STRIPE RUST OF WHEAT: SYMPTOMS, EPIDEMIOLOGY AND HOST RANGE IN NEW ZEALAND

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SUMMARY

Stripe rust of wheat was first located in New Zealand in Southland in November 1980. From there, it has spread throughout the South Island and into the North Island. The symptoms on seedlings differ from those on mature leaves. Symptoms on the ears are also characteristic, and grain harvested from heavily infected crops was pinched. Overwintering was by urediniospores on volunteer wheat and latent period was influenced by mean temperatures. The race in New Zealand is 104E 137, the same as that in Australia. Other hosts are listed. The disease is providing wheat growers with a challenge to overcome a further constraint to production.

INTRODUCTION

Stripe rust (also known as yellow rust) is caused by the fungus *Puccinia striiformis*. It is reported to be the most serious rust of wheat in N.W. Europe, temperate South America and North American wheat growing areas, Kenya, China and some areas of the Middle East. The disease first appeared in New Zealand in November, 1980, in an autumn-sown wheat crop at Otama, near Gore in Southland. In that growing season, it spread throughout Southland, requiring fungicide spray treatment. By the end of that season, it had spread to Canterbury, but too late to be of any consequence. In the 1981-82 season, the disease became widespread on wheat crops throughout Canterbury and Southland and spread to Marlborough and the Manawatu. It was immediately recognized that there was a potential for considerable yield loss in the susceptible cultivars in Southland and Canterbury, and growers quickly responded to advice to apply control measures.

Estimates from overseas work indicate that in an epidemic year, 5-15% loss of production can occur overall from the rust, and in individual paddocks, up to 50% loss in susceptible cultivars (Manners 1971).

The disease probably spread by air currents from Australia, where it was reported in October, 1979. Even though the urediniospores that spread the disease are said to be relatively short lived because of their susceptibility to ultraviolet light (Maddison and Manners 1972) the spores probably spread in dense cyclonic cloud and during long winter or early spring nights.

SYMPTOMS

Stripe rust has a range of symptoms, depending on the age of the infected leaf, the inoculum pressure and the susceptibility of the cultivar. On seedlings (Fig. 1), the rust forms large areas of powdery, bright yellow to yellow-orange pustules (uredinia), which extend completely across the width of the seedling leaf blade. Just prior to sporulation, irregular yellow blotching of leaves is often evident. Spore formation on seedling leaves can be so abundant that when leaves are lifted off the soil, yellow powdery deposits of spores often remain on the area where the leaf rested. Infected leaves eventually wither and die.

On older plants, yellow-orange pustules develop in long pale green to yellow stripes (Fig. 1) on the leaves. Within the stripes, yellow pustules (uredinia) develop producing wind-disseminated urediniospores. On some cultivars (e.g. Hilgendorf) the pustules

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Stripe rust symptoms on flag leaves of a susceptible cultivar.

Elongated pustules (uredinia) of *Puccinia striiformis*.

Symptoms on seedling leaves.

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Severe damage on a susceptible cultivar in the field.

Flecking reaction on mature leaves of a resistant cultivar.

develop in blotches or flecks. In more resistant cultivars such as Kopara and Oroua, necrotic or chlorotic flecking appears with little or no sporulation.

Stripe rust can attack the developing wheat ear, producing necrosis of the glumes. Within the glumes, masses of bright yellow urediniospores are produced. Early and severe leaf infection reduces root and floret development and causes leaf death and stunting. Such plants cannot withstand late season drought conditions and this together with late infections of upper leaves and glumes can lead to shrivelled grain, and hence reduced grain weight.

EPIDEMIOLOGY IN CANTERBURY AND SOUTHLAND 1981-82

Stripe rust could be found sporulating on volunteer wheat plants from the previous season during June 1981 in Canterbury and during September 1981 in Southland. This was about one month before infection was found in the new season's crops in each region. Autumn-sown crops of susceptible cultivars in Canterbury were found to be infected from late July onwards, but there was no marked increase in incidence within fields until early September, after which it began to spread and the epidemic began to develop rapidly. Cool winter temperatures appeared to delay stripe rust development, markedly during August.

