SPOT BLOTCH OF BARLEY

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In 1975, *Cochliobolus sativus*, a seed or soil-borne pathogen of barley was found on certified barley seed from the North Island and northern South Island. The infection level averaged 2.4% but ranged from 0.1% to 19.6%. Tests indicated that the seed-borne inoculum had little effect on germination and that seed treatments with thiram, carboxin-thiram, or carboxin effectively controlled the seed-borne phase.

INTRODUCTION

Cochliobolus sativus (conidial state *Drechslera sorokiniana* syn. *Helminthosporium sativum*) has many graminaceous hosts, but is most important as a pathogen of wheat and barley. It may attack all parts of the host plant, producing symptoms which include pre- and post-emergence seedling blight, foot rot, basal browning, leaf spotting (spot blotch), and head blight. Symptoms vary according to the climatic conditions; in the U.S.A., seedling and crown damage occur in relatively dry hot areas, but abundant infection of all tissues occurs in warm humid regions (Dickson 1956). The fungus may be either seed or soil-borne.

OCCURRENCE

C. sativus has been recorded in all the major cereal growing areas of the world, but is regarded as a more important pathogen in North America than it is in Europe and Britain. However, recent surveys (Jorgensen 1974; Hewett 1975), have shown that the fungus which was once rarely found, is now common on seed in Europe.

In New Zealand, *C. sativus* has been found on seed of wheat and barley (Matthews pers comm), and oats (Sheridan 1975). During 1975,

TABLE 1: INFECTION LEVEL OF *C. SATIVUS* IN CERTIFIED 'ZEPHYR' AND 'CARLSBERG' BARLEY LINES (1974-75 SEASON)

Area	No. Lines tested*	% Lines infected	Mean % seeds infected
Manawatu	44	32	3.4
Wairarapa	13	23	2.0
Hawke's Bay	10	80	19.6
Marlborough/Nelson	8	25	8.5
Canterbury	85	0	0.0
North Otago	14	7	0.1
Southland	13	0	0.0
North Island	67	37	5.5
South Island	120	3	0.5
New Zealand	187	15	2.4

* All seed tested by the standard blotter method.

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a survey of seed from all certified 'Zephyr' and 'Carlsberg' barley crops from the 1974/75 season was carried out at the Seed Testing Station. The level of infection by *C. sativus* is shown in Table 1.

In North America, *C. sativus* can be isolated consistently from the soil where cereals are typically grown, and conidia which can survive the winter on stubble and in the surface soil are considered the source of primary infection of wheat seedlings (Sallans 1965).

SYMPTOMS

In the seedling phase of the disease, dry dark-brown to black lesions usually occur first on the coleoptile and progress inwards (Dickson 1956). Seedling leaves of infected plants are dark green, with lesions near the soil-line which may extend into the leaf blade. Crown rot develops at or below the soil surface. Cortical and leaf-sheath tissues are lesioned, tiller buds are blighted, and the crown-root system is invaded.

Seedling and crown infection occur from seed-borne mycelium or from crop residue in the soil, over a temperature range of 8-28° C, with a minimum rate of development at about 20° C.

Leaf and stem lesions develop rapidly at 24-28° C with maximum severity at 25° C (Clark and Dickson 1958). Lesions are round to oblong, dark brown in the centre, fading out gradually into the normal green tissue, 0.5-3 mm wide, and 3-20 mm long (Sheridan 1975). The spots coalesce to form blotches that may cover large areas of leaf blade. Heavily infected leaves dry out and mature early. Lesions on floral bracts and grains range from small black spots to dark-brown discolouration of the surface, especially in the region of the embryo and groove. Invasion of floral parts may result in sterility and grain shrivelling (Mead 1942).

ECONOMIC IMPORTANCE

C. sativus has long been regarded as a serious pathogen of cereals in North America (Dickson 1956), with losses of 12-40% being recorded. More recently, Harper and Piening (1974) estimated a 6% yield loss in the Alberta barley crop due to *C. sativus*. Soil-borne inoculum is considered the primary inoculum source and little importance is attached to seed-borne inoculum. Clark and Wallen (1969) found that seed infection caused a considerable reduction in seedling emergence, but this reduction had to be greater than 50% before there was any effect on yield. In Denmark, however, Jorgensen (1974) found that the level of seed infection had little effect on emergence, and Tables 2 and 3 suggest that this may also be the case in New Zealand.

