

Occurrence of *Septoria* species on cereals in Finland in 1971—1973

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Abstract. This study was carried out on *Septoria* species found on cereals: spring and winter wheat (*Triticum aestivum* L.), spring barley (*Hordeum vulgare* L.), winter rye (*Secale cereale* L.) and oats (*Avena sativa* L.). The objective was to ascertain their distribution and general significance in Finland. The results were obtained from samples of cereals gathered in 2 040 fields all over the country during the growing season 1971—1973.

The fungi in all the samples were examined by microscope and cultures and inoculation tests were used as well in laboratory.

One of the *Septoria* species was found to occur on all the cereals, being most commonly on wheat and two-rowed barley, moderately common on winter rye, very rare on six-rowed barley and only sporadic on oats.

Septoria species were observed to occur most commonly in the southwestern and southern parts of the country, whereas they were very rare in the middle parts of the country and Ostrobothnia.

The imperfect stages of the fungi (*Septoria*) occurred dominantly, whereas at all times the perfect stages (*Leptosphaeria*) were found only occasionally.

The following *Septoria* species were found to occur on cereals:

Septoria nodorum (Berk.) Berk. & Br. was found to occur as the most common species on spring and winter wheat and was moderately common on two-rowed barley. The fungus was found on wheat in 60—70 per cent, and on barley, in about 40 per cent of the localities and for both cereals in 1/3 of the fields that were studied. On the other hand the fungus was found to be very rare on six-rowed barley and winter rye in 6—10 per cent of the localities and only 2—4 per cent of the fields studied.

Also in the inoculation tests it was found that *S. nodorum* isolates, which originated from different cereals, infected not only their own host but all the other cereals with the exception of oats.

The perfect stage, *Leptosphaeria nodorum* Müller was found only a few times on spring wheat, spring barley and winter rye.

Septoria avenae Frank f. sp. *triticea* T. Johanson was found to be the most common on two-rowed barley in about 45 per cent of the localities and in about 1/3 of the fields studied; on wheat in about 35—40 per cent of the localities and in nearly 1/4 of the fields studied.

The perfect stage of the fungus, *Leptosphaeria avenaria* Weber f. sp. *triticea* T. Johnson was found only a few times on spring wheat and barley.

S. avenae Frank f. sp. *avenae* Shaw was found to occur only occasionally on oats in nearly 10 per cent of the localities and only in 3 per cent of the fields studied. The perfect stage of the fungus, *L. avenaria* Weber f. sp. *avenaria* Shaw was found a few times also on oats.

Septoria tritici. Rob. ex Desm. was found to occur only on winter wheat in about 1/2 of the localities and in about 40 per cent of the fields studied. The fungus was found only in the spring (May to early June). It sometimes attacked fields in great profusion. In the inoculation tests it was found that the *S. tritici*' isolate originated from rye weakly infected not only rye but also spring wheat and winter rye.

Septoria secalis Prill. & Delacr. was found to occur only on winter rye, being moderately common in 1/2 of the localities and in about 1/4 of the fields studied.

On the basis of this study not much can be said about the magnitude or economic importance of the damages caused by the *Septoria* species. In addition to *Septoria* species, several other parasitic fungi such as *Helminthosporium*-, *Puccinia*-, *Fusarium*-species and *Erysiphe graminis* DC. were observed to grow at the same time on the leaves of cereals.

Introduction

Several *Septoria* species are known to be serious causers of leaf spot diseases on cereals cultivated all over the world (SPRAGUE 1950). Particularly *S. nodorum* (Berk.) Berk. & Br. has been found to cause large yield loss (BLOCK 1959, BRÖNNMANN 1968). On the other hand little is known of the occurrence and effect of several other *Septoria* species on cereals in many countries. In Scandinavia *Septoria* species have also been known since the last century (cf. FRANDSEN 1943, JØRSTAD 1967), but their significance has remained rather obscure (LEIJERSTAM 1962, KOLK 1966, HANSEN and MAGNUS 1969). In recent years, however, growing attention has begun to be attracted to *Septoria* species on cereals in Norway (HANSEN and MAGNUS 1969), Denmark (SMEDEGÅRD—PETERSEN 1974) and particularly in Britain (HEWETT 1965, HOLMES and COLHOUN 1970, RICHARDSON and NOBLE 1970, RICHARDSON 1972, WILLIAMS and JONES 1972).

In Finland *Septoria* species has been rather insignificant to date. In recent years they have been found to be uncommon on barley and grasses (MÄKELÄ 1972 a, 1972 b).

This study is part of a research project dealing with spot diseases on cereals and specifically with the pathogens causing these diseases (cf. MÄKELÄ 1972 b, 1974, 1975). The purpose of the present study is to clarify the occurrence of *Septoria* species on cereals. The study is based on samples of cereals which were gathered in farmers' fields throughout the country over a three year period (1971—1973).

Materials and Methods

The bulk of the cereals samples (Table 1) was gathered at a growth stage when the grain was milky ripe, chiefly from late July to early August. The samples of winter wheat and rye were gathered in May also.

The leaves were checked for diseases by ocular examination on the basis of symptoms. *Septoria* and *Leptosphaeria* species were determined in the following way: 1. Diseased leaves were kept on moist blotter paper in Petri dishes for a few days, after which the pycnidia and conidia that had grown were examined with a stereomicroscope. 2. Identification of these fungi is not possible by the above procedure alone, therefore microscope slides were

Table 1. Frequency of *Septoria* species as a per cent of samples of cereals gathered in various localities and fields in 1971–1973.

Cereals	Year	The samples researched		<i>Septoria</i> species, % of the cereals researched in the fields (F) and localities (L)							Total	
		No. of localities	No. of fields	<i>S. avenae</i> f. <i>sp. avenae</i> F	<i>S. avenae</i> f. <i>sp. triticea</i> F	<i>S. nodorum</i> F	<i>S. secalis</i> F	<i>S. tritici</i> F	<i>Septoria</i> spp. F	F	L	
Oats	1971	50	73	3	—	—	—	—	0	3	20	
	1972	142	233	3	—	—	—	—	0	3	14	
	1973	48	109	6	—	—	—	—	6	11	19	
	1971–73	181	415	3	—	—	—	—	1	5	10	
Spring barley ..	1971	69	157	—	13	3	—	—	—	19	36	
		Two-rowed	25	39	—	21	8	—	—	—	23	36
		Six-rowed	58	117	—	10	1	—	—	—	18	33
Spring barley	1972	135	348	—	16	8	—	—	5	26	57	
		Two-rowed	47	59	—	34	29	—	—	14	63	68
		Six-rowed	113	289	—	13	3	—	—	4	19	40
Spring barley	1973	124	299	—	14	8	—	—	5	28	42	
		Two-rowed	23	52	—	29	40	—	—	8	83	85
		Six-rowed	112	247	—	11	1	—	—	4	17	29
Spring barley	1971–73	251	803	—	15	7	—	—	4	26	38	
		Two-rowed	83	150	—	29	27	—	—	8	59	90
		Six-rowed	234	653	—	12	2	—	—	3	18	41
Spring wheat	1972	88	140	—	25	39	—	—	1	60	75	
		1973	62	82	—	18	33	—	—	9	56	50
		1972–73	111	222	—	23	37	—	—	5	59	72
Winter wheat	1972	62	112	—	22	27	—	17	4	52	63	
		1973	56	147	—	8	33	—	54	3	60	75
		1972–73	93	259	—	14	30	—	38	3	56	81
Winter rye	1972	90	201	—	—	6	38	—	4	44	67	
		1973	62	140	—	—	1	8	—	3	11	19
		1972–73	112	341	—	—	4	26	—	3	30	62

made from the leaves and, using these, the fungi were measured and microphotographed. 3. One-spore cultures of the fungi were made on potato dextrose agar (PDA). Petri dishes were kept under laboratory conditions (temp. +15°–+25° C). 4. Inoculation tests were performed on the different species of cereals (two-rowed barley cv. Ingrid, six-rowed barley cv. Otra, oats cv. Ryhti, Spring wheat cv. Ruso, winter wheat cv. Nisu and winter rye cv. Ensi). The cereals were raised to the 2–3 leaf stage in the plant growth chamber. The plants were inoculated with a suspension of spores or mycelia prepared in

distilled water. After inoculation the plants were kept at $+12^{\circ} - +15^{\circ} \text{C}$ under illumination by day and at $+7^{\circ} - +10^{\circ} \text{C}$ and in the dark by night for a period of 21 days. 5. The pycnidia and conidia of *Septoria* species grown on leaves were studied with a microscope.

Climate and Weather

The weather in summer in 1971, particularly in southern Finland, was characterised by low precipitation, except for part of August.

The weather during the growing seasons of 1972 and 1973 was exceptionally warm. Precipitation conditions varied greatly in different parts of the country. In 1972 there was little rain in May and June, whilst in August there was quite a lot of rain in southern and central Finland. During the entire growing season 1973 the amounts of precipitation were subnormal (Meteorol. Yearb. Finland 1971, 1972, 1973).

Results

Septoria avenae

Septoria avenae Frank, Ber. D. Bot. Ges., 13: 64, 1895, perfect stage: *Leptosphaeria avenaria* Weber, Phytopath. 12: 454, 1922 a.

The species has been divided into two *formae speciales*:

L. avenaria Weber f. sp. *avenaria* Shaw, imperfect stage: *S. avenae* Frank f. sp. *avenae* Shaw, Can. J. Bot. 35: 97, 1957, on oats (*Avena sativa* L.).

L. avenaria Weber f. sp. *triticea* T. Johnson, imperfect stage: *S. avenae* Frank f. sp. *triticea* T. Johnson, Can. J. Res. 25 C: 259, 1947, on wheat (*Triticum vulgare* L.), barley (*Hordeum vulgare* L.).

The *formae speciales* differ from each other in host range, symptoms and cultural characteristics (JOHNSON 1947, SHAW 1957 a, 1957 b).

Septoria avenae f. sp. *avenae*

S. avenae f. sp. *avenae* causes speckled blotch, leaf spot or *Septoria* disease of oats (WEBER 1922 a, HUFFMAN 1955, NOBLE and MONTGOMERIE 1956, SHAW 1957 a).

