Investigations on fungal diseases of winter rape cultivated in Poland, in the aspect of breeding for resistance

I. FRENCEL - Institute of Plant Genetics of the Polish Academy of Sciences
Strzeszyńska 30/36. 60-479 POZNAN/Poland

INTRODUCTION

The problem of fungal diseses in winter oil-seed rape plantations in Poland have not been a subject of detailed investigations so far.

The actual program for plant protection is mainly focused on pests. On the other hand, plant breeders are equally concerned with plant winterhardiness.

There is a commonly accepted opinion that a low plant drilling on plantations after wintering is mainly due to the effect of frost, followed by "losses" as a result of young plant death. However, there is no detailed diagnosis and selective estimate of the portion of losses caused by pathogenic biotic factors, particularly by phytopathogenic fungi - known causal agents of frequently epidemic diseases of rape.

Signal information from observations of winter oil-seed rape growing in the field has pointed out to an intensifying occurrence of fungal diseases for the last few years in Poland. In the light of that information and the world literature, it was recognised necessary to undertake detailed studies in a complex program for elucidation of the economic importance of fungal diseases under our con-

ditions of cultivation and crop production.

This report presents results of preliminary etiological-diagnostic observation performed with the aim to establish the main directions of further investigations.

Fragmentary investigations on the influence of some fungal pathogens at the stage of seed germination were also carried out.

MATERIAL AND METHODS

During 1980-1982 some information concerning natural infections of winter rape in Poland was obtained. The sources of that information were as follows: 1/ individual notices of disease incidence and opinions on the state of health of field-grown plants, which were delivered voluntarily by Regional Stations for Quarantine and Plant Protection, 2/ the Registration of Plant Pests and Diseases /the General Register of Rape Pests and Diseases/ taken for the period of 1970-1981 - quarterly records /1/ and 3/ inspections of rapeseed field plantations in different locations throughout the country. Totally, about 400 samples of plant material with symptoms of fungal diseases were collected for mycologico-diagnostic analyses.

RESULTS AND DISCUSSION

The information survey according to the General Register /1/ for the last ten years /1970-1981/ showed that the most frequent fungal diseases of rape in Poland were the Gray Leaf Spot /Alternaria brassicae Bark./ Sacc., as well as the Downy Mildew /Peronospora brassicae Gäum./. Other fungal diseases /pathogens/ were recorded at lower frequ-

ency: Pythium debaryanum Hesse, Erysiphae communis Gr. f.s. brassicae Hanm., Plasmodiophora brassica Woronin, Botrytis cinerea Pers.et Fr., Fusarium nivale /Fr./ Ces., Septorium sp., Sclerotinia sclerotiorum /Lib./ de Bary, Phoma lingam /Fr./ Desm. However, it should be mentioned that the above survey of pathogens given in the order of an approximate frequency of recorded diseases ahould be treated at least as probable. We do not know exactly how large is the percentage of error in subjective essesment of widespread or incidental diseases, in the lack of information or in unreliable diagnoses of individual diseases.

Etiological studies started in 1981 enabled us to outline the hierarchy of the importance of some fungal pathogens in contrast to others, which currently seem to be of no economical importance.

On the basis of our observations of field-grown winter rape in 1980-1982 we came to the conclusion that further investigations concerning economically important fungal diseases and methodology of resistant plant breeding should particularly be focused on the following group of pathogens: Alternaria, Botrytis, Phoma, Sclerotinia /given alphabetically/.

Significant influence of climatic conditions on the occurrence and severity of the disease incidence was especially evident in the case of Botrytis and Sclerotinia. The degree of the plantation damage by Botrytis sp. during one vegetation period /1981/ was locally estimated as 30 to 50 % of infected plants, whereas during the next year it was in general no significant.

Similarly, a larger occurrence range of Sclerotinia sclerotiorum was also recorded in 1981, as compared to the next year. The disease appeared endemically, mainly in the south-western part of the country. The infection degree ave-

raged to about 30 % of plants attacked on plantations and locally it was sometimes about 50 % and more.

