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FIRST REPORT OF FOUR NEW DISEASES ON ARROWLEAF CLOVER IN EAST TEXAS

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Background. Poor stand establishment, failure to recover after grazing, and premature plant death have reduced the utilization of arrowleaf clover as a major, reliable forage in the southeastern United States in recent years. Virus diseases occur annually and can severely impact yield potentials; however, these diseases appear in the spring and are not related to the establishment problems observed at planting. Arrowleaf clover plants collected from poor stands in East Texas pastures during the 1995-96 and 1996-97 seasons first exhibited root disease symptoms as young seedlings in the fall. Our objectives were to observe and describe naturally occurring symptoms from field plants, isolate and identify the organism(s) responsible for causing the disease, and finally, duplicate the disease symptoms on arrowleaf clover plants in the greenhouse with the suspected disease organism(s).

Research Findings. Symptoms from field-grown arrowleaf clover consisted of one or more of the following: tan discoloration of lateral roots and taproot; root pruning (roots die and rot away from the tip back); and small, tan, sunken lesions on the taproot and crown. Many *Rhizobium* nodules were brown and dead. Toward spring, symptoms increased in severity. Root lesions became larger and darker, and internal crown discoloration was observed. Disease incidence reached 100% in both the 1995-96 and 1996-97 growing seasons. Premature death of plants also was observed, especially in pastures where plants had been grazed. Most of the organisms isolated from symptomatic roots brought back to the lab were soil-inhabiting fungi known to cause disease in a wide range of plants. Of these, four were identified as potential root rot pathogens on arrowleaf clover: *Pythium ultimum*, *Pythium irregulare*, *Rhizoctonia solani* AG4, and *Fusarium proliferatum*. Greenhouse studies confirmed that each of these fungi were able to infect and cause root disease on arrowleaf clover individually. However, in the field, roots were attacked by two or more pathogens simultaneously. Symptoms and plant emergence from greenhouse studies are summarized in Table 1.

Application. The fungi recovered from symptomatic arrowleaf clover roots represent four previously unreported diseases for arrowleaf clover. Several pathogens can attack a germinating seed or young seedling simultaneously and kill or severely weaken it, which may result in poor stands. There are no arrowleaf clover cultivars currently known to possess resistance to any of these diseases. The first steps towards understanding this seed/seedling disease complex were identification of the pathogenic organisms and confirming their pathogenicity on arrowleaf clover.

Table 1. Percent seedling emergence and symptom description of arrowleaf clover infected with one of four pathogenic fungi in greenhouse studies.

Pathogen	Seedling emergence	Symptoms
<i>Pythium ultimum</i>	0%	All seedlings killed prior to emergence; fungus attacks germinating seed.
<i>P. irregulare</i>	83%	Tan discoloration of lateral roots and taproot; root pruning (destruction of feeder roots).
<i>Rhizoctonia solani</i> AG4	31%	Tan to brown root lesions; root rot; internal crown discoloration.
<i>Fusarium proliferatum</i>	94%	Hyperelongation of hypocotyl and stem; mild chlorosis; slight tan discoloration of roots.
Healthy controls	95%	Healthy white roots.