

## COMPARISON OF *CULICOIDES* SPP. (DIPTERA: CERATOPOGONIDAE) ATTRACTED TO CATTLE IN AN OPEN PASTURE AND BORDERING WOODLAND<sup>1, 2</sup>

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**ABSTRACT.** A field study was conducted at Auburn, AL to compare the species of *Culicoides* midges attacking cattle in an open pasture and adjacent woodland from 1.5 hr before to 1.5 hr after sunset. Collections were made twice weekly from late April through October (50 trap nights) using drop-type closure traps baited with Holstein bulls. The same 13 *Culicoides* spp. were trapped at both sites, indicating no apparent difference in the species compositions in these two habitats. With one exception (*C. arboricola* which is typically ornithophilic), the number of each *Culicoides* sp. attracted to cattle in the open pasture was consistently greater (1.3–4.6 X) than the number of the same species taken on cattle in the bordering woods.

### INTRODUCTION

In August 1981, an 8-month-old Angus calf on a farm at Tuskegee, Alabama, was diagnosed as having bluetongue (BT) by the School of Veterinary Medicine, Tuskegee Institute. The animal exhibited classic signs of ulcerated hooves, lameness, oral lesions and crusty exudate about the muzzle and lips. Despite supportive treatment the calf died 20 days after admission to the veterinary clinic. Infection with BT virus (BTV) was confirmed by virus isolation in embryonated chicken eggs at the Charles S. Roberts Veterinary Diagnostic Laboratory, Auburn. No other animals in the herd (ca 25 head) exhibited clinical signs of BT.

A follow-up investigation revealed that the calf had escaped into the surrounding woods through a break in the pasture fence. It was not seen again until 4 wk later when it was discovered in an adjacent pasture. How long this animal had been in the woods is uncertain because the adjacent pasture was not being used, and the calf could have been there unnoticed for some time.

The principal means of transmission of BTV is by the bite of infected ceratopogonid flies in the genus *Culicoides*. To date *C. variipennis* is the only confirmed vector species in North America, although recently *C. insignis* has been found to be naturally infected with BT virus in Florida (Collisson 1984, Greiner 1984). Fourteen *Culicoides* spp., including *C. variipennis*, have been collected from cattle in Alabama

(Mullen et al. 1984) but the potential role which these individual species play in the transmission of BTV remains uncertain.

The fact that only the one animal at Tuskegee developed bluetongue suggested the possibility of greater exposure of cattle to *Culicoides* vectors in the woods than in the pasture. This prompted the following comparative study of *Culicoides* spp. attracted to cattle in an open pasture and adjacent woodland. The objective was to compare the degree of exposure of cattle to biting midges in these two habitats by determining the species composition and the relative numbers of each species attracted to cattle in the two areas.

### MATERIALS AND METHODS

The study area was an open pasture and bordering woodland at the Auburn University School of Veterinary Medicine which was very similar in nature to the Tuskegee site where the BT case occurred less than 32 km away. The pasture of coastal bermuda and bahia grasses was surrounded by mixed loblolly pines and hardwoods with a small intermittent stream traversing the two habitats.

Two 6-month-old Holstein bulls of approximately the same size (250 kg) and color pattern were used as hosts for the *Culicoides* collections. During collecting periods, each bull was placed in an open-style, wooden stall (2 × 1 m) with a head catcher located at one end (Fig. 1). The enclosure was designed to restrain the animal without interfering with exposure to attack by biting flies. One enclosure was located in the open pasture, the other in the adjacent woods ca 25 m from the pasture clearing.

A drop-type closure trap modified after the techniques of Bennett (1960), Schmidtman et al. (1980), and Zimmerman and Turner (1983) was used to capture *Culicoides* adults attracted to the bulls. The drop traps were constructed of Saran screening (National Filter Media Company, Hamden, CT) fabricated to fit over a

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rectangular aluminum-pole frame joined at the corners and midsections with PVC plastic elbow and tee joints forming a box-like trap ( $2 \times 3 \times 2$  m). The upper frame of the trap was connected to a cable and secured at the top center by lead lines attached to each of the four corners and midsections of the aluminum frame. The trap was suspended from a wooden crossbeam supported 5 m above the ground by two vertical posts (Fig. 1). A pulley system and winch attached to the support structure was used to raise and lower the trap (Fig. 2).

Night collections were made twice each hour with alternate 15-min exposure and collecting intervals from 1.5 hr before to 1.5 hr after sunset twice each week from April 29 to October 28, 1982 for a total of 50 trap nights. Collections were taken simultaneously from the traps in the open pasture and woods during each sampling period. Following exposure of the restrained animal for 15-min, the drop trap was lowered over the enclosure and secured to the ground with tent stakes. At the end of each sampling period, collectors entered the traps from beneath to collect the insects with oral and battery-operated, mechanical aspirators. All insects resting on the inside of the screen cage were collected. Battery-operated head lamps were used in collecting the insects after dark.

All specimens collected from the bait animals were stored in 80% ethanol, labelled according to date, habitat and collection period, and were returned to the laboratory for species determinations. Because of the difficulty in reliably distinguishing females of the closely related species *C. obsoletus* and *C. sanguisuga*, individuals belonging to these two species were combined in each collection. Both occurred in the study area. The species, numbers of each collected, and the percentages taken in the open pasture versus the bordering woods were tabulated.

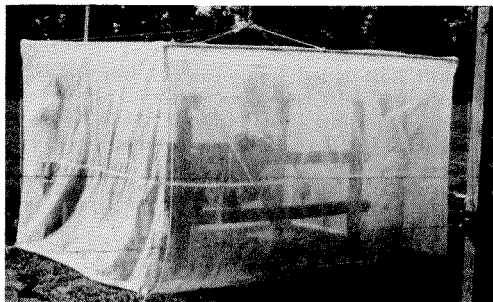
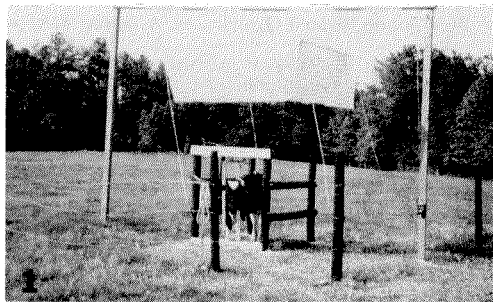
## RESULTS AND DISCUSSION

The same thirteen species of *Culicoides* were collected in both the open pasture and woods (Table 1). *Culicoides stellifer* was the predominant species collected in both areas, followed by *C. paraensis* and *C. obsoletus-sanguisuga*. These four species comprised 84% of the total number of *Culicoides* spp. collected in the open pasture and 82% of those collected in the bordering woods. *Culicoides debilipalpis*, *C. biguttatus*, *C. venustus* and *C. variipennis* were collected less frequently, representing only 13% of the total number of *Culicoides* collected in the open pasture and 12% of the total number collected within the woodland. The remaining five species (*C. guttipennis*, *C. arboricola*, *C. spinosus*, *C. haematopodus*, and *C. piliferus*) were collected only incidentally with less than 10 specimens of each species represented in the total collections.

With the exception of *C. arboricola*, the number of each *Culicoides* sp. collected in the open pasture was consistently greater than the number of the same species collected in the bordering woods. However, the numbers in individual collections were not sufficient to calculate meaningful comparative estimates of biting rates in the two habitats on individual nights.

Thirty percent of the *Culicoides* specimens collected in the drop traps were at least partially blood fed, presumably on the bovine host. Some individuals in all species except *C. guttipennis*, *C. piliferus* and *C. spinosus* had taken a blood meal.

These results do not support the hypothesis that cattle are subject to higher intensities