SCLEROTINIA CROWN ROT OF FORAGE LEGUMES IN PRINCE EDWARD ISLAND[1]

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Abstract

Significant losses from sclerotinia crown rot caused by Sclerotinia trifoliorum Erikss. have been observed in forage legume stands in Prince Edward Island over the period, 1964 to 1966. Field and greenhouse tests showed that red clover was the most susceptible of the forage legumes studied. In greenhouse tests birdsfoot trefoil was the most resistant. Under conditions of natural infection in the field 'Ladino' white clover was the most resistant in broadcast populations and alfalfa in spaced populations. An isolate of S. sclerotiorum (Lib.) de Bary was less pathogenic than 3 isolates of S. trifoliorum. The role of S. trifoliorum infections in the persistence of forage legumes in Prince Edward Island is discussed.

Introduction

The longevity of perennial legumes used for forage has been of concern for many years. A number of the factors responsible for shortening the life span include 'winter-killing', diseases, improper nutrition, and poor management. 'Winter-killing' is a term used to describe the failure to survive from one growing season to another usually without making any attempt to explain the underlying cause or causes of death. Sclerotinia crown rot caused by Sclerotinia trifoliorum Erikss., is known to be a factor in the overwinter loss of red clover (1). Observations indicate that sclerotinia crown rot is an important factor in the 'winter-killing' of forage legumes in Prince Edward Island (4). This paper presents a further summation of these observations and the results of pathogenicity tests of Sclerotinia isolates on forage legumes.

Materials and methods

The areas examined for 'winter-killing' in the spring of 1964 were located on six distinct soil series (3). All fields had been seeded the previous year to a forage mixture which included red clover, alsike clover and timothy. In each field, 100 random square-foot areas were examined for the presence of red clover plants. The number of plants, both living and dead, was recorded and all dead plants were dissected and carefully examined for the presence of sclerotia. If sclerotia were found attached to, or embedded in, a dead plant it was assumed to have been infected with S. trifoliorum.

Data on 'winter-killing' in 1965 and 1966 were obtained from replicated field plots of 'Lasalle' red clover which had been established the previous year as part of a study of factors affecting root rot development. Data were also obtained from replicated field plots, representing both spaced and broadcast populations, of several forage legume species.

Artificial inoculations were carried out in the greenhouse. A modification of Kreitlow's (2) dried grain method of crown inoculation was used. A number of isolates of S. trifoliorum were used as well as one isolate of S. sclerotiorum which had been obtained from carrot.

Plants for artificial inoculation were grown in five-inch pots, 10 plants per pot, and inoculated at 8 weeks of age. All plants were held in a mist chamber at 60" to 65°F for 7 days following inoculation. The plants were then maintained on a greenhouse bench at the same temperature for a further 14-day incubation period after which individual plants were recorded as being healthy, infected or dead.

Table 1. Relationshin between 'winter-killed' red clover plants in mixed stands and dead plants infected with S. trifoliorum, winter of 1963-1964.

Soil Series[1]	Number of plants[2]	Dead plants 7'	Dead plants infected %
Dunstaffnage	5.0	4	64
Culloden	1.2	26	96
Alberry	3.8	15	46
Charlottetown	9.1	10	70
O'Leary	3.0	34	53
Queens	2.1	29	5

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1 Soil series arranged in order of texture from light (Dunstaffnage) to heavy (Queens).

2 Number of seedling red clover plants per square foot: 100 random one-foot squares counted.

Table 2. Relationship between 'winter-killed' plants of forage legume species and dead plants infected with S. trifoliorum, winter of 1965-1966.

Forage Legume and Variety[1]	Spaced populations[2] Dead plants %	Spaced populations[2] Dead plants infected %	Broadcast populations Density[3]	Broadcast populations Dead plants %	Broadcast populations Dead plants infected %
Red Clover 'Lasalle'	95.6	100	6.0	42	100
Alsike Clover commercial	98.4	95	13.5	22	100
White Clover 'Ladino'	78.4	98	16. 3	12	100
Alfalfa 'Vernal'	6. 3	100	6. 5	23	100
Birdsfoot Trefoil 'Empire'	68.0	69	5.5	27	100
'Viking'	76. 7	78			

[1] Seeded in the spring of 1965.

[2] 80 plants per variety 18 inches apart in rows 27 inches apart

[3] Mean number of plants per square foot.

Table 3. Pathogenicity of Sclerotinia trifoliorum on forage legumes species.