The fungus can be seed borne (NOBLE and MONTGOMERIE 1956, RICHARDSON and NOBLE 1970). It may persist also in the mycelial form on stubble and microspores constituting the primary inoculum (HUFFMAN 1955) or perfect stage (ascospores) are probably the principal spring inoculum (SHAW 1957 a).

The fungus is widespread (FRANDSEN 1943, SPRAGUE 1950), but its economic importance varies with area and season (NOBLE and MONTGOMERIE 1956, SHAW 1957 a). In Europe the fungus is a common seedling and leaf pathogen of oats in Scotland (NOBLE and MONTGOMERIE 1956, RICHARDSON and NOBLE 1970). It occurs in Germany, particularly in moist conditions (MÜLLER 1963). In Scandinavia *S. avenae* on oats has been known in Denmark since 1898 (cf. FRANDSEN 1943) and in Norway (JØRSTAD 1930, 1945, 1967). Nevertheless, the fungus is of little economic importance.

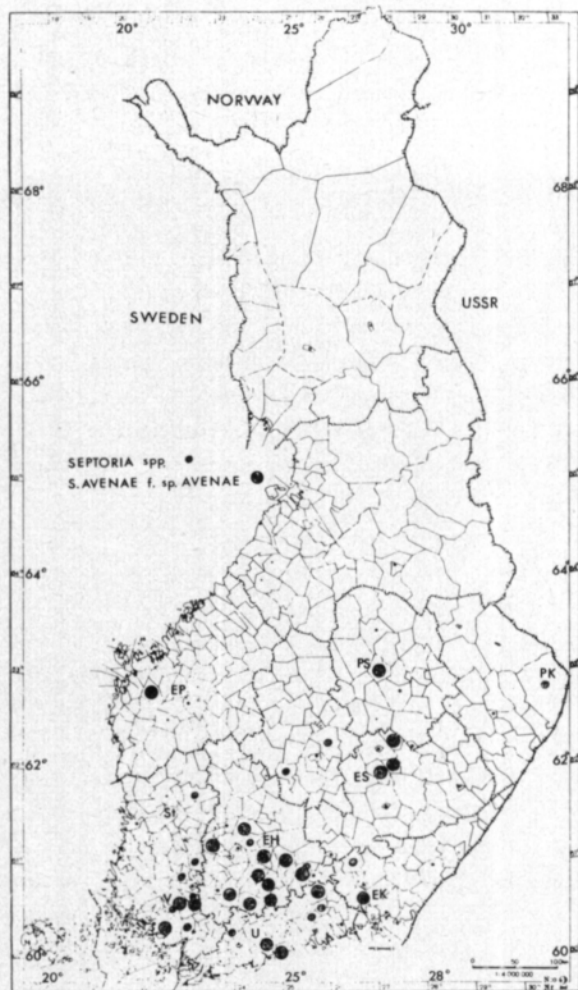


Fig. 1. The occurrence of *Septoria avenae* f. sp. *avenae* and *Septoria* spp. on oats (*Avena sativa*) by localities in Finland in 1971-1973.

S. avenae has been found also on various grasses (SPRAGUE 1950).

The perfect stage *Leptosphaeria avenaria* was found on oats (WEBER 1922 a, JØRSTAD 1930, HUFFMAN 1955, SHAW 1957 a). Micropycnidia with microspores were also found (JOHNSON 1952, HUFFMAN 1956, NOBLE and MONTGOMERIE 1956, SHAW 1957 a).

In this study *S. avenae* f. sp. *avenae* occurred rarely on oats in the southern parts of the country (Fig. 1). The fungus was encountered only in 3 % of fields (415 fields) studied (Table 1) in the following localities:

- V: Karinainen, Koski TI, Piikkiö;
- U: Anjala, Espoo, Helsinki, Orimattila;
- EH: Hauho, Hollola, Hämeenlinna, Janakkala, Kangasala, Lammi, Loppi, Riihimäki, Tamela, Vesilahti;
- EP: Laihia;
- PS: Haukivuori, Jäppilä, Maaninka, Virtasalmi.

Perfecta stage, *Leptosphaeria avenaria*:

- U: Helsinki, Viikki 6. 6. 1972, Snappertuna 24. 5. 1972, Tuusula 20. 11. 1972.

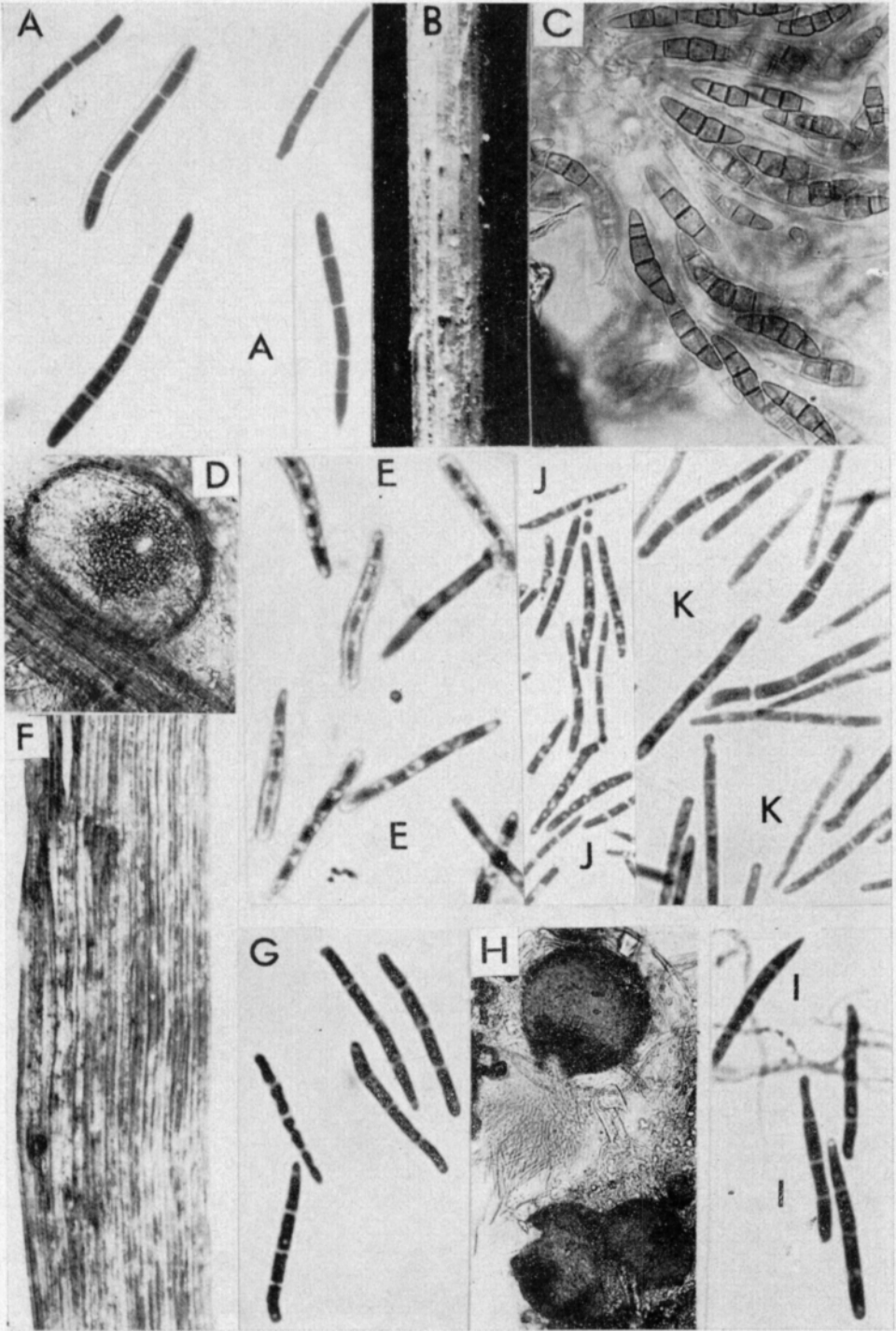


Fig. 2. A: *Septoria avenae* f. sp. *avenae* on oats, B-C: *Leptosphaeria avenaria* on winter rye and D-K: *Septoria avenae* f. sp. *triticea*; D, E: on winter wheat, F-H: on spring wheat, I, J: on six-rowed barley, K: on two-rowed barley. A, E, G, I, J, K: pycnospores, $\times 1000$, except J: $\times 500$; B: ascus on the dead straw, $\times 2$, C: ascus and sacospores, $\times 1000$, D and, H: pycnidia on the leaf of wheat, D $\times 200$, H $\times 100$, F: the lesion with black pycnidia on the leaf of spring wheat, $\times 2$.

Pycnidia of the fungus were found on ripening and withering leaves mostly in addition to *Helminthosporium avenae* Eidam (MÄKELÄ 1975). Pycnidia measured (100) 146 (162) μ in diam. Macroconidia were cylindrical, rounded at the ends 22.8–55.5 \times 2.4–5.4, 2–5-septa, mostly 37.1 \times 3.4 μ , 3.1-septa (Figs. 2 and 6) (cf. WEBER 1922 a, JØRSTAD 1967).

Perfect stage, *L. avenaria*, was found only a few times on overwintered stubble of oats.

Septoria avenae f. sp. *triticea*

S. avenae f. sp. *triticea* causes a leaf blotch of wheat and, less commonly, barley (SPRAGUE 1950, HOSFORD et al. 1969).

The fungus probably persists on stubble (cf. SHAW 1957 b). It has not been found in the seed samples (KIETREIBER 1962, RICHARDSON and NOBLE 1970).

The fungus has been found on wheat and, less commonly, on barley in Canada since 1943 (JOHNSON 1947). Today it is still common in Canada (SHAW 1957 b), as well as in the USA (SPRAGUE 1950, HOSFORD et al. 1969). In Europe the fungus is found in Austria on wheat but is, however, of lesser significance than *S. nodorum* (KIETREIBER 1962). On the other hand the fungus is found commonly in Scotland on wheat and barley (RICHARDSON and NOBLE 1970, RICHARDSON 1972). Richardson and Noble (1970) believe that *S. avenae* f. sp. *triticea* has long been known in Scotland but that it has been frequently misidentified as *S. passerinii* Sacc.

