and hybrids was treated with metalaxyl — based fungicides which efficiently control the fungus.

In the last theree years, six new parasites were found in only two countries. It is a clear indication that the work on disease mapping should be further intensified in order to make sure that new sunflower parasites are observed on time and methods of their control are developed.

We are aware that it is not an easy task to follow and register all occurrences and changes in sunflower fields. However, the returns for these efforts are highly rewarding. It is of utmost importance to improve the system of vigilance in all countries because sunflower diseases do not recognize state borders.

CONCLUSIONS

The following conclusions were drawn on the basis of the results on the occurrence, distribution, and number of sunflower diseases in the ten European countries, the United States, and Australia in the period 1981—1983.

Thirty-five sunflower diseases were registered in Europe : eight in Bulgaria, nine in France, 13 in Hungary, 11 in Italy, nine in Poland, 11 in Portugal, 19 in Romania, 14 in Spain, 10 in Turkey, and 25 in Yugoslavia. Sixteen diseases were found in the United States and 22 in Australia.

The compositions of parasites in Europe and the United States were similar. The composition of parasites in Australia was similar to them in some points but it also included several specific parasites which are either completely unknown or hardly known in Europe and the United States *(Colletotrichum coccodes, Albugo tragopogonis, Puccinia xanthii, Sclerotium minor, Phytophthora drechsleri).*

Botrytis cinerea and *Sclerotinia sclerotiorum* were the most widely spread sunflower parasites. They were found in all ten European countries. *Plasmopara helianthi* and *Sclerotium bataticola* were found in nine countries, *Alternaria* spp. in eight, and *Erwinia carotovora, Erysiphe cichoracearum, Orobanche cumana, Septoria helianthi,* and *Verticillium dahliae* in five. The remaining 23 diseases were found in less than five countries.

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LES MALADIES DU TOURNESOL EN EUROPE, AUX ETATS-UNIS ET EN AUSTRALIE, 1981—1983

Résumé

Conformément aux recherches et observations effectuées en 1981—1983 dans les principaux pays cultivateurs de tournesol d'Europe, des Etats-Unis et d'Australie, une série de conclusions a été formulée, concernant le nombre des maladies du tournesol, leur apparition et distribution.

En Europe 35 maladies ont été enregistrées, comme il suit : 8 en Bulgarie, 9 en France, 13 en Hongrie, 11 en Italie, 9 en Pologne, 11 en Portugal, 19 en Roumanie, 10 en Turquie et 25 en Yougoslavie. Aux Etats-Unis 16 maladies ont été rapportées, et 22 en Australie.

L'éventail des parasites en Europe a été presque similaire à celui des Etats-Unis. Une partie des parasites enregistrés en Australie ont été également similaires à ceux d'Europe et des Etats-Unis, l'autre partie étant, toutefois, constituée des espèces caractéristiques au continent australien, ou même inconnues en Europe et aux Etats-Unis (*Colletotrichum coccodes, Albugo tragopogonis, Puccinia xanthii, Sclerotium minor, Phytophthora drechsleri*).

Les parasites les plus répandus ont été *Botrytis cinerea* et *Sclerotinia sclerotiorum*. Ceux-ci ont été trouvés dans tous les 10 pays européens. *Plasmopara helianthi* et *Sclerotium bataticola* ont été enregistrés en 9 pays, *Alternaria* spp. en 8 pays et *Erwinia carotovora, Erysiphe cichoracearum, Orobanche cumana, Septoria helianthi* et *Verticillium dahliae* en 5. Le reste de 23 maladies ont été trouvées dans moins de 5 pays.

LAS ENFERMEDADES DEL GIRASOL EN EUROPA, ESTADOS UNIDOS Y AUSTRALIA, 1981—1983

Resúmen

En virtud de las investigaciones y observaciones efectuadas en el período 1981—1983 en los principales países cultivadores de girasol en Europa, los Estados Unidos y Australia, ha sido formulada una serie de conclusiones en cuanto al número de enfermedades del girasol, su aparición y distribución.

En Europa fueron registrados 35 enfermedades como sigue : 8 en Bulgaria, 9 en Francia, 13 en Hungria, 11 en Italia, 9 en Polonia, 11 en Portugal, 19 en Rumanía, 14 en España, 10 en Turquía y 25 en Yugoslavia. En los Estados Unidos se han comunicado 16 enfermedades y en Australia 22.

El espectro de los parásitos en Europa fue casi similar a aquello de los Estados Unidos. Una parte de los parásitos registrados en Australia fueron también similares a los de Europa y 10 de los Estados Unidos, la otra parte en cambio fue constituída de especies específicas al continente Australiano, o hasta desconocidas en Europa y Estados Unidos (*Colletotrichum coccodes, Albugo tragopogonis, Puccinia xanthii, Sclerotium minor, Phytophthora drechsleri*).

Los parásitos más difundidos fueron *Botrytis cinerea* y *Sclerotinia sclerotiorum*. Estos se encontraron en todos los 10 países europeos. *Plasmopara helianthi* y *Sclerotium bataticola* se señalaron en 9 países, *Alternaria* spp. en 8 países y *Erwinia carotovora, Erysiphe cichoracearum, Orobanche cumana, Septoria helianthi* y *Verticillium dahliae* en 5. El resto de 23 enfermedades fueron encontradas en menos de 5 países.