THE EPIDEMIC REGULARITY OF SEPTORIA SPOT OF SUNFLOWER

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Abstract

The factors relating to the epidemic development of the Septoria spot of sunflower caused by *Septoria helianthi* Ell. et Kell. were investigated in the study during 1983-1990. The pathogen overwintered in the infected sunflower residues and no conidia were found on the surface of the seeds and inside part of the seeds. In the successive cropping fields, the disease developed earlier and more severely and in the rotation fields later and more gentlely. The rainfall during July to the middle of August was the most important meterological factor for the development of the disease. In the duration, if the successive precipitation was more than 12 days, relative humidity 100% and average temperature 21-23 C, the disease would develop very fast and make severe damage for the sunflower growth.

Key-words: Sunflower, Septoria Spot, *Septoria helianthi*, Epidemic regularity

Introduction

The Septoria spot, *Septoria helianthi* Ell.et Kell, of sunflower is an epidemic leaf spot disease which occurs everywhere in the sunflower production areas in the world. It occurs every year in the sunflower production areas in the three northwestern provinces, Liaoning , Jilin , Heilongjiang of China. In the epidemic years, the disease makes effect both on the yields and quality of the seeds with 10-40% seed yield losses estimated. And the frequency of the epidemic year of the disease is quite high. No former reports on the epidemic regularity of the disease have been found so far in the world. The study was made to find out the relations of epidemic of the disease with the pathogen resources of primary infection(PRPI) and some of the meteorological factors .

Materials and methods

Investigation of PRPI. The pathogen was tested for the overwintering survivals in 1983-1985. In the October , the infected sunflower leaves were collected from the sunflower fields and placed in the rooms with the heating system, in the rooms without heating

system, on the fences, in the upper, middle and low parts of the sunflower stem piles , on the ground surface and in the soil 10 cm under ground , respectively , for overwintering. From the January to the June of next year, the leaves were sampled from the places each month. The pycnidiospores on the spots of the leaves were scraped off and collected in the 2% sucrose solution confained in the dishes and then put in the chamber with the temperature of 25 C for 48 hours. As many as 300 cultured pycnidiospores were checked under the microscope for recording the sprouting percentage.

Detection of the pathogen on the seeds. Five sunflower varieties susceptible to the diseases were used for detecting the possibility of the pathogen on the seeds. Fifty gram seeds sampled from each variety were fully washed with the sterilized water for collecting the pycnidiospores. The spore suspension was made subside by centrifugolization and then the water upper part was poured away. The sediment was suspended with the stationary liquid(1/3 glycerine + 2/3 95% alcohol). The suspension was detected under the microscope for the existence of the pathogen. There were four replicates per treatment. The seeds were dehulled and the kernels were placed on the PDA medium to grow at 25 C for 5-7 . There were 20 seeds per treatment with 4 replicates.

Investigations of the epidemic regularity of the disease. In 1983, 1985,1988 and 1989, the effect of the successive cropping fields, fields adjoining the diseased fields and rotation fields on the disease development was investigated by recording the disease index (DI). The diseased plants were rated for severity of disease on a scale of 0-8, where 0 = no symptoms on leaves; 1 = 1% of the total leaf area spotted ; 2 = 5% of that spotted ; 3 = 10% of that spotted ; 4 = 20% of that spotted ; 5 = 30% of that spotted; 6 = 50% of that spotted ; 7 = 70% of that spotted and 8 = 100% of that spotted . The DI was calculated using the formula: $DI = \Sigma(I \times j) \times 100/n \times I$, where n=total number of plants; I=the highest severity class of the plants investigated; I=the severity class of each plant and j=number of plants in each class . From 1984 to 1990, the effect of the meterological factors on the disease epidemic was investigated . The investigations were conducted every three days from 19th of June to the middle of August each year. Fifty plants of the local sunflower variety "Changlingdake" were selected for calculating the DI from the third pair of the true leaves from root in each of both successive cropping fields and rotation fields at Baicheng City, Jilin Province.

Results and discussion

The results showed that the pycnidiospores and mycelia of the pathogen on the leaves overwintering in the rooms with heating system, in the rooms without heating system, on the fences , in the upper, middle and lower parts of the sunflower stem piles, on the ground surface and in the soil 10 cm under ground , respectively, survived till the middle

of June but the surviving rates tended to decreasing. The sprouting percentage of the spores overwintering on the surface of ground decreased to 48% in the middle of June. The spores overwintering in the soil 10 cm under ground began to have decreased sprouting percentage in the middle of April and died in the early of May . By testing the diseased sunflower residues overwintering in the fields which were collected in the beginning of June , the pycnidiospores and mycelia in them still survived. About 90% of the sunflower volunteer seedlings were infected by the pathogen so that it was clear that the pathogens overwintering in the residues became the main PRPI for next year. The results of testing the sunflower seeds showed that there were no the pathogens found either in the hulls or in the kernels .

The investigating results indicated that the disease developed earlier and more severely in the successively cropping fields and the fields adjoining the diseased fields and later and less severely in the rotation fields(Table 1) .

Table 1. Relations of the Septoria spot development to the pathogen resources

Fields	Years	Dates of first infection	DI in the middle of August
Rotation fields	1983	1st of July	32.3
	1985	10th of June	70.0
	1988	23rd of June	12.4
	1989	9th of July	13.6
Fields adjoining the diseased fields	1983	5th of June	66.0
	1985	7th of June	76.3
	1988	19th of June	26.4
	1989	19th of June	30.7
Successively cropping fields	1983	5th of June	75.6
	1985	3rd of June	92.6
	1988	5th of June	35.4
	1989	9th of June	35.9

The development of the disease early or late was related to the rainfall time during the late of May to the early of June and the pathogen quantity left last year. And the severity of the disease was closely correlated with the temperature, relative humidity, rainfall quantity and successive rainfall times during the late of July to the early of August (Table 2.). Table 2 shows that In 7 years from 1984 to 1990 only the air temperature in 1988 during the period was 3-5 C higher than that in the other years. In 1989, the rainfall quantity, relative humidity and rainfall times were lower, which were not favourable for the disease epidemic, so that the DI was very low. But in the other five years, the average temperature range was 20 - 30 C with maximum 25.16 C and the rainfall quantity, relative humidity and rainfall times were high so that the conditions were favourable for the disease epidemic and the DI was high.

Table 2. The relations of the meterological factors during the late of July to the early of August to the disease development in 1984-1990

Years	Average temperature (C)	Average relative humidity (%)	Total rainfall (mm)	Rainfall times	DI
1984	25.16	69.9	34.8	8	79.0
1985	22.95	84.6	158.6	14	100.0
1986	21.70	81.5	294.2	5	79.2
1987	22.30	76.0	152.0	6	72.9
1988	26.90	81.0	154.4	10	35.4
1989	23.17	71.1	15.2	6	13.6
1990	23.17	80.7	25.9	9	83.4

On the basis of the investigations for the 7 years, the principal meterological factors of the disease epidemic were of the temperature of 21-23 C, relative humidity of 69.9%, successive rainfall of 8 times and more dew during night.

The severe epidemic of the disease made significant reduction of the seed yields and quality, such as poor maturity of the seeds and low seed oil content. In 1985, the disease was very severe, so the seed oil content was only 44.6% . And in 1986, the DI was lower than 1986, so the seed oil content was 49.4%. In line with the meterological data in Baicheng City, during 1951-1986, in 9 years of which, the weather conditions were similar to those in 1985, meaning that the epidemic frequency of the disease is quite high.