In Finland *S. avenae* f. sp. *triticea* was found in 5 % of the barley fields examined in 1970 and 1971 (MÄKELÄ 1972 b).

The fungus infects, besides wheat and barley, also oats, rye and certain grasses, particularly the species *Agropyron* and *Elymus* (JOHNSON 1947 SPRAGUE 1950).

The perfect stage *L. avenaria* f. sp. *triticea* has been found on wheat (JOHNSON 1947, SHAW 1957 b, HOSFORD et al. 1969).

Wheat

Septoria avenae f. sp. *triticea* occurred on wheat in the southern parts of Finland, which are the country's main wheat-cultivating areas (Figs. 3 and 4, Table 2). The fungus was encountered in 23 % of the fields of spring wheat (222 fields) and in 14 % of the fields of winter wheat (259 fields) examined (Table 1). The fungus was found in the following localities:

Spring wheat

V: Karinainen, Kuusjoki, Lemu, Pusula, Pöytyä, Suomusjärvi, Tarvasjoki, Tenhola;

U: Inkoo, Pornainen mlk., Porvoo, Tammisaari, Tammisaari mlk., Tuusula;

EK: Sippola;

St: Kiikka, Mellilä, Punkalaidun;

EH: Aitoo, Hattula, Hauho, Janakkala, Kärkölä, Lammi, Pälkäne, Sahalahti, Tuulos, Urjala;

ES: Juva, Mäntyharju, Puumala;

EP: Jalasjärvi, Laihia, Maksamaa;

Table 2. Frequency of *Septoria* species on spring wheat, winter wheat (*Triticum aestivum*) and winter rye (*Secale cereale*) in the fields researched in 1972 and 1973.

Biological provinces of Finland	The samples researched																																												
	Spring wheat				Winter rye				Spring wheat				Winter wheat				Winter rye																												
	No. of localities	No. of fields	No. of localities	No. of fields	No. of localities	No. of fields	No. of localities	No. of fields	No. of localities	No. of fields	No. of localities	No. of fields	No. of localities	No. of fields	No. of localities	No. of fields	No. of localities	No. of fields	No. of localities	No. of fields	No. of localities	No. of fields																							
V	19	42	18	78	19	53	21	36	2	12	41	47	0	0	26	6	20	56	2	7	22	58	3	26	0	0	26	6																	
U	20	56	18	67	19	86	20	56	2	7	22	58	3	3	23	2	20	56	2	7	22	58	3	3	0	3	23	2																	
EK	2	2	1	1	3	2	(50)	(0)	(0)	(100)	(0)	(0)	(0)	(0)	(50)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(50)	(0)	(0)																
St	13	27	10	39	10	29	19	74	4	13	26	28	8	3	45	3	13	26	28	8	26	28	8	3	3	45	3	3																	
EH	27	55	18	70	28	107	24	27	7	21	21	26	3	2	22	3	21	21	26	3	21	26	3	2	2	22	3	3																	
ES	10	10	1	1	9	22	30	60	0	(0)	(0)	(0)	(0)	0	27	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	0	0	27	0	0																	
EP	4	6	1	1	3	7	50	33	0	(0)	(0)	(0)	(0)	0	14	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	43	14	0	0	0																	
PH	3	3	3	3	6	8	(0)	(33)	(0)	(50)	(50)	(0)	(0)	(0)	25	0	(50)	(50)	(0)	(0)	(0)	(0)	(0)	25	25	0	0	0																	
PS	7	12	—	—	5	6	25	67	8	—	—	—	—	—	0	0	—	—	—	—	—	—	—	0	0	17	0	0																	
PK	3	5	1	1	4	10	20	40	0	(0)	(0)	(0)	(100)	0	20	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	0	0	20	0	0																	
KP	2	2	1	1	3	5	(50)	(0)	(0)	(0)	(50)	(50)	(0)	40	20	20	(0)	(0)	(50)	(0)	(0)	(50)	(0)	40	20	20	20	20																	
Kn	1	2	—	—	1	1	(0)	(50)	(0)	(0)	(0)	(0)	(0)	(0)	(100)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(100)	(0)	(0)																	
PP	—	—	—	—	2	5	—	—	—	—	—	—	—	—	0	0	—	—	—	—	—	—	—	0	0	0	20	20																	
InL	(1)	(13)	—	—	—	—	(0)	(100)	(0)	(0)	(0)	(0)	(0)	(0)	—	—	(0)	(0)	(0)	(0)	(0)	(0)	(0)	0	0	—	—	—																	
Total	111	222	72	259	112	341																																							

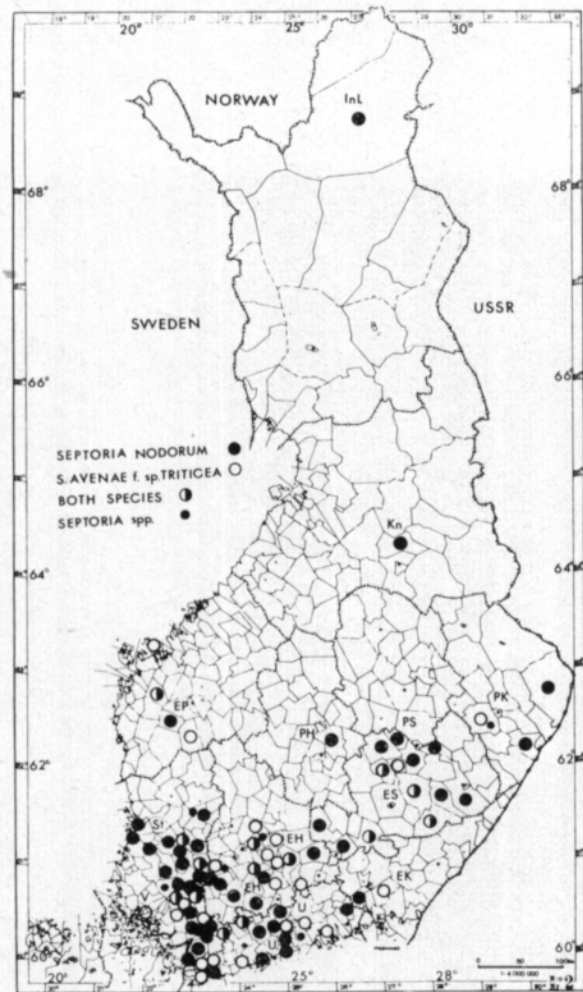


Fig. 3. The occurrence of *Septoria avenae* f. sp. *triticea* and *S. nodorum* on spring wheat (*Triticum aestivum*) by localities in Finland in 1972 and 1973.

PS: Haukivuori, Virtasalmi;

PK: Liperi;

KP: Pyhäjoki;

Perfect stage, *Leptosphaeria avenaria*

U: Tammisaari 18. 7. 1972.

Winter wheat

V: Aura, Kalanti, Karinainen, Karkkila, Kisko, Koski Tl, Nauvo, Salo, Suomusjärvi, Tenhola;

U: Lapinjärvi, Vantaa, Tuusula;

EK: Vehkalahti

St: Lauttakylä, Loimaa mlk., Punkalaidun;

EH: Aitoo, Hattula, Hauho, Hämeenlinna, Jokioinen, Kangasala, Sahalahti, Sääksmäki, Toijala, Urjala, Vesilahti, Viiala;

EP: Jalasjärvi.

Pycnidia of *S. avenae* f. sp. *triticea* were found in the greatest abundance on ripening and withering leaves, i.e. on yellow-brown lesions (Fig. 2).

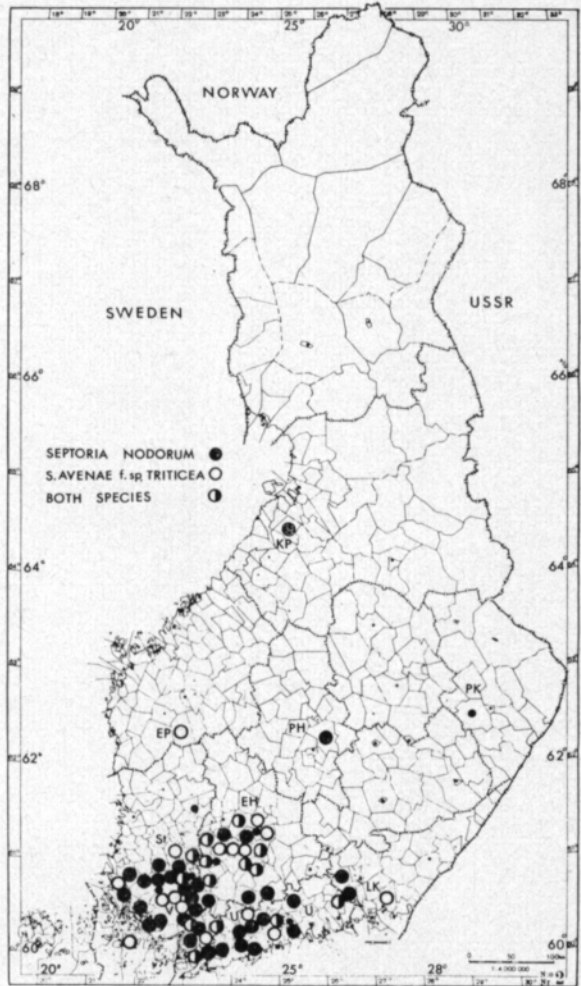


Fig. 4. The occurrence of *Septoria avenae* f. sp. *triticea* and *S. nodorum* on winter wheat (*Triticum aestivum*) by localities in Finland in 1972 and 1973.

Pycnidia were light brown, measuring 81–288 μ , mostly 158 μ in diam. Macroconidia were cylindrical, rounded at the ends, straight or slightly curved, 16.5–54 \times 2–4.5 μ , 1–5-septa mostly 33.0 \times 3.2 μ , 3.0-septa (Figs. 2 and 6). JOHNSON (1947) gave the following conidial size for *S. avenae* f. sp. *triticea* on wheat: (18) 26–42 (53) \times (2.3) 2.8–3.5 (4.2) μ .