Species and Variety	Plants killed	Plants infected but not killed	Total
Red Clover Trifolium pratense L.			
'Lasalle'	80	20	100
'Kenland'	77	21	98
'Lakeland'	55	45	100
Alfalfa Medicago sativa L.			
'Vernal'	25	65	90
'Rhizoma'	52	37	89
Alsike Clover Trifolium hybridum L.			
commercial	29	54	83
White Clover Trifolium repens L.			
'Old Gold'	47	22	69
'Ladino'	19	66	85
Birdsfoot Trefoil Lotus corniculatus L.			
'Empire'	6	51	57
'Viking'	0	55	55

Table 4. Pathogenicity of Sclerotinia sclerotiorum and S. trifoliorum on forage legume species.

Species and Variety	Sclerotinia sclerotiorum	Sclerotinia trifoliorum 13-64	Sclerotinia trifoliorum C-65	Sclerotinia trifoliorum U-65
Red Clover Trifolium pratense L. 'Lasalle'	20[1]	96	96	96
Alsike Clover Trifolium hybridum L. commercial	6	30	58	66
White Clover Trifolium repens L. 'Ladino'	4	30	68	50
Alfalfa Medicago sativa L. 'Vernal'	24	80	90	86
Birdsfoot Trefoil Lotus corniculatus L. 'Empire'	4	14	14	20
'Viking'	4	16	8	18

[1] Percentage of plants infected, including those killed.

Results

The percentages of red clover plants which failed to survive the winter of 1963-1964 ranged from 4 to 34 (Table 1). The failure to survive did not appear to be related to the texture of the soil in which the plants had grown. The lowest percentages of dead plants were in the forage stands with the greatest density of red clover plants. The percentage of dead plants which had sclerotia associated with them varied from 5 to 96.

Forty-one percent of the plants in 'Lasalle' red clover plots failed to survive the winter of 1964-1965. All dead plants examined in the spring of 1965 were found to have sclerotia associated with them.

The data in Table 2 compare the failure to survive and Sclerotinia infections in a number of forage legume species both in spaced and broadcast populations except for 'Vernal' alfalfa. Sclerotia were associated with a lower proportion of the dead birdsfoot trefoil plants than with the other species. Even though a high proportion of the alfalfa plants survived, many of the survivors showed varying amounts of damage from Sclerotinia infections as evidenced by wilting and often death of part or all of the early growth. Sclerotia were associated with many of these infected plants. The percentages of dead plants among the broadcast populations were lower except for alfalfa. Sclerotia were associated with all dead plants examined.

The data presented in Table 3 show that forage legume species, when inoculated in the greenhouse, display varying degrees of susceptibility to attack by a mixture of isolates of S. trifoliorum. The red clover varieties were the most susceptible and the birdsfoot trefoil varieties the least.

An isolate of S. sclerotiorum was considerably less pathogenic to a number of forage species than S. trifoliorum isolates (Table 4). S. trifoliorum isolate 13-64 appeared to be less pathogenic to alsike and white clovers, otherwise no differences were apparent among the isolates of S. trifoliorum. The birdsfoot trefoil varieties again were less susceptible than the other species.

Discussion

Sclerotinia crown rot caused widespread losses in forage legumes in Prince Edward Island over the period from 1964 to 1966. The 3 winters and springs concerned were similar in aspects which favored the development of S. trifoliorum. Large areas of fields were observed with abundant and almost continuous snow cover which persisted into the spring period. These areas invariably had little or no frost in the ground and, therefore, provided environmental conditions suitable for activity by S. trifoliorum.

Sclerotia were observed associated with many plants which failed to survive the previous winter. Their presence suggests that infection with S. trifoliorum does not necessarily imply that the organism was solely responsible for the death of the plant. Many of the dead plants with which no sclerotia were associated may have been infected with S. trifoliorum, the infection being responsible, in part at least, for the ultimate death of the plants. Plants which apparently survived the winter, but which became infected to varying degrees by S. trifoliorum, would be less productive and have a shorter life expectancy than healthy plants. The surviving plants which are under stress because of infection by S. trifoliorum would be more readily attacked by other root-rotting organisms which in turn shorten life expectancy (5).

Field and greenhouse tests indicate that birdsfoot trefoil is less susceptible to S. trifoliorum than red clover, the most important forage legume grown in Prince Edward Island at the present time.

Sclerotinia crown rot, as a part of the root and crown rot complex of forage legumes, requires further investigation.

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