Concerning the Black Leg /Phoma lingam/ it seems to spread more and more in Poland. As follows from our observations this disease cannot be attributed to special regions differing by climatic conditions, since its highest severity was recorded in both nothern and south-western cultivation areas, whereas the pathogen was found under all local conditions.

However, analysing a progressing incidence of winter rape fungal diseases in Poland, particularly Phoma- and Sclerotinia diseases, the most probable seems to be the assumption, that the largest spread of pathogens and an increasing severity of the disease incidence are in a causal relation with the rape sowing area. A logical explanation of that would be a larger inoculum concentration within the rape plantation.

In fact, similar conclusion could be made after the synthesis of data from the Statistical Annual Report /2/. These data show that for the last twenty years /1960-1982/ the rape sowing area in Poland has markedly increased attaining almost a 3-fold increase in 1980 as compared to the initial year. This constituted 320 th ha of the rape cultivation area /winter oil-seed rape is dominating/ and about 5,2 % of the world crop production, placing Poland in the fifth position after Canada, China, India and France.

In the year 1981 a slight regression was noticed in the above values, which resulted from adverse climatic conditions, namely frost damages; the rapeseed sowing area occupied then 277 th ha giving 4,2 % of the world crop production.

Simultaneously, the last ten years were characterized by an evident change in the structure of rapeseed produc-

ction in Poland: from private farms it went over to collective state farms. The ratio of crop harvest for private and state farms in 1970 was approximately 1,3 : 1, respectively. For the last ten years it changed just the opposite and is approximately 1 : 5. These changes in the agrarian structure have brought about a lesser scattering of rapeseed fields and a larger concentration of local plantations.

Another feature of the rapeseed plantations in Poland is their concentration mainly in two macroregions of the country. Some provinces, like Szczecińskie and Opolskie with the vicinities ranged above 20- and 30 th ha of the rapeseed area, i.e. three- to two-fold more than do other provinces. It should also be emphasized that these provinces have the largest per cent of state farms in relation to the whole area of agricultural utilization of the country. Besides the mentioned areas, the regions of winter rape plantations are located also in some other geographical areas in Poland. However, they are smaller.

If particular cultivation regions /after provinces/ are divided into three categories according to their sowing area, i.e. category I - above 10 th ha, category II - above 20 th ha and category III - above 30 th ha, then the highest infection severity caused by Phoma lingam observed by us will be in the third and second categories, while the lowest disease incidence will be in the first category.

Regarding climatic conditions the cultivation areas of winter oil-seed rape are located in several agricultural-climatic regions distinguished in the map of climatic regions of Poland.

Summing up the results of our preliminary investigations, it may be inferred that the influence of climatic conditions during plant growth has evidently manifested itself in the case of Sclerotinia and Botrytis. On the other hand, the degree of infection and spread of Phoma lingam in

rape-seed plantations seem to be effected, as it was mentioned, by an increasing concentration of the cultivation areas, counteracting disintegration and scattering of local plantations. We are aware of other factors which can also influence the Phoma lingam plant colonization during the vegetation period. The source of primary inoculum, moisture conditions and the sowing date - the factors, the interrelation of which effects the occurrence of infection, as follows from our recent observations /1982-1983/ are of great importance, changing the infection ratio from year to year, or even from one plantation to the other.

Undoubtedly, more experience and knowledge concerning plant-pathogen dynamic relations may reveal some unknown variation factors and their regulation.

After the achieved survay of presently occurring economically important winter rape diseases we have started the complex investigation program. The following investigations are in progress: 1/ the identification and frequency of pathogens in natural infection - special problems of etiology and epidemiology, continued as a long-term studies; 2/ methodology of susceptible/resistant plant reaction differentiation in routine and reliable tests; 3/ intervarietal diversity in reaction to pathogens and pathogen variation in pathogenicity within populations; 4/ damaging effect of fungal pathogens during seed germination and seedling stage.

LITERATURE

1. Rejestracja Szczegółowa Chorób i Szkodników Roślin. Ogólny Rejestr Chorób i Szkodników Rzepaku. Sprawozdania kwartalne. Instytut Ochrony Roślin, Poznań.
2. Rocznik Statystyczny 1982. XLII. Główny Urząd Statystyczny, Warszawa 1982, 243,244,246,536.