Perfect stage, *L. avenaria*, was found only once on the leaves of spring wheat.

Barley

Septoria avenae f. sp. *triticea* was encountered on barley throughout the country as far north as Inari, Lapland (Fig. 5). The disease occurred most commonly in the southwestern and southern parts of the country, which are the most important barley-growing areas (Table 3). The fungus was found in the following localities:

Table 3. Frequency of *Septoria* species on spring barley (*Hordeum vulgare*) in the fields researched in 1971-1973.

Biological provinces of Finland	The samples researched						Septoria species, % of the samples researched in the fields					
	Two-rowed		Six-rowed		Total		<i>S. avenae</i> f. sp. <i>triticea</i>		<i>S. nodorum</i>		<i>Septoria</i> spp.	
	No. of localities	No. of fields	No. of localities	No. of fields	No. of localities	No. of fields	Two-rowed	Six-rowed	Total	Two-rowed	Six-rowed	Total
A	—	—	1	1	1	1	—	(0)	(0)	—	(0)	(0)
V	20	31	23	27	28	58	32	19	5	19	4	7
U	18	32	17	37	21	69	22	8	0	22	0	4
EK	1	1	7	11	7	12	(0)	18	1	(100)	0	8
St	13	24	26	72	27	96	33	31	5	38	1	4
EH	20	45	39	132	41	177	31	8	2	36	1	1
ES	3	4	14	48	15	52	(50)	13	0	(0)	0	0
EP	4	4	12	42	14	46	(0)	19	0	(25)	10	9
PH	1	2	19	77	19	79	(50)	1	11	(0)	4	4
PS	—	—	13	28	13	28	—	14	0	—	7	7
PK	—	—	13	49	13	49	—	10	0	—	8	8
KP	2	4	25	53	26	57	(25)	8	0	0	(25)	4
Kn	—	—	6	15	6	15	—	0	0	—	7	7
PP	1	3	14	40	15	43	(0)	13	0	(0)	3	2
Ks	—	—	3	10	3	10	—	0	0	—	10	10
KemL	—	—	2	11	2	11	—	0	0	—	0	0
InL	(1)	(7)	(1)	(8)	(1)	(15)	(0)	(0)	(0)	(14)	(0)	(7)
Total	83	150	234	653	251	803						

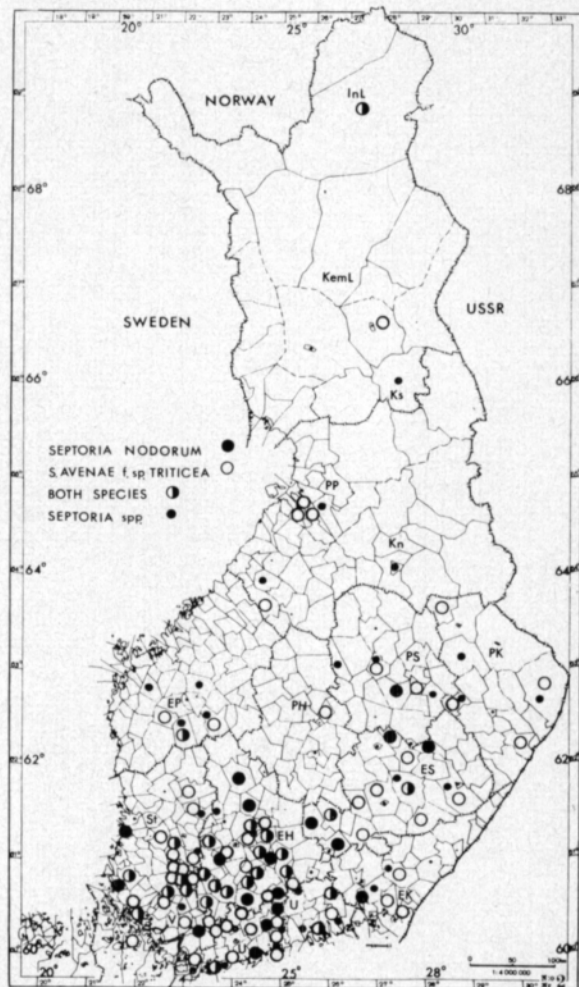


Fig. 5. The occurrence of *Septoria avenae* f. sp. *triticea* and *S. nodorum* on spring barley (*Hordeum vulgare*) by localities in Finland in 1971–1973.

- V: Aura, Halikko, Karkkila, Kiiikala, Laitila, Lemu, Masku, Nauvo, Nummi, Pöytyä, Suomensjärvi, Tenhola, Vihti;
 U: Anjala, Helsinki, Inkoo, Liljendal, Porvoo mlk., Snappertuna, Tuusula, Vantaa;
 EK: Vehkalahti, Virolahti;
 St: Alastaro, Huittinen, Hämeenkyrö, Ikaalinen, Keikyä, Kokemäki, Loimaa, Loimaa mlk., Mellilä, Oripää, Punkalaidun, Vampula;
 EH: Forssa, Hartola, Hattula, Hauho, Humppila, Hämeenlinna, Koski HI, Kuhmalahti, Kärkölä, Lammi, Luopioinen, Pälkäne, Renko, Riihimäki, Sahalahti, Somero, Tammela, Toijala, Vesilahti;
 ES: Juva, Hirvensalmi, Luumäki, Mikkeli mlk., Mäntyharju, Puumala, Sääminki;
 EP: Alavus, Jalasjärvi, Kurikka;
 PH: Sumiainen;
 PS: Joroinen, Maaninka, Riistavesi;
 PK: Ilomantsi, Liperi, Tohmajärvi, Valtimo;
 KP: Kalajoki, Kauhava, Pyhäjoki, Raahe, Sievi;
 PP: Kemijärvi, Kempele, Liminka, Tyrnävä;
 InL: Inari.

Perfect stage, *Leptosphaeria avenaria*:

- U: Helsinki, Viikki 6. 6. 1972,
 PS: Jäppilä 25. 7. 1972.

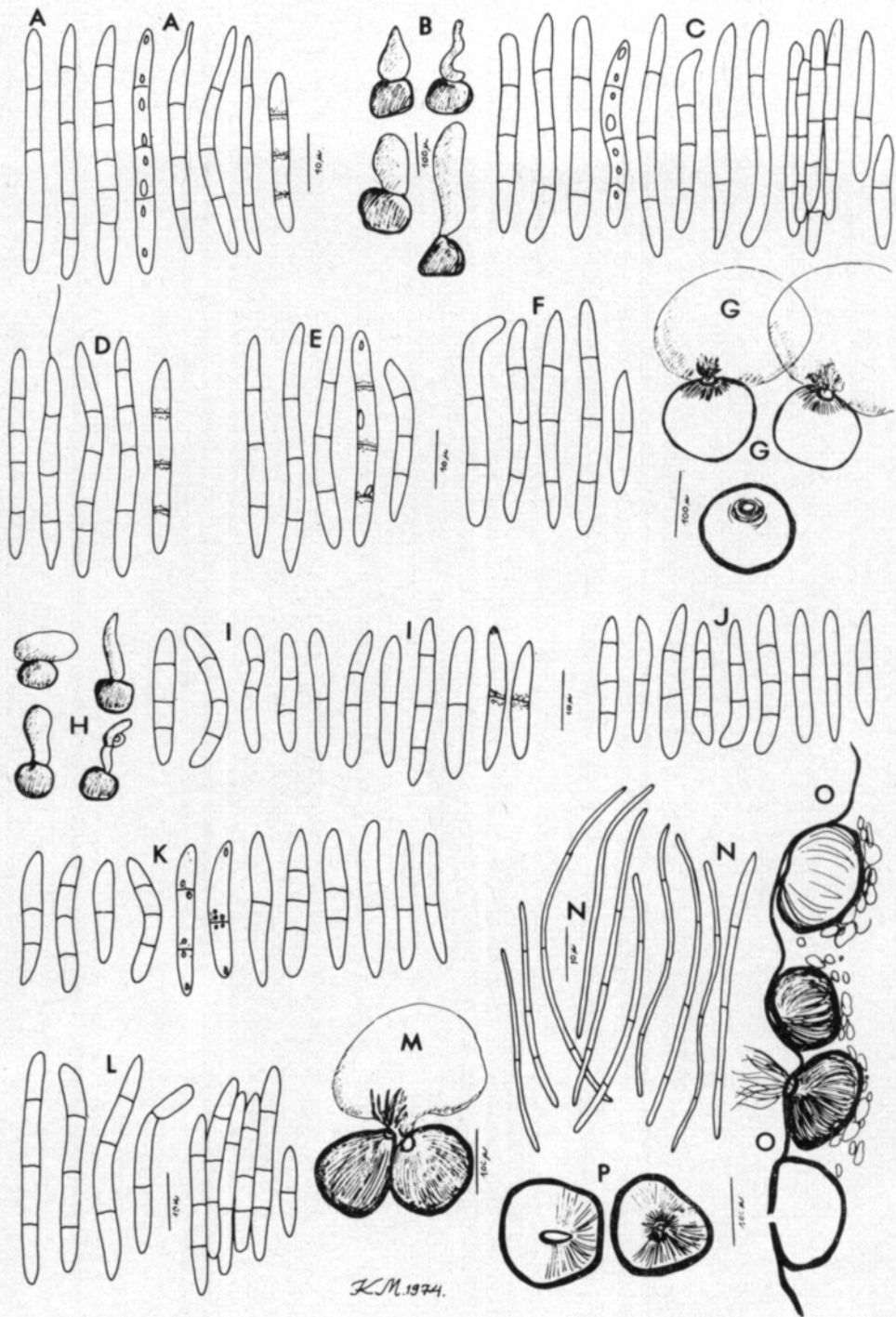


Fig. 6. Pycnidia and pycnospores of *Septoria* species on cereals. A: *Septoria avenae* f. sp. *avenae* on oats; B–F: *S. avenae* f. sp. *triticea*, B, C: on spring wheat, D: on winter wheat, E: on two-rowed barley, F: on six-rowed barley; G–K: *S. nodorum*, G–I: on spring wheat, J: on winter wheat, K: on spring barley; L, M: *S. secalis* on winter rye and N–P: *S. tritici* on winter wheat.

