Journal of the Arkansas Academy of Science

Volume 41 Article 33

1987

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INFECTION RATE OF TALL FESCUE WITH ACREMONIUM COENOPHIALUM

There are approximately 0.8 million hectares of tall fescue (*Festuca arundinacea* Schreb.) in Arkansas. Plants of this cool season perennial grass growing in established pastures harbor an endophyte fungus (*Acremonium coenophialum* Morgan, Jones, and Gams) at an infection level of 83 percent (Daniels, Piper, Nelson, Gee, and Hankins, Proc. Amer. Forage Grasslands Coun. Conf., Pp. 254-257, 1987). The fungus is associated with poor animal health (Reed and Camp, Agronomy J. 79:848, 1986).

The purpose of this study was to determine whether uninfected plants remained uninfected while growing adjacent to infected ones.

Seed of Forager tall fescue, labeled as having less than five percent of its seed infected (the seed trade refers to this as endophyte free or reduced endophyte seed), was planted during the fall of 1984 in rows at distances of either 60 cm (treatment one), 40 cm (treatment two), 20 cm (treatment three), or 0 cm (treatment four) from rows of heavily infected Kentucky 31 tall fescue. Twenty percent of the culms produced by plants that grew from the forager seed and 60 percent of the culms produced by plants that grew from the Kentucky 31 seed were initially infected with the endophyte.

The experiment was planted on October 3, 1984 at the University of Arkansas Livestock and Forestry Research Station near Batesville. Four treatments were assigned to four replications in a randomized complete block design. Each treatment in the experiment consisted of 16 rows 15.4 meters long. Treatment four was planted to a mixture of 60 percent Forager and 40 percent Kentucky 31 tall fescue seed. The seed hopper of a 16 row grain drill with 20 cm row spacing was then partitioned to facilitate placing the seed into proper row spacing for each of the remaining three treatments. A small amount of volunteer ryegrass (*Lolium multiflorum* Lam.), but no volunteer fescue was observed during the fall of 1984. Mowing was used to inhibit seedhead formation and thereby reduce to a minimum contamination of the plots with volunteer seed. A low soil fertility level was maintained to impede plant spreading. As a result, original rows were distinguishable throughout the duration of the experiment.

Endophyte infection analysis was performed microscopically on plant tissue from each plot in the experiment twice annually — at the end of the spring and fall growth periods. The lowermost portion of 15 culms were collected from both Forager and Kentucky 31 plants growing within each of the four treatments in each of the two replications in July, 1985 and within each of four replications in the experiment thereafter. From each sample of 15 culms, six were chosen at random for leaf sheath analysis to determine the endophyte infection levels. Results of the analysis are presented in Table 1.

Table 1. The influence of distance and time on *Acremonium coenophialum* fungal infection of low endophyte forager

Treatment	Distance separating Rows of Forager and Kentucky 31 Tall Fescue (cm)	Tall Fescue Variety	Endophyte Infection Level (%) July 85	Nov. 85	May 86	Oct. 86
1	60	Forager	0	0	0	0
		Kentucky 31	60	25	37	41
2	40	Forager	20	9	0	13
		Kentucky 31	40	0	54	63
3	20	Forager	40	0	12	29
		Kentucky 31	80	44	65	41
4	0	Mix	0	42	33	38

The endophyte fungal infection level observed in Forager plants that had grown for 28 months in rows located only 20 cm from rows of heavily infected Kentucky 31 fescue plants was 29 percent while the infection level in Forager plants that grew 60 cm from the source of infection for the same length of time, was only eight percent. However, the differences among all treatments means were not significant at $P = 0.05$. Therefore, the infection level of Forager tall fescue grown under Arkansas conditions did not increase for a period of 28 months after planting regardless of how close it grew to heavily infected Kentucky 31 plants.

We thank the Arkansas Beef Council for supplying the funds to conduct this experiment. We also thank Dr. Ken Harrison for his assistance in caring for the experiment at the University of Arkansas Livestock and Forestry Research Station near Batesville, and Dr. Bernard Daniels for assistance in analysis of samples.