TABLE 2: EFFECT OF SEED-BORNE *C. SATIVUS* ON
LABORATORY GERMINATION OF 'ZEPHYR' BARLEY

% seed-borne <i>C. sativus</i>	2	6	18	22	46	70	74
% laboratory germination	98	97	97	90	96	95	94

de Tempe (1958) found that mercurial seed treatment improved both emergence and yield (plant weight) over that of untreated seed, but concluded that the effect of *C. sativus* in seed barley was not of great importance even when infection levels were high. However, Mead (1942) found that plants grown from *Ceresan'-treated infected seed outyielded those from untreated infected seed by 50% when there was strong competition for moisture.

TABLE 3: EFFECT OF TREATMENT OF BARLEY SEED,
cv 'ZEPHYR' ON EMERGENCE AND SEEDLING DISEASE
LEVEL IN GLASSHOUSE AND FIELD

Seed* treatment (0.4% ai)	Glasshouse (20 days after planting)		Field (30 days after planting)	
	% Emergence	Disease score	Emergence (plants/m)	Disease score
untreated	92	4.3	34.8	1.8
carboxin thiram 1 : 1	90	0.5	32.6	0.1
thiram	90	0.6	34.8	0.2
captan	93	3.8	31.2	1.3
carboxin	86	2.6	29.2	0.7
LSD 1%	NS	0.84	NS	0.56
CV %	21.7	29.8	18.0	37.6

* Seed carried 66% *C. sativus*.

In New Zealand, little is known about the effects of *C. sativus* on barley yield. During 1975-76, a seed treatment trial used seed infected with 66% *C. sativus* and showed that thiram, carboxin, and carboxin/thiram 1:1, applied as slurry seed treatments at 0.4% a.i. provided good control of the seedling phase of this disease (Table 3). The latter two outyielded untreated plots by 9%, but this was not significant. However, applying sprays of mancozeb at growth stage 4, carboxin at growth stage 7 and mancozeb at growth stage 10, all at 2.2 kg/ha, reduced the amount of spot blotch infection which appeared on stems and leaves at growth stage 10 and increased yield by 20%, which was significantly different ($P = 0.01$) from that of the unsprayed plots. Further work to establish the effect of *C. sativus* on barley yields in New Zealand is proceeding.

CONTROLS

Crop rotation may decrease the risk of crop losses but when soil contamination occurs, climatic conditions rather than crop sequence or cultural practices determine the incidence of the disease (Western 1971). Seed treatments with mercurial fungicides have given good control of the seed-borne phase of the disease. Treatments based on captan are not effective (Spencer and Sheridan 1976) but these authors have shown that seed dressings based on the systemic fungicide carboxin effectively controlled *C. sativus*, and Table 3 shows that thiram is also effective. Dickson (1956), considered that resistant varieties may well provide the best method for control of this pathogen.

REFERENCES

- Clark, R. V., and Dickson, J. G., 1958. The influence of temperature on disease development in barley infected by *Helminthosporium sativum*. *Phytopath* 48: 305-310.
- Clark, R. V., and Wallen, V. R., 1969. Seed infection of barley by *Cochliobolus sativus* and its influence on yield. *Can. Plant Dis. Surv.* 49:
- Dickson, J. G., 1956. Diseases of field crops. McGraw-Hill Book Co. Inc., New York. pp. 517.
- Harper, F. R., and Piening, L. J., 1974. Barley diseases in south and central Alberta in 1971: distribution, severity, and yield losses. *Can. Plant Dis. Surv.* 54: 1-5.

* Mercurial seed dressing.

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- Hewett, P. D., 1975. A health survey of seed barley. *Pl. Path.* 24 : 229 - 232.
- Jorgensen, J., 1974. Occurrence and importance of seed-borne inoculum of *Cochliobolus sativus* on barley seed in Denmark. *Acta Agriculturae Scandinavica* 24 : 49 - 54.
- Mead, H. W., 1942. Environmental relationships in a seed-borne disease of barley caused by *Helminthosporium sativum*. *Can. J. Res.*, C 20 : 525 - 538.
- Sallans, B. J., 1965. Root rots of cereals. III *Bot. Rev.* 31 : 505 - 536.
- Sheridan, J. E., 1975. *Helminthosporium* diseases of cereals and their control. In *Cereal seed diseases and their control*, R. C. Close, Ed., Lincoln College.
- Spencer, M. M., and Sheridan, J. E., 1976. Results of trials for the control of *Helminthosporium* diseases and smuts of oats and barley in the 1975 - 76 season. Report No. 2, Botany Department, Victoria University. pp. 16.
- Tempe, J. de, 1958. Three years of field experiments on seed-borne diseases and seed treatment of cereals. *Proc. Int. Seed Test. Ass.* 23 : 38 - 67.
- Western, J. H., 1971. Diseases of crop plants. Macmillan Press Ltd, London. pp. 404.