S. avenae f. sp. *triticea* was found in different years in an average 15 % (range 13–16 %) of the fields (803 fields) examined (Table 1). The fungus was rather commoner in two-rowed varieties (21–34 %) than in six-rowed varieties (10–13 %).

Pycnidia of the fungus were found in greatest abundance on maturing and withering leaves, i.e. on brown necrotic lesions.

Pycnidia were yellowish brown measuring 70–270 μ , averaging 148 μ in diam. Macroconidia were cylindrical 15–46.5 \times 2–6 μ , 1–5-septa, mostly 31.4 \times 3.2 μ , 3.0-septa (Figs. 2 and 6).

The perfect stage, *L. avenaria*, was found only twice on barley.

Septoria nodorum

Septoria nodorum (Berk.) Berk. & Br. Ann. Mag. Nat. Hist., Ser. 2, 5: 379, 1850, perfect stage: *Leptosphaeria nodorum* Müller, Phytopath. Z. 19: 409, 1952. Syn. cf. MÜLLER 1952: 409.

The species has been divided into two *formae speciales* (SMEDEGÅRD—PETERSEN 1974).

The fungus causes glume blotch on wheat, attacks all parts of the plant except the roots in all stages of its growth. Leaf lesions often coalescing to form a general leaf necrosis. The fungus is, however, primarily an ear pathogen (WEBER 1922 b, FRANSEN 1934, HOPP 1957, JØRSTAD 1967, BRÖNNIMANN 1968). On barley the symptoms of the disease are redbrown spots which often continue in the form of chlorotic tissue along the leaf-ribs (HANSEN and MAGNUS 1969, SMEDEGÅRD—PETERSEN 1974).

The fungus is seed-borne (MACHACEK 1945, KIETREIBER 1961, HEWETT 1965, BAKER 1971), but can also be found on stubble (WEBER 1922 b, HOPP 1957, SCHAREN 1964, JONES and ODEBUNMI 1971). It is possible that *S. nodorum* may overwinter also on grasses (WILLIAMS and JONES 1973).

Epiphytotics have often occurred particularly under moist and rainy climatical conditions (HOPP 1957, BLOCK 1959, SCHAREN 1964, JØRSTAD 1967, BRÖNNIMANN 1968).

S. nodorum occurs widespread in most of the world's wheat-growing areas (SPRAGUE 1950, C.M.I. map no. 283). In Europe, the fungus was first observed by Berkeley in 1845 in the British Isles (GROVE 1935). Today the fungus is very common on wheat (HEWETT 1965, RICHARDSON and NOBLE 1970) and occurs also on barley (HOLMES and COLHOUN 1970, RICHARDSON 1972). *S. nodorum* has been known to be common and destructive on wheat also in Germany (HOPP 1957, BLOCK 1959, BOCKMANN 1963), Switzerland (MÜLLER 1952, BRÖNNIMANN 1968), Austria (KIETREIBER 1961, 1962) and in the Netherlands (BECKER 1955).

In Scandinavia *S. nodorum* has been known to blight wheat in Denmark (FRANSEN 1943) and in recent years it has been widespread also on barley (SMEDEGÅRD—PETERSEN 1974). In Norway the fungus is found on wheat and barley. Only on wheat does it appear to be a parasite of economic importance (JØRSTAD 1930, 1945, 1967, HANSEN and MAGNUS 1969). In Sweden

S. nodorum is today quite common on wheat (LEIJERSTAM 1972) and also on rye (KOLK 1966).

In Finland *S. nodorum* is apparently considered to be of negligible significance because up to now it has not attracted attention. In recent years, however, the fungus was found on barley (MÄKELÄ 1972 b), and on different grasses (MÄKELÄ 1972 a).

The perfect stage, *Leptosphaeria nodorum* has been found on wheat in Switzerland (MÜLLER 1952) and in Britain (LUCAS and WEBSTER 1967) and on barley in Denmark (SMEDEGÅRD—PETERSEN 1974).

S. nodorum infects, besides wheat, barley and rye as well as other species of gramineae (WEBER 1922 b, SPRAGUE 1950, HOPP 1957, JØRSTAD 1967, WILLIAMS and JONES 1973).

Wheat

In this study *Septoria nodorum* occurred on wheat in the southern parts of Finland, where most of the country's wheat is cultivated, occasionally turning up as far north as Inari, Lapland (Figs. 3 and 4). *S. nodorum* was more common than *S. avenae* f. sp. *triticea* both on spring wheat and winter wheat (Tables 1 and 2). *S. nodorum* was found in about 1/3 of the wheat fields studied as follows:

Spring wheat

- V: Halikko, Kiikala, Marttila, Muurla, Perniö, Pusula, Pöytyä, Salo, Suomusjärvi, Tenhola, Vihti;
U: Elimäki, Helsinki, Hyvinkää, Kirkkonummi, Lapinjärvi, Nurmijärvi, Snappertuna, Vantaa;
St: Hämeenkyrö, Keikyä, Kiikka, Kiukainen, Kokemäki, Lauttakylä, Loimaa mlk., Luvia, Mellilä, Metsämaa, Oripää, Pori, Punkalaidun, Säskylä, Vammala;
EH: Asikkala, Forssa, Hattula, Heinola mlk., Humppila, Hämeenlinna, Lammi, Loppi, Pälkäne, Sysmä, Tammela;
ES: Juva, Mäntyharju, Puumala, Sulkava, Sääminki;
EP: Kurikka, Laihia;
PH: Laukaa;
PS: Haukivuori, Joroinen, Jäppilä, Kangaslampi, Pieksämäki mlk.;
PK: Ilomantsi, Tohmajärvi;
Kn: Paltamo;
InL: Inari.

Perfect stage, *Leptosphaeria nodorum*

- V: Tenhola 18. 7. 1972,
U: Helsinki, Viikki 6. 6. 1972, Pornainen 25. 5. 1972.

Winter wheat

- V: Halikko, Kaarina, Karjaa, Karjala, Koski Tl, Kuusjoki, Laitila, Lohja mlk., Masku, Muurla, Perniö, Piikkiö, Pohja, Salo, Suomusjärvi, Tenhola, Vehmaa, Vihti;
U: Elimäki, Kirkkonummi, Lapinjärvi, Mäntsälä, Nurmijärvi, Sipoo, Siuntio, Tuusula;
St: Alastaro, Loimaa mlk., Mellilä, Oripää, Punkalaidun, Säskylä, Yläne;
EH: Hauho, Hattula, Hämeenlinna, Iitti, Jokioinen, Kangasala, Lempäälä, Loppi, Pälkäne, Riihimäki, Somero, Urjala, Vesilahti, Ypäjä;
PH: Laukaa;
KP: Paavola.

Pycnidia of *S. nodorum* were found in greatest abundance on ripening and withering leaves, on brownish leafspot as well as on ears (Fig. 7). Pycnidia were yellow brown, measuring 90–300 μ , mostly 157 μ in diam. Conidia were short, cylindrical, stright or bent, 10–29 \times 1.5–4.5 μ , 1–3-septa, mostly 19.7 \times 3.0 μ , 1.8-septa (Figs. 6 and 7) (cf. JØRSTAD 1967).

In the inoculation tests (Table 4) it was found that the eleven isolates of *S. nodorum* which originated from spring and winter wheat and came from different localities, infected barley, wheat and rye, but did not infect oats. The perfect stage, *L. nodorum*, was found only a few times on spring wheat (Fig. 7).

Table 4. Results of the inoculation tests in the laboratory with *Septoria* species in 1973.

<i>Septoria</i> species	No. of isolates researched	The origin of isolates		Spring barley						
		Cereals	Localities	Two-rowed cv. Ingrid	Six-rowed cv. Otra	Spring wheat cv. Ruso	Winter wheat cv. Nisu	Winter rye cv. Ensi	Oat cv. Ryhti	
<i>S. nodorum</i>	3	Spring barley								
		Two-rowed	St: Loimaa, Mellilä, PS: Kuopio	***	**	***	**	*	0	
	1	Six-rowed	St: Loimaa	***	**	—	**	*	0	
	5	Spring wheat	V: Karinainen, Suomensjärvi St: Vampula	***	*	***	***	**	0	
	6	Winter wheat	V: Halikko, Karinainen, Piikkiö St: Loimaa, EH: Hattula	***	*	**	***	**	0	
	1	Winter rye	PH: Sumiainen	*	*	***	***	*	0	
<i>S. tritici</i>	1	Winter wheat	U: Lohja	0	0	*	**	*	0	

Barley

Septoria nodorum occurred on barley in the southern parts of the country, occasionally also as far north as Inari, Lapland (Fig. 5). *S. nodorum* was found to be moderately common on two-rowed barley in 1/3 of the fields studied, whilst on six-rowed barley it occurred only occasionally. The fungus was found in the following localities:

- V: Kalanti, Laitila, Masku, Muurla, Pöytyä;
 U: Anjala, Artjärvi, Hyvinkää, Kirkkonummi, Nurmijärvi, Porvoo mlk., Snappertuna;
 St: Kiiikka, Loimaa mlk., Luvia, Mellilä;
 EH: Forssa, Hartola, Hauho, Hausjärvi, Heinola mlk., Humppila, Hämeenlinna, Koski HI, Kylmäkoski, Lammi, Loppi, Luopioinen, Orivesi, Renko, Ruovesi, Sahalahti, Somero, Sysmä, Tammela, Tuulos, Vesilahti;
 ES: Juva;
 EP: Jalasjärvi;
 PS: Jäppilä, Kangaslampi, Kuopio;
 InL: Inari.

Perfect stage, *Leptosphaeria nodorum*:

- U: Helsinki, Viikki 6. 6. 1972;
 EK: Sippola 1. 8. 1972.