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REPORTED BAT RABIES IN ARKANSAS

Data on bat rabies were not reported in the United States until 1953 (Baer, 1975). Since then, bats have become recognized as one of the major wildlife vectors, and bat rabies is the most widespread geographically (*e.g.*, 47, 46, and 45 states in 1982, 1983, and 1984 respectively) in the United States (CDC, 1983, 1984, 1986). These figures may reflect that, for reporting purposes, data on all species of bats are lumped together and that over 30 species have been reported to carry rabies (Constantine, 1979).

In Arkansas, bat rabies was not reported until 1961. Heidt (1982) summarized reported bat rabies from 1961 through 1981. McChesney *et al.* (1983) reviewed reported bat rabies for 1982. Heidt (1982) pointed out that between 1961 and 1981, reported rabid bats averaged a little over nine cases per year and accounted for 6.7% of the total reported cases in Arkansas. He further pointed out that reported cases were increasing and that bat rabies epidemiology was hampered in that the Arkansas Department of Health did not identify those bats submitted for testing.

General Notes

Beginning in July, 1982 one of the authors (DAS) has routinely identified bats submitted for testing to the Arkansas Department of Health. This paper reviews reported bat rabies in Arkansas since identification procedures have been practiced (1982-1986).

Table 1 summarizes reported bat rabies and compares it to the total reported rabies in Arkansas between 1982 and 1986. Reported cases have risen from an average of nine (Heidt, 1982) to 15.6 cases per year, and the percent of total reported rabies has risen from 6.9 to 10.3. Reasons for these increases are not clear. As the epidemiology of rabies is complex, it would not be safe to simply assume that there are more rabid bats in the state.

Between 1982-1986, a total of 641 bats have been identified (83% of the bats submitted) and 61 tested positive (78% of the total positive bats). There are 16 species of bats in Arkansas (Sealander, 1979); all of which have been reported in the literature to have carried rabies (Constantine, 1979). Of the 16 species, 11 have been submitted for testing since identification procedures were initiated (Table 2). Individuals from six of the 11 species have tested positive.

Table 1. Summary of reported bat rabies in Arkansas: 1982 - 1986

Year	Number of Bats Tested/Positive	% Positive	% Total Animals Tested	% Reported Rabies
1982	149/19	12.8	7.6	12.1
1983	137/16	11.7	7.0	10.0
1984	249/16	6.4	14.7	15.8
1985	142/13	9.1	9.2	8.6
1986	100/14	14.0	15.5	8.3
Total	777/78	10.0	8.9	10.3

Table 2. Summary of identified bats tested for rabies in Arkansas: 1982-86

Species	Number Submitted/ Positive (%)
Family Vespertilionidae	
Red Bat (Lasiurus borealis)	258/44 (17.1)
Big Brown Bat (Eptesicus fuscus)	134/7 (5.2)
Evening Bat (Nycticeius humeralis)	83/1 (1.2)
Eastern Pipistrelle (Pipistrellus subflavus)	25/5 (25.1)
Hoary Bat (Lasiurus cinereus)	15/3 (20.1)
Gray Bat (Myotis grisescens)	11/0 (0.0)
Little Brown Bat (Myotis lucifugus)	9/0 (0.0)
Keen's Bat (Myotis keeni)	1/0 (0.0)
Silver-haired Bat (Lasionycteris noctivagans)	7/0 (0.0)
East. Big-eared Bat (Plecotus rafinesquii)	4/0 (0.0)
Family Molossidae	
Free-tailed Bat (Tadarida brasiliensis)	94/1 (1.1)
Total	641/61 (9.5)

The red bat *(Lasiurus borealis)* accounted for roughly 40% of the total bats submitted and 72% of the bats testing positive. The red bat is found throughout the state and is one of the most common species (Sealander, 1979). Positive red bats have been reported from 24 counties: Arkansas (2), Benton (2), Cleveland, Conway (2), Dallas, Faulkner (5), Franklin, Garland, Hot Spring, Jefferson (3), Logan, Lonoke, Mississippi (3), Ouachita, Perry, Pulaski (6), Saline (2), Scott, Sebastian, Sevier, Van Buren, Yell, Washington, and White. Although scattered across the state, all of the counties (except Desha) encompassing the Arkansas River Valley are represented. Furthermore, the majority of cases involve the counties with major population centers (i.e., Pulaski, Saline, Faulkner and Jefferson counties).