The activity of stripe rust in infected wheat plants, as measured by latent period (time from spore deposition on a leaf to rupturing of new pustules full of spores i.e. one uredinial cycle), is governed by mean air temperatures (Zadoks 1971). During August in Canterbury with mean air temperatures of 4-5°C, the latent period was greatly extended (30-40 days) and this slowed the rate of spread. As temperatures increased during September and October the latent period became rapidly shorter and reached its minimum (12-14 days) between late November and early March when mean temperatures were 16-18°C.

The rapid development of stripe rust in Canterbury began in early to mid-October with the epidemic increasing in intensity until mid-December. However, spraying of crops started from early August, when some farmers acted at the first sign of the disease.

In Southland with spring sowing, the crops did not emerge until mean air temperatures were 10-12°C (latent period 16-18 days), and as a result there was generally not the long delay, which occurred in Canterbury, between first appearance of disease in crops and substantial increases in intensity. First infections appeared in middle to late November and the epidemic developed during December and January, about one month later than in Canterbury.

Overseas, the prevailing summer weather conditions are reported to have a profound influence on the stripe rust epidemic in the following winter, spring and summer (Rapilly 1979). If mean air temperatures are above 30°C for long periods, the urediniospores and the fungus in the lesions on the leaves are inactivated. Thus, little inoculum carries over into the autumn-winter period to infect volunteer plants. Mild, or moist summers favour the pathogen and inoculum is readily carried through for the next season. In Canterbury and Southland, even though temperatures can reach, at times, over 30°C, they are probably never sustained for a sufficient period of time to produce the high mean temperatures that can cause reduction in inoculum.

The teliospore stage of the stripe rust is readily found on infected glumes in New Zealand, but not so readily on leaves. However, this spore stage is not known to play any part in the life cycle of the disease (Fig. 1).

RACES AND HOST RANGE

The race of stripe rust present in New Zealand is 104E 137 (R.A. McIntosh, University of Sydney, pers comm) the same as that occurring in Australia. This race is widespread in Europe. More than 60 races of wheat stripe rust are known throughout the world, and the Asian, African and American races are different to that in New Zealand and Australia. This suggests that stripe rust came to Australia from Europe by human agencies.

Many samples of stripe rust on a range of hosts have been sent from New Zealand to the University of Sydney for race analysis. One cultivar of barley commonly grown in New Zealand (cv. Magnum) was found to be infected in the seedling stage and proved to be attacked by the same race as that on wheat. The disease never developed in infected barley crops past the seedling stage and no control measures were required. Some other barley cultivars in a nursery observation plot at DSIR also proved to be susceptible.

Stripe rust can attack a wide range of grasses, and the host range of these and the role that they play in the life cycle of the disease on wheat in Australia and New Zealand is still being investigated. Stripe rust on cocksfoot (*Dactylis glomerata*) has been in New Zealand for some years (Latch 1976) caused by a separate *forma specialis* of the fungus that does not attack wheat.

The arrival of stripe rust in New Zealand has provided another facet to wheat growing, and has heightened the awareness of advisers and growers to the losses in production that can be caused by disease attack. The control of the disease by the wide application of fungicide has undoubtedly led to the control of other diseases such as leaf rust, mildew, and speckled leaf blotch, which may all reduce yields in certain instances.

Stripe rust, if left unattended, would devastate the susceptible cultivars which make up the bulk of the wheat grown in New Zealand. However, the availability of effective fungicides, the advisory efforts of MAF field officers, plant pathologists and merchant representatives, and the increase in farmer interest of making wheat growing a more profitable exercise, have all led to the control of stripe rust being integrated into the wheat growing programme without a marked reduction in national yield.

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