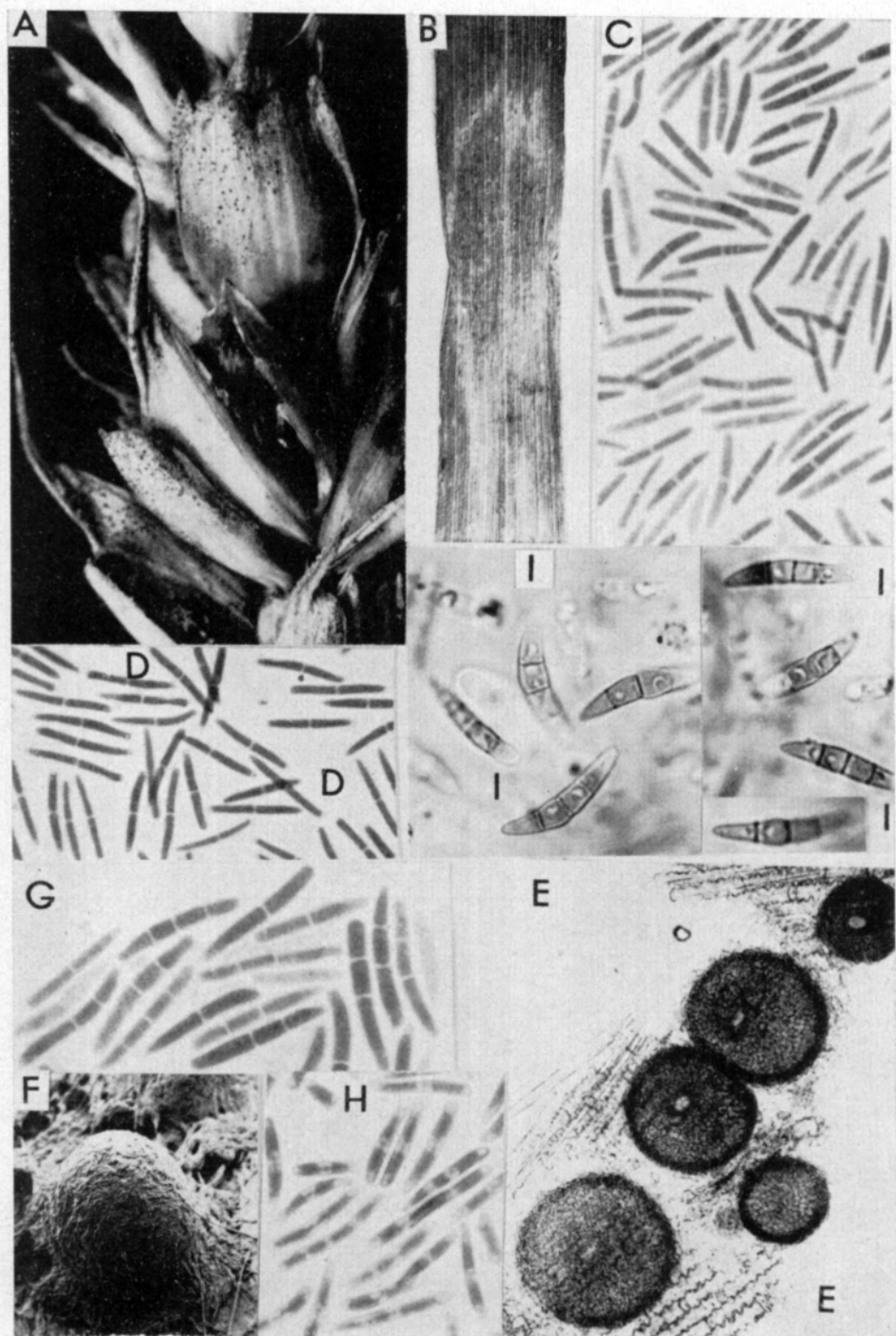


Fig. 7. *Septoria nodorum*, A—C: on winter wheat, D: on spring wheat, G: on six-rowed barley, E—H: on two-rowed barley. A: lesions with black pycnidia on glume of ear $\times 5$, B: the brown lesion with black pycnidia on the leaf $\times 2$, C, D, G, H: pycnospores; C, D $\times 500$; G, H $\times 1\ 000$, E: pycnidia on the leaf, $\times 200$, F: the pycnidium with mass of pycnospores on the leaf $\times 400$, SEM, Viikki. I: *Leptosphaeria nodorum*, ascospores from spring wheat $\times 1\ 000$.

Pycnidia of *S. nodorum* were found in withering leaves on necrotic tissues. Pycnidia were light brown, measuring 70–234 μ , mostly 138 μ in diam. Conidia were 12–27 \times 2–4.5 μ , 0–3-septa, mostly 19.4 \times 2.7 μ , 1.6-septa (Figs. 6 and 7) (cf. JØRSTAD 1967).

In the inoculation tests (Table 4) it was found that the four isolates of *S. nodorum*, which originated from two-rowed and six-rowed barley and came from different localities, infected barley, wheat and rye, but did not infect oats.

The perfect stage, *L. nodorum*, was found only twice on barley.

Rye

Septoria nodorum was found to be very rare on winter rye, occurring in only 4 % of the fields (341 fields) studied (Tables 1 and 2). The fungus was found sporadically throughout the country as far north as Raahe (Fig. 8) as follows:

- U: Tuusula;
- St: Loimaa mlk.;
- EH: Renko, Sahalahti;
- EP: Jalasjärvi, Koivulahti, Laihia;
- PH: Konginkangas, Sumiainen;
- KP: Raahe, Sievi.

Perfect stage, *Leptosphaeria nodorum*:

- U: Orimattila 25. 5. 1972;
- EP: Alavus 3. 8. 1973.

Pycnidia of *S. nodorum* were found on ripening leaves (Fig. 9.) Conidia were 12–24 \times 2–4.5 μ , 1–3-septa, mostly 19.9 \times 3.3 μ , 1.9-septa (Figs. 6 and 9).

In the inoculation tests (Table 4) it was found that the isolates of *S. nodorum* which originated from winter rye, infected barley, wheat and rye, but did not infect oats.

The perfect stage, *L. nodorum*, was found only twice on rye.

Septoria secalis

Septoria secalis Prill. & Delacr., Bull. Soc. Myc. Fr., 5: 125, 1889; microform see SPRAGUE 1950: 253, JØRSTAD 1967: 48.

The fungus causes leaf blotch on rye (WEBER 1923, FRANSEN 1943).

The fungus is rarely encountered in the USA (WEBER 1923, SPRAGUE 1950) and Europe (cf. FRANSEN 1943: 40); lately it has only been reported in Scotland (RICHARDSON and NOBLE 1970). In Scandinavia *S. secalis* has been known in Denmark (FRANSEN 1943) and Norway (JØRSTAD 1930, 1945, 1967).

The fungus has been reported only on rye and is considered to be economically unimportant (WEBER 1923, JØRSTAD 1930, FRANSEN 1943).

In this study *S. secalis* occurred only on winter rye throughout the country as far north as Muhos and Hyrynsalmi (Fig. 8). The disease was observed to occur most commonly in the southwestern and southern parts of Finland, which are the country's main rye-cultivating areas (Table 2).

S. secalis was found in an average 26 % of the fields (341 fields) examined. In 1973 the fungus was found to be comparatively rarer than in 1972, apparently owing to weather conditions (Table 1). The fungus was found in the following localities:

- V: Kiikala, Korppoo, Koski Tl, Lokalahti, Masku, Mietoinen, Nauvo, Nummi, Raisio, Vehmaa, Vihti;
U: Helsinki, Hyvinkää, Inkoo, Lapinjärvi, Tuusula, Vantaa;
EK: Sippola;
St: Ikaalinen, Huittinen, Kokemäki, Kullaa, Köyliö, Loimaa mlk., Luvia, Mellilä, Oripää, Pori, Punkalaidun;
EH: Asikkala, Hattula, Heinola mlk., Humppila, Janakkala, Jokioinen, Kuhmalahti, Kylmäkoski, Kärkölä, Lempäälä, Luopioinen, Pälkäne, Sahalahti, Sysmä, Toijala, Urjala, Vesilahti, Viiala;
ES: Juva, Puumala, Sulkava, Sääminki;
EP: Jalasjärvi, Laihia;
PH: Hankasalmi, Pihtipudas, Sumiainen;
PS: Virtasalmi;
PK: Ilomantsi, Nurmes;
KP: Kannus;
Kn: Hyrynsalmi;
PP: Muhos.

Pycnidia of *S. secalis* were found in greatest abundance on ripening and withering leaves, on brown necrotic spot.

Pycnidia were brown, measuring 72–279 μ , mostly 155 μ in diam. Macroconidia were cylindrical, rounded at the ends 16.5–54 \times 2.5–5.0 μ , 2–5-septa, mostly 34.4 \times 3.2 μ , 3.0-septa (Figs. 6 and 9) (cf. SPRAGUE 1950, JØRSTAD 1967).

Septoria tritici

Septoria tritici Rob. ex Desm., Ann. Sci. Nat., Ser. 2, 17: 107, 1842; syn. cf. FRANSDEN 1943: 14.

The fungus causes speckled leaf-blotch mainly on winter wheat (SPRAGUE 1950, SANDERSON 1964). Weakened plants may even die (FRANSDEN 1943).

The fungus has been mainly considered to be a foliar parasite. There have been no confirmed reports of the disease being seed borne (JONES and COOKE 1971, WILLIAMS and JONES 1972). It may overwinter on weed species and stubble (JONES and ODEBUNMI 1971) as well as on grasses (WILLIAMS and JONES 1973).

S. tritici is widespread and important, particularly in moist conditions (FRANSDEN 1943, SPRAGUE 1950). In Europe the fungus is found in Britain (GROVE 1935), also on spring wheat (WILLIAMS and JONES 1973) and in Scotland only rarely on winter wheat (RICHARDSON and NOBLE 1970). In Scandinavia *S. tritici* has been known in Denmark and Sweden since the last century (cf. FRANSDEN 1943) and in Norway since 1931 (JØRSTAD 1945, 1967). Today the fungus is little known.