The second most commonly submitted bat was the big brown bat *(Eptesicus fuscus)* with 134 (21%) animals. The big brown bat is also found statewide and is quite common, especially around human habitations (Sealander, 1979). This probably accounts for the high number of submissions and low incidence of positive cases (5.2%). Positive big brown bats have been reported from the following counties: Cleburne, Craighead, Faulkner, Garland, Pulaski, and Scott (2).

The evening bat *(Nycticeius humeralis)* occurs statewide, but is not particularly common (Sealander, 1979). While primarily a tree-dwelling species, it may use human habitations. Only one (from Pulaski County) of 83 submissions was positive.

The eastern pipistrelle *(Pipistrellus subflavus)* is a small, but common bat found statewide (Sealander, 1979). Five of 25 (20%) eastern pipistrelles have tested positive. Because relatively few bats were submitted, the significance of the high positive percentage is not known. Positive bats were from Benton (2), Garland, Saline, and Searcy counties.

The hoary bat *(Lasiurus cinereus)* is the largest bat in Arkansas. It is found statewide, but is not particularly common (Sealander, 1979). Three of 15 bats tested were positive. Again, the total number of bats tested was too small to draw any conclusions from the high positive percent. Positive bats were from Logan, Jefferson, and Pulaski counties.

The freetail bat *(Tadarida brasiliensis)* is the only member of the Family Molossidae in Arkansas. Its exact range and status in the state is not known; however, large colonies have been found in human habitations in Pulaski, Faulkner, Garland, and Little River counties (Saugey *et al.*, 1983; authors' unpubl. data).

Only one of 94 freetail bats submitted for testing was positive. The positive animal was one of 74 from a housing project in Hot Springs, Garland County. The role of the freetail bat in the epidemiology of rabies in Arkansas is not known, although western populations have been highly implicated in the transmission of the disease (Baer, 1975).

As reported in Table 2, there were no positive submissions of the gray bat *(Myotis griscescens)*, little brown bat *(Myotis lucifugus)*, silver-haired bat *(Lasionycterus noctivagans)*, eastern big-eared bat *(Plecotus rafinesquii)*, or Keen's bat *(Myotis keenii)*. This does not mean, however, that these species are rabies-free. It should be noted that the gray bat is included on the Federal Endangered Species List.

The authors would like to thank T. McChesney and M. Edelman of the Arkansas Department of Health for helping compile documents.

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A YELLOW RAIL *(COTURNICOPS NOVABORACENSIS)* WITH DARK PLUMAGE FROM ARKANSAS

A Yellow Rail *(Coturnicops novaboracensis)* that is much darker than others of its species was collected by Buford Smith in January 1963 near Beebe in White County, Arkansas. The specimen was mounted by Truston H. Holder in a lifelike position (Fig. 1 and 2) before presentation to the University of Arkansas at Fayetteville, where it now is part of the university museum collection (Cat. No. 784). Roberts (The birds of Minnesota, 2 vols., Univ. of Minn. Press, 1932) thought that dark Yellow Rails were young birds and Ripley (Rails of the world, D. R. Godine Publ., Boston, 1977) supported this view. However, Friedmann (Ridgeway and Friedmann, The birds of north and middle America, Part IX, U.S. National Museum Bull. no. 50, 1941) recognized a pale and rufescent plumage phase in both adult and juvenile birds. My study of museum skins of Yellow Rails did not clarify this matter due to a lack of specimens with specific age data. Dickerman (1971, Wilson Bull. 83:49-56) also stressed this problem. Therefore, not having better information, I am treating the Arkansas specimen simply as one that exhibits an unusually dark plumage. However, a specimen taken in September in Ontario, Canada, and identified as a juvenile (ROM 37443, Royal Ontario Museum) also showed a dark scaling pattern on the sides of the head and on the breast, which most Yellow Rails lack, but the criterion for calling the bird a juvenile was not given. The presence of dark Yellow Rails presents some difficulty in field identification with respect to the other small North American rail, the Black Rail *(Laterallus jamaicensis)*.

