NECROTIC RING SPOT RESEARCH IN MICHIGAN

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Patch symptoms on Kentucky bluegrass were first reported in the late 1950's in many eastern states. This coincided with the time that "improved" Kentucky bluegrass cultivars began to be used. During the 60's the disease was epiphytotic in these bluegrass stands, and intensive study led to the incitants being names as Fusarium roseum and F. tricinctum, a diagnosis based primarily on the abundant presence of these organisms on dying grass tillers, as well as their induction of a foliar blighting in controlled experiments. Although Koch's postulates were never completed since the characteristic patch symptom was never reproduced on mature turf, the original hypothesis was generally accepted, and the name Fusarium blight has since been associated with the patch or "frogeye" symptom on Kentucky bluegrass. Though Leptosphaeria korrae has been proven to be a cause of patch symptoms of Poa pratensis in Michigan and several other states, the interactions of this pathogen with other biotic and abiotic factors in both the cause and the disappearance of this disease should not be ignored.

L. korrae was identified as an incitant of patch disease symptoms of Kentucky bluegrass in Michigan. This fungal pathogen has previously been reported in other eastern, northwestern, and mid-western states as the cause of necrotic ring spot of Kentucky bluegrass (Smiley 1984, Chastagner 1984a, 1984b, Jackson 1984, Worf and Stewart 1986). It has also been cited recently as an incitant of spring dead spot of Bermudagrasses in the south western U.S. (Endo et al., 1984). This is the first confirmed report of L. korrae in Michigan.

Symptoms of necrotic ring spot in Michigan include development of circular to irregular patches of grass, 0.1 to 1 meter in diameter, first wilted, then turning straw colored, often with reddened leaf blades interspersed. In some locations, disease may appear as a dead ring of grass with apparently healthy grass in the center. Roots and crowns of infected plants observed under a dissecting microscope show the presence of dark, ectotrophic runner hyphae. Under a compound microscope angular-celled, plate like hyphopodia and infection pegs, characteristic of L. korrae may be seen. Infection pegs penetrate the cortex of the roots and in severe infections, root and crown vascular discoloration may be observed.

The Michigan isolates resembled L. korrae in cultural characteristics and temperature-growth relations. Pseudothecia (fungal fruiting bodies), were induced on stems and roots of Kentucky bluegrass infected with three Michigan isolates. Ascospore measurements compared favorably with values cited by other researchers (Chastagner et al. 1984a, Smiley 1984, Worf and Stewart 1986, Walker and Smith 1972).

Pathogenicity of the Michigan isolates on Kentucky bluegrass was proven in the growth chamber, greenhouse and in the field. Inoculations incited root necrosis and wilting and death of the leaf tissue. Patch symptoms were induced under field conditions. Reddening of leaf tissue was also occasionally observed in growth chamber, greenhouse,and field inoculations.

Identification of three Michigan isolates as L. korrae was accomplished through cultural characteristics, temperature--growth relations, ascospore measurements, and pathogenicity studies.

Host range studies did not vary greatly from those of other researchers. Fyking Kentucky bluegrass proved highly susceptible followed closely by Adelphi Kentucky bluegrass. Adelphi has previously been reported as a fairly resistant bluegrass cultivar (Smiley and Craven Fowler 1985, Worf and Stewart 1986). Pennlawn red fescue, reportedly susceptible (Smiley and Craven Fowler 1985), reacted variably - from moderate to highly susceptible at both 20 and 28 C. Manhattan perennial ryegrass appeared to be of intermediate susceptibility. K-31 tall fescue, reportedly resistant, reacted variably, and Penncross creeping bentgrass, reportedly susceptible, appeared moderate to susceptible at both temperatures. The cultivar of Bermudagrass used was resistant although pseudothecia did develop on root tissue of these plants at 28 C.

From growth chamber studies and field observations it is clear that L. korrae can infect and cause symptoms over a wide range of temperatures. In addition, it was shown by field inoculations that this disease can be spread by turf/soil cores, a factor that should be considered when cultivation practices are used.

In 1986 a direct relationship was noted between soil moisture and necrotic ring spot symptoms on a site that had been artificially inoculated in 1985. During periods of prolonged high soil moisture, symptoms decreased dramatically, and increased again when soil dried. This coincides with the majority of reports in the literature which state drought stress as an important factor in predisposing turf to Fusarium blight.

Lab studies in which L. korrae was grown on agar into which fungicides were incorporated, compared well with the reports in the literature. Rubigan, Banner, Tersan 1991, Fungo 50, and Cleary's 3336 all were highly effective at inhibiting growth of L. korrae at all rates. Chipco 26019 and Vorlan provided about 50% inhibition of L. korrae's growth and Bayleton was ineffective.

In greenhouse bioassays Rubigan, Banner, Tersan 1991 and Chipco 26019 all gave some degree of control relative to the check when applied as drenches at .5 and 2 oz ai/M. In one study, however, pots that received fertilizer either as 10-4-4 solution or dry Lawn Restore (10-4-4 analysis) at a rate equivalent to 1 lb N/M ranked significantly better than all fungicides other than the low rate of Banner, indicating a potential for recuperation when plants are supplied with adequate balanced fertility.

Field studies over the past three years have not been successful in demonstrating chemical control of this disease. Studies conducted by Vargas and Detweiler in 1984, 1985, and 1986 (personal communication), have been unsuccessful due to lack of symptom development. At Dearborn in 1986 no significant differences were obtained among the fungicide treatments from factorial analysis of variance.

Field studies have indicated the importance of fertility in recuperation of necrotic ring spot diseased areas, and it appears that

proper balanced nutrition is especially important in encouraging new root growth and promoting a "disease escape mechanism" which allows the plants to escape serious damage even in the presence of the pathogen. In essence, because of the ectotrophic growth habit, the rate of root infection is relatively slow in comparison to new root growth in well fertilized areas. Increased root volume may permit the plant to overcome the effects of the pathogen in reducing water uptake and nutrient absorption. Three to four pounds of nitrogen per year should be adequate for most areas. P and K should also be applied based on soil tests.

Preliminary studies have shown two commercial fertilizers to be especially effective in causing turf recovery in diseased areas (Ross and Vargas, 1984). One of these products, Lawn Restore (Ringer Corp., Eden Prairie, MN), contains several species of dormant microorganisms said to be isolated from soils suppressive to plant disease. Cultures of four species of bacteria and two species of actinomycetes were tested separately and in mixed culture for antagonism to L. korrae on agar plates. It was found that when the bacteria were plated in mixed culture against L. korrae zones of inhibition were formed in most cases. Both actinomycete spp. showed antagonism to L. korrae on agar plates as well. These results warrant further investigation into the potential for biological control of this disease.

The other fertilizer tested, Green Magic (Agro-Chem Inc) is composed of plant by-products and soluble nitrogen and micronutrient sources. Part of the activity of this product is said to be due to the anti-biotic nature of some of its organic constituents. In lab tests, significantly less L. korrae growth was seen on agar amended with Green Magic at low to intermediate rates than with a nutrient solution prepared to simulate it. The activity of this product in field studies may be of a nutritional nature.

Significant progress has been made towards development of a management program for necrotic ring spot. Lab studies indicate that Lawn Restore and Green Magic may have activity in addition to nutritional to aid in the management of this disease. In addition, greenhouse and field studies have indicated the importance of nutrition in recovery of diseased areas. Soil moisture has also been shown to be an important factor in necrotic ring spot development. Thus, the biological and cultural control of necrotic ring spot deserves further investigation. Lab and greenhouse studies have indicated the potential of several anti-fungal chemicals in managing this disease, but adequate data from field tests are still needed.

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