S. tritici mostly infected winter wheat in the spring (SPRAGUE 1950, JØRSTAD 1945, 1967, SANDERSON 1964, RICHARDSEN and NOBLE 1970) but it also

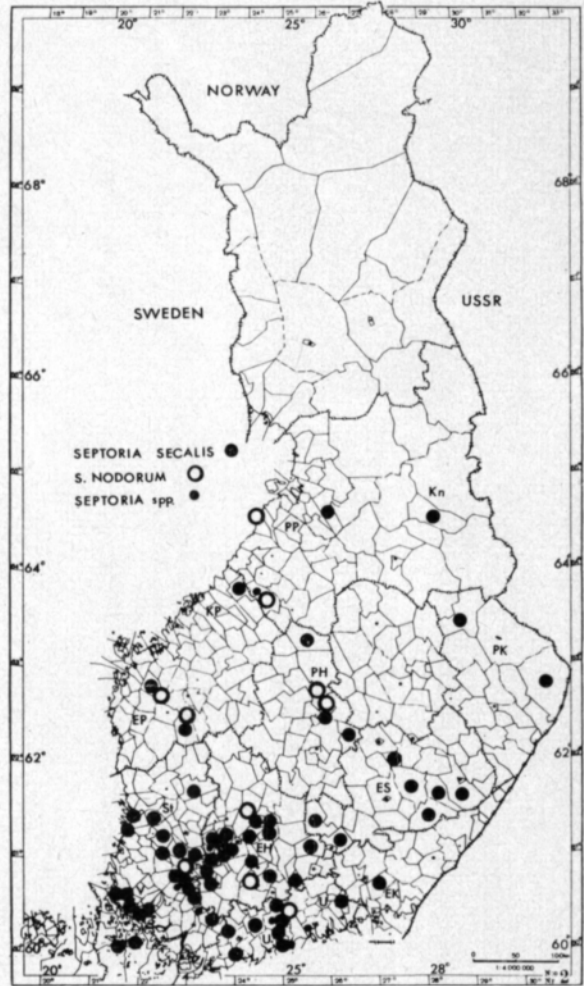


Fig. 8. The occurrence of *Septoria secalis* and *S. nodorum* on winter rye (*Secale cereale*) by localities in Finland in 1972 and 1973.

attacked other *Triticum* species, rye (*Secale cereale* L.) (WEBER 1922 b, SPRAGUE 1950) and various species of gramineae (GROVE 1935, WILLIAMS and JONES 1973).

In this study *S. tritici* occurred only on winter wheat, being common, particularly in 1973 (Table 1), in the south—western parts of Finland, where most of the winter wheat is grown (Table 2, Fig. 10). The fungus was encountered in 38 % of the fields (259 fields) studied. The localities are as follows:

- V: Halikko, Kaarina, Karinainen, Karjala, Kiikala, Koski Tl, Laitila, Lohja mlk., Masku, Muurla, Mynämäki, Nummi, Paimio, Perniö, Piikkiö, Pohja, Suomensjärvi, Tenhola;
- U: Inkoo, Kirrkonummi, Snappertuna, Tuusula;
- St: Loimaa mlk., Mellilä, Oripää, Yläne;
- EH: Hattula, Humppila, Iitti, Jokioinen, Pälkäne, Somero, Ypäjä;
- KP: Paavola.

Pycnidia of *S. tritici* were found abundantly only in the spring (May-early August), on brown — greyish brown — yellowish brown leaf spots (Fig. 9).

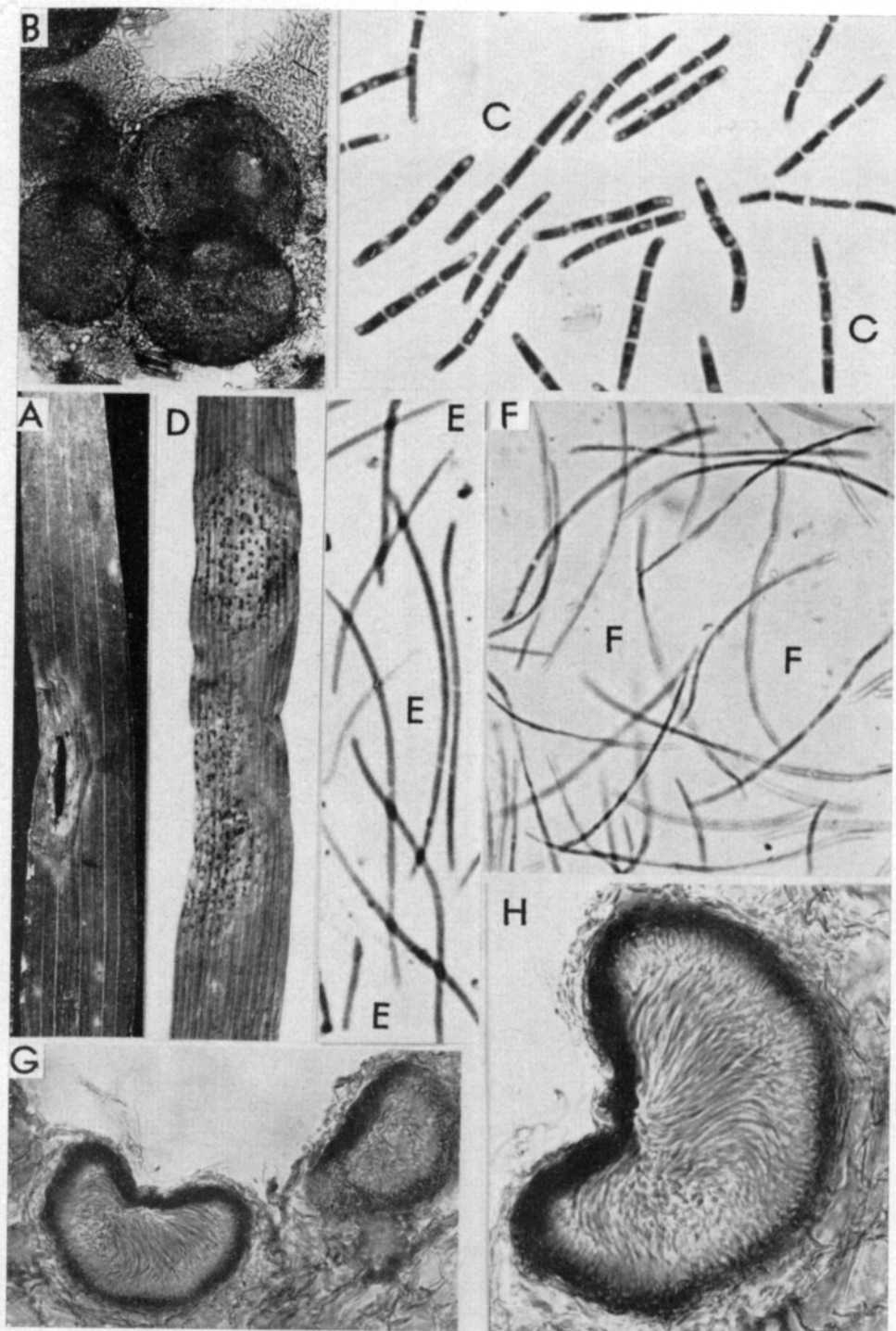


Fig. 9. A—C: *Septoria secalis* on winter rye, D—H: *S. tritici* on winter wheat. A, D: the brown lesions with black pycnidia in the leaves, $\times 2$; B, G, H: pycnidia in the leaves, B, G $\times 200$, H $\times 400$; C, E, F: pycnosporangia, C, F $\times 750$, E $\times 1\,000$.

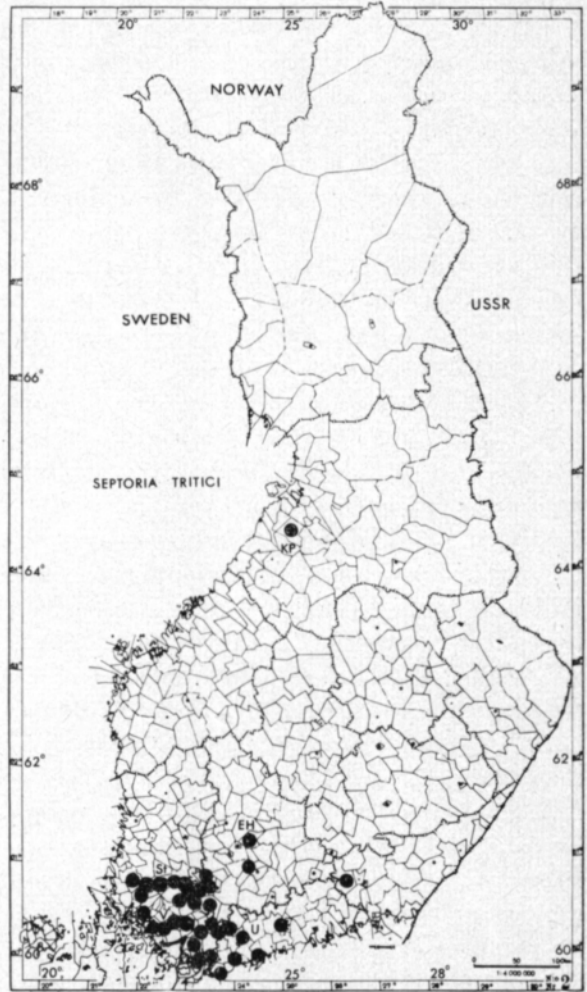


Fig. 10. The occurrence of *Septoria tritici* on winter wheat (*Triticum aestivum*) by localities in Finland in 1972 and 1973.

Pycnidia were blackish brown flattened, measuring (62) 117×129 (204) μ in diam. (Figs. 6 and 9). Macroconidia were obclavate — filiform, slightly curved, $24-80 \times 1-3 \mu$, 1-6-septa, mostly $55.5 \times 2.0 \mu$ 3.2-septa (Figs. 6 and 9) (cf. JØRSTAD 1967).

Discussion

This study is based on samples of cereals gathered during three growing seasons (1971-1973), except for wheat and rye samples, which were only gathered during two growing seasons (1972-1973). The weather during the growing seasons of 1972 and 1973 was exceptionally warm and there was less precipitation than normal although rainfall varied greatly in different parts of the country (cf. p. 221). On the other hand it is known that epiphytotics of *Septoria* species have often occurred, particularly under moist and rainy conditions (HOPP 1957, BLOCK 1959, MÜLLER 1963, SCHAREN 1964, JØRSTAD 1967, BRÖNNIMAN 1968).

In any event this study has clarified the interrelationships of *Septoria* species on different cereals as well as their relation to other pathogens causing leaf-spot diseases, such as *Helminthosporium* species and *Rhynchosporium secalis* (Oud.) J. J. Davis (cf. MÄKELÄ 1974, 1975).

Septoria species occurred most commonly on wheat and two-rowed barley, which are primarily cultivated in southern and southwestern Finland. It was in this area that the fungi were observed to thrive. On the other hand, on six-rowed barley, too, *Septoria* species were more common in southwestern Finland than in Ostrobothnia. The reverse held for the *Helminthosporium* species, which in the same samples of cereals were observed to be most abundant in Ostrobothnia (cf. MÄKELÄ 1975).

Septoria nodorum occurred on wheat, particularly as a foliar parasite. In some cases it was observed to affect the ears of spring wheat so severely that the field turned a dark grey colour (St: Vampula, Aug., 1973). Likewise *S. nodorum* was found to occur according to the author very common and abundantly on ears of winter and spring wheat in many fields located in southwestern Finland in the exceptional rainy growing season 1974. The significance of the fungus in causing glume blotch of wheat can hardly be as large in Finland as it is in other countries (cf. HOPP 1957, HEWETT 1965, JØRSTAD 1967, BRÖNNIMANN 1968, RICHARDSON and NOBLE 1970). This is simply due to the small area in which wheat is cultivated. Of Finland's total field area (2 665 000 hectares), spring wheat occupies less than five per cent and winter wheat less than two per cent. The fungus also occurred on barley, particularly on two-rowed varieties (cf. JØRSTAD 1967) but is apparently of little significance, as has been observed in other countries (HANSEN and MAGNUS 1969, RICHARDSON 1972). According to SMEDEGÅD—PETERSEN (1974), the fungus is an important pathogen on barley in Denmark.

The present study showed that *S. nodorum* occurred rather commonly not only on cereals but also on numerous cultivated and wild grasses (cf. MÄKELÄ 1972 a). This confirms that *S. nodorum* occurs commonly in Finland. In other countries has also been known the occurrence of the species on grasses (SPRAGUE 1950, HOPP 1957, JØRSTAD 1967, TETEREVNIKOVA—BABAYAN and BOKHYAN 1970, WILLIAMS and JONES 1973). The fungus is regarded as being a very weakly specialised species (WEBER 1922 b, HOPP 1957, BRÖNNIMANN 1968). This opinion is supported by the laboratory inoculation tests performed in this study, in which isolates of *S. nodorum* originating from different cereals infected not only their own host but also all other cereals except oats (cf. HOLMES and COLHOUN 1970). This conclusion runs counter to the results obtained by SMEDEGÅRD—PETERSEN (1974).

Septoria tritici occurred exclusively on winter wheat, especially in the spring of 1973, and caused severe seedling-leaf mortality. Similar observations have been made elsewhere (SANDERSON 1964, JØRSTAD 1967, RICHARDSON and NOBLE 1970). The fungus is held to be strictly a foliar parasite, though it is capable of infecting all parts of the plant (JONES and COOKE 1971). In the field, however, the fungus was not observed on spring wheat, on which it is known to occur in, for example, Britain (JONES and ODEBUNMI 1971, WILLIAMS and JONES 1972, 1973), nor was it observed on rye (cf. WEBER 1922 b,

SPRAGUE 1950). In the laboratory inoculation tests, however, isolates of *S. tritici* originating from winter wheat infected not only their own host but also spring wheat and rye.

Septoria avenae f. sp. *triticea* occurred rather commonly on wheat and barley. The fungus is apparently a pathogen of minor importance in Finland for it is considered to be a weak parasite (JOHNSON 1947, SHAW 1957 b). Similarly, on wheat it is considered to be of far less significance than *S. nodorum* (KIETREIBER 1962).

This study has shown that besides occurring on cereals, *S. avenae* f. sp. *triticea* is also found on numerous grass species, apparently as a saprophyte (cf. JOHNSON 1947, SPRAGUE 1950).

Septoria avenae f. sp. *avenae* is of quite negligible importance on oats owing to its sporadic occurrence. Similarly, *S. secalis*, which occurs to some extent on rye, is generally considered to be economically insignificant (WEBER 1923, JØRSTAD 1930, FRANDSEN 1943).

The perfect stage (*Leptosphaeria avenaris* and *L. nodorum*) were found on all cereals and on numerous grasses, as were the corresponding *Septoria* species. The present study did not clarify the role these play in the surviving and transmission of fungi. In other countries there is also knowledge about the occurrence of the same *Septoria* species on cereals and grasses (WEBER 1922 b, SPRAGUE 1950, JØRSTAD 1967, TETEREVNIKOVA—BABAYN and BOKHYAN 1970, WILLIAMS and JONES 1973).

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SELOSTUS

Septoria-sienien esiintymisestä viljakasvustoissa vuosina 1971—1973.

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Tutkimuksessa selvitettiin *Septoria*-lajien levinneisyyttä ja merkitystä viljoilla. Tulokset perustuvat pääosin kasvukausina 1971—1973 kautta maan 315 paikkakunnalta, etupäässä viljelijäin pelloilta kerättyihin 2 040 viljanäytteeseen.

Kaikki näytteet tutkittiin silmävaraisesti ja mikroskooppisesti. Sienet mitattiin ja valokuvattiin, osa niistä viljeltiin keinoalustalla sekä tehtiin saastutuskokeita laboratorio-oloissa.

Septoria-lajeja esiintyi kaikilla viljoilla, yleisimpänä vehnällä ja 2-tahoisella ohralla, jossain määrin rukiilla, harvinaisena monitahoisella ohralla ja kauralla.

Septoria-lajeja esiintyi runsaimmin maan lounais- ja eteläosissa; Varsinais-Suomessa, Uudella maalla, Satakunnassa ja Etelä-Hämeessä. Sensijaan niitä oli erittäin vähän Pohjanmaalla ja maan pohjoisosissa tuskin lainkaan.

Septoria nodorum (Berk.) Berk. & Br. esiintyi yleisimpänä lajina sekä kevät- että syysvehnällä ja melko yleisenä 2-tahoisella ohralla. Sientä todettiin n. 1/3:ssa tutkituista pelloista ja vehnällä n. 60—70 %:ssa sekä ohralla n. 40 %:ssa paikkakunnista. Sensijaan monitahoisella ohralla ja rukiilla *S. nodorum* esiintyi harvinaisena, 2—4 %:ssa tutkituista pelloista ja n. 6—10 %:ssa paikkakunnista. Kauralla ei sientä varmuudella todettu lainkaan.

Myös *S. nodorum*in eri viljoista eristetyt kannat, joita tutkittiin laboratorio-oloissa, saastuttivat isäntäkasvinsa lisäksi kaikkia muitakin viljalajeja, kauraa lukuunottamatta.

Sienen suvullinen aste, *Leptosphaeria nodorum* Müller, tavattiin muutaman kerran kevätevehnällä, ohralla ja rukiilla.

Septoria avenae Frank, f. sp. *triticea* T. Johanson esiintyi yleisimpänä 2-tahoisella ohralla, n. 1/3:ssa ja vehnällä vaajaassa 1/4:ssa tutkituista pelloista ja kummallakin n. 35–45 %:ssa paikkakunnista. Rukiilla ja kauralla ei sientä todettu lainkaan.

Sienen suvullinen aste, *Leptosphaeria avenaria* Weber f. sp. *triticea* T. Johnson tavattiin muutaman kerran kevätevehnällä ja ohralla.

Septoria avenae Frank f. sp. *avenae* Shaw esiintyi vain kauralla harvinaisena, n. 3 %:ssa tutkituista pelloista ja vajaassa 10 %:ssa paikkakunnista. Sienen suvullinen aste, *L. avenaria* Weber f. sp. *avenaria* Shaw, löytyi myös kauralta muutaman kerran.

Septoria tritici Rob. ex Desm. todettiin vain syysvehnällä n. 40 %:ssa tutkituista pelloista ja n. 1/2:ssa paikkakunnista. Sientä esiintyi vain keväällä, joskus hyvinkin runsaana ja lehdistöä tuhoavana. Sieni saastutti laboratorio-oloissa syysvehän lisäksi jonkin verran kevätevehnää ja ruista.

Septoria sesalis Prill. & Delacr. esiintyi vain rukiilla melko yleisenä n. 1/4:ssa tutkituista pelloista ja n. 1/2:ssa paikkakunnista.

Septoria-lajien esiintymisessä oli tiettyä yhdenmukaisuutta eri vuosina. Vain syysvehnällä ja rukiilla esiintyi eräitä *Septoria*-lajeja vähemmän v. 1973 kuin v. 1972. Tähän on ilmeisesti syynä kesän 1973 poikkeuksellisen aikainen ja nopea tuleentuminen kuumuuden ja kuivuuden seurauksena.

Septoria-sienten aiheuttamien tautien vaikutus satoon jää selvittämättä tässä tutkimuksessa. *S. tritici*tä lukuunottamatta nämä sienet esiintyivät vasta viljan tuleentumisvaiheessa yhdessä muiden sienten kuten *Helminthosporium*-, ruoste- ja härmäsienten kanssa. Lisäksi saattoi useita *Septoria*-lajeja esiintyä viljassa samanaikaisesti. On ilmeistä, että *Septoria*-sienten merkitys meillä jää vähäisemmäksi kuin monissa muissa maissa jo yksistään siitä syystä, että niiden tärkeimmän isäntäkasvin vehnän viljelyala on verraten pieni.

Monien *Septoria*-lajien, kuten *S. nodorum*, *S. tritici* ja *S. avenae* f. sp. *triticeae* tiedetään säilyvän talven yli viljan sängessä ja kasvijätteissä, ilmeisesti myös heinissä. *S. nodorum* leviää myös siemenen mukana. Millä tavoin viljojen *Septoria*-sienet meidän oloissamme säilyvät ja leviävät ja mikä osuus siinä on suvullisella *Leptosphaeria*-asteella ja heinillä, jää avoimeksi tässä tutkimuksessa.