

Diseases of Alfalfa in Alabama

F. A. GRAY, Plant Pathologist-Nematologist, Alabama Cooperative Extension Service; R. L. HAALAND and E. M. CLARK, Associate Professors, Department of Agronomy and Soils and Departments of Botany, Plant Pathology and Microbiology, respectively; and D. M. BALL, Agronomist, Alabama Cooperative Extension Service, Auburn University, Auburn, AL 36830

ABSTRACT

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A 3-yr survey of fields in Alabama showed several diseases associated with declining stands of mature alfalfa (*Medicago sativa*). These include anthracnose (*Colletotrichum trifolii*), Sclerotinia crown and stem rot (*Sclerotinia trifoliorum*), Rhizoctonia crown rot (*Rhizoctonia solani*), summer black stem and leaf spot (*Cercospora medicaginis*), charcoal rot (*Macrophomina phaseolina*), and the alfalfa stem nematode (*Ditylenchus dipsaci*). Rust (*Uromyces striatus*) severely damaged a seedling stand of alfalfa. Rhizoctonia crown rot, charcoal rot, and the alfalfa stem nematode are reported from the state for the first time. Eleven of 15 isolates of *R. solani* from diseased alfalfa crowns were pathogenic on seedling alfalfa. Six additional fungi and eight nematodes also were associated with the alfalfa plant.

Alfalfa production in Alabama reached a peak of 2,000 ha in the early 1950s. With the introduction of the alfalfa weevil

Present address of senior author: Associate Professor, Plant Science Division, University of Wyoming, Laramie, WY 82071.

(*Hypera postica* Gyllenhal), however, acreage rapidly declined, and alfalfa production was essentially nonexistent by the late 1950s. The acreage planted in alfalfa has steadily increased since 1975 to a current estimated 1,200 ha, with more planned for production.

Alfalfa is attacked by at least 70 different pathogens of which approximately 30 are considered to limit its

growth and reproduction (11). Several brief reports of alfalfa diseases in Alabama were published before 1950 (15), but an extensive survey of diseases of alfalfa has never been done. The need for such a survey appeared to be particularly important since alfalfa was not grown for 15–20 yr and essentially represents a new crop for the state.

Economic control of alfalfa diseases is usually obtained through plant resistance (11). An alfalfa breeding program is under way at Auburn University. In addition, several private seed companies have expressed interest in the development of alfalfa cultivars specifically for the South. Identification and assessment of major diseases of alfalfa in the state would not only aid in making valid selections of available varieties but also provide vital information about the disease resistance that should be incorporated in cultivars developed for Alabama and adjacent areas.

The purpose of this paper is to update

the major diseases associated with alfalfa in Alabama and to report three new diseases not previously reported here. The pathogenicity of several isolates of *Rhizoctonia solani* from alfalfa is also reported. Preliminary reports have been published (9,10).

MATERIALS AND METHODS

Survey. Our 3-yr survey of alfalfa fields began 1977 August and ended 1979 September. Plants suspected of being diseased were placed in a moist chamber at 25 ± 3 C to induce fungal sporulation. Tissue isolations from diseased plants were made on both potato-dextrose agar (PDA) and water agar media. Before being placed on the media, tissue pieces were surface-disinfected for 3 min in a 0.5% solution of NaOCl, rinsed in sterile distilled water (SDW), and blotted on a sterile filter pad. Swollen stems and crown buds of plants with suspected alfalfa stem nematode infection were diced and submerged in SDW for 1 hr. Nematodes that emerged were then heat killed and fixed in lactophenol for microscopic observation.

Pathogenicity studies. For pathogenicity tests of several isolates of *Rhizoctonia solani* Kuehn, seeds of the cultivar Buffalo were placed in three shallow furrows (5 mm deep) in 10-cm plastic pots (10 seeds per furrow, 30 seeds per pot). A Norfolk sandy loam soil previously fumigated with methyl bromide was used in the test. Before the seeds were covered, 30 ml of either an aqueous mycelial suspension of one of 15 isolates of *R. solani* or SDW alone was placed in the furrow.

Inoculum was prepared by dicing 2-wk-old cultures of each *R. solani* isolate, placing them in 250 ml of SDW, and macerating the material in a Waring Blender. Cultures were grown for 2 wk at room temperature (22–27 C) on PDA. Treatments were replicated five times and placed in a randomized complete block design. After inoculation, pots were maintained in the glasshouse at 27 ± 3 C. Seedling death was determined after 14 days.

RESULTS AND DISCUSSION

Anthracnose caused by *Colletotrichum trifolii* Bain & Essary (1) was associated with declining stands of alfalfa throughout the state. Symptoms were similar to those previously described (7,11,13). The most common symptom we observed consisted of individual "flags" (white dead shoots) and tan, oval to diamond-shaped lesions on the lower portions of stems. Black acervuli containing single-celled, hyaline conidia, as described for *C. trifolii* (7), were usually within the lesion. The fungus was consistently isolated from the margins of stem lesions. Anthracnose appeared to be most prevalent during July and August.

Barnes et al (2) suggested that

anthracnose may be partially responsible for the summer unthriftness of alfalfa in the middle Atlantic and southeastern states. Our observations are in agreement with those of Barnes. Although the crown rot phase of the disease (7) was not identified, anthracnose appeared to be a contributing factor in the overall stand decline in many fields. Several cultivars including Liberty, WL-31, Gladiator, Vanguard, and Cimmaron are all reported to have resistance to anthracnose and have performed well in Auburn University forage yield trials. The use of these cultivars presently offers the best economical means of controlling this disease in the state.

Sclerotinia crown and stem rot caused by *Sclerotinia trifoliorum* Eriks (8) was observed on mature alfalfa plants in central and north Alabama. Stems as well as entire plants were killed. White fluffy mycelial mats of *S. trifoliorum* were observed on the crown and base of lower stems of affected plants. Black sclerotia $1-2 \times 4-5$ mm were embedded in the mycelial mat on the crown and stem surfaces (7). Linear shaped sclerotia ($0.5-1.0 \times 6-8$ mm) were occasionally observed inside stems, essentially replacing the pith tissue. The disease was particularly prevalent during the spring of 1978, which had a prolonged period of cool, wet weather that was optimum for development of *S. trifoliorum* (1). Damage from this disease should be expected to be severe during the mild, wet winters and cool wet springs that are common in Alabama.

Summer black stem and leaf spot caused by *Cercospora medicaginis* Ell. & Ev. (3) was found throughout the state. Blackening of lower stems was first noticed in July and increased in severity toward late summer and early fall (August and September). Leaf infections occurred throughout the growing season but were more evident from July to September. *C. medicaginis* was actively sporulating as late as 8 November 1979. The appearance and size of conidia and conidiophores on leaves agreed with those described by Graham et al (7).

Rhizoctonia crown rot caused by *R. solani* (14) was found throughout the state, particularly in stands 3 yr or older showing signs of decline. Symptoms ranged from partial rotting of crowns to dead plants. Roots of these plants appeared healthy. *R. solani* was frequently isolated from the margin of brownish discolored tissue that extended as far as 5 cm down into the crown of affected plants. The root canker, stem blight, and foliage blight phases of the disease (7) were not observed.

Eleven of the 15 isolates of *R. solani* from rotting crowns of alfalfa plants were pathogenic on seedling alfalfa. Seedling kill ranged from 42 to 100% after 14 days. A correlation between seedling damping-off and a cortical root rot of mature

alfalfa plants was reported in 1975 for *Phytophthora megasperma* (12) and in 1976 for *R. solani* on sugar beet (4). A similar association is expected with *R. solani* on alfalfa. However, an attempt to produce the crown rot phase with the pathogenic isolates was not attempted.

Alfalfa stem nematode (*Ditylenchus dipsaci* Kuhn & Filipjev) (6) was observed in a 3-yr-old stand of cv. Cody alfalfa in north Alabama during April 1979. Approximately one-half of the 40-acre field showed severe signs of stunting. The "white flagging" described by Evans et al (5) was observed on scattered plants in the field. Lower stems and crown buds of affected plants were stunted, swollen, and heavily wrinkled. Plant tissue contained large numbers of larvae and adults of *D. dipsaci*. By mid-July, when day time temperatures were 27–34 C, most plants appeared to have recovered. Although the stand did not appear to be severely injured, yield loss in the spring cutting most likely occurred. Because winters in Alabama are relatively mild and short, optimum environmental conditions for the development of *D. dipsaci* (7) exist for extended periods. Although the presence of this pest appears to be restricted at present, additional spread and damage should be anticipated, particularly in the north part of the state.

Rust caused by *Uromyces striatus* Schroet. was found in several stands of mature alfalfa in central and south Alabama. Pustules containing reddish brown masses of urediospores were abundant on leaves and occasionally found on petioles and upper portions of stems. Losses in these fields appeared to be slight. In April 1979, a 6-mo-old stand of cv. Gladiator alfalfa was found to be severely damaged with rust. More than one-half of the plants were dead and the remainder were severely infected with *U. striatus*. Rust has been reported to be primarily associated with mature plants and especially in seed production fields when harvest is delayed (7). Although rust was found on mature plants, it was most severe in Alabama on seedling alfalfa. Rust was first noticed in early April 1979, but infection may have occurred the previous fall. Since the field had not been previously planted with alfalfa, primary infection most likely could be attributed to windblown urediospores (7).

Charcoal rot caused by *Macrophomina phaseolina* Tassi (7) was found during July 1979 in one field in west central Alabama where plants were under extreme water stress. The field was in an area that received no summer rain, which obviously encouraged the development of the disease (7). The overall stand appeared unthrifty. Many plants were small and showed symptoms of dry rot. Portions of the lower root epidermis were partially sloughed off or entirely missing, exposing masses of black sclerotia of *M.*

phaseolina. When sclerotia were removed from the root surface and submerged in PDA, the fungus grew rapidly, producing masses of sclerotia on the medium surface. Because this pathogen attacks a wide range of host plants in Alabama, charcoal rot is expected to be an endemic problem in droughty areas during most years.

Other fungi associated with the alfalfa plant included *Leptosphaerulina briosana* (Poll.) Graham and Luttrell, *Sclerotium rolfsii* Sacc., *Fusarium* spp., *Pythium* spp., *Cylindrocladium* spp., and *Curvularia* spp. Additional nematodes recovered from soil beneath alfalfa plants included root knot (*Meloidogyne* spp.), lesion (*Pratylenchus* spp.), ring (*Criconemoides* spp.), dagger (*Xiphenema* spp.), stunt (*Tylenchorhynchus* spp.), stubby root (*Trichodorus* spp.), spiral (*Helicotylenchus* spp.), and lance (*Hopolaimus* spp.).

In fields where stands were declining, stem and crown diseases were usually present. Of the diseases identified, anthracnose, *Sclerotinia* crown and stem rot, and *Rhizoctonia* crown rot were most frequently associated with declining plants. Roots of these plants were usually healthy. Although several taproot diseases attack alfalfa (7), none were

found during the survey.

Alfalfa production in Alabama is presently limited to about 1,200 ha. The diseases detected and the localized distribution of some of them therefore reflect this limited production. As acreage increases, however, existing diseases should be expected to spread, and additional diseases will undoubtedly surface. The warm, humid climate and long growing season in Alabama are conducive to the development and spread of many diseases that attack alfalfa. The incorporation of resistance to major diseases should therefore be a prime consideration in any breeding program aimed at developing alfalfa varieties for the South.

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