In searching for dark Yellow Rails, I have inspected over 100 specimens in several collections (American Museum of Natural History, Bell Museum of Natural History at the University of Minnesota, U.S. National Museum of Natural History, and Royal Ontario Museum). Specimens range from light birds to dark birds especially ventrally (Fig. 3), not so pronounced dorsally (Fig. 4). The graded series shown in Fig. 3 and 4 are from the U.S. National Museum, but is similar in variation to specimens found in other collections. None of the specimens are as dark ventrally as the Arkansas specimen.

The Arkansas bird is not as dark as it appears in Fig. 1 and 2. The light longitudinal edges of the black feathers on the dorsum and wing coverts are actually buffy or yellowish in color. The thin white cross bars turning to spotting on the head and upper breast are very white. The back and wing coverts are in fact similar to other Yellow Rails. It is in the underparts that the Arkansas bird is much darker than other specimens. Most of its breast and belly is a dark buffy brown with thin white barring. The underparts behind the legs are blackish with white barring as in other Yellow Rails. The extensive light venter found in most Yellow Rails is reduced in the Arkansas specimen to a small whitish triangle on the chin and upper throat, and a whitish area (25 x 25 mm in size) just anterior to the legs. The several white secondaries are present in the wing that produces the posterior white wing patch on the inner part of each wing in flight.

Using the specimens from the U.S. National Museum (USNM) for a detailed comparative synopsis, the amount of buff edging on the back feathers varies somewhat (Fig. 4) and is minimal in the Arkansas bird, but not less than in some other specimens. So, although the Arkansas bird is on the dark end of the dorsal gradient, other specimens are just as dark. The black of the back feathers with the thin white barring is the same in all birds (Fig. 4), and the varying lightness in overall shade is due to differing amounts of buffy edging to the feathers. There is more buff on the margins of the upper tail coverts in some specimens than in the Arkansas bird, but most other specimens are equally as dark there as the Arkansas bird.

The dark brown of the lower flank feathers and under tail coverts appear darker in the Arkansas specimen than in all others, and the dark area is more extensive too. Also, the white area on the lower mid-breast and abdomen is smaller in the Arkansas bird than in the others. The Arkansas bird (Fig. 1 and 2) differs most markedly from the other specimens (Fig. 3) in the nature of the sides of the face, sides and front of the neck, and breast and upper flanks. In most Yellow Rails the breast is a light buffy color, but varies from pale buff to a darker buffy brown shade (Fig. 3). The light color on the breast extends on to the sides of the head and neck and includes the superciliary line that borders above a darker area extending from the beak back below the eye. In the Arkansas specimen the breast, upper flanks, neck and sides of the face are a darkish buffy brown, giving these areas a very dark appearance. The feathers have numerous thin white bars on the breast and flanks shortening to white spots on the neck and head. Even the dark crown has white flecks. The superciliary line is barely visible. Only the bird on the far right in Fig. 3 (USNM 189862) has this type of plumage on the head and breast, but even in this bird the light whitish of the belly extends medially on the breast to join the light throat and chin (not visible in Fig. 3 because of the way the head was turned in preparing the specimen). Thus, only the sides of the breast has the dark speckled appearance. In the Arkansas bird the dark plumage extends across the breast and upper abdomen (Fig. 2) giving it its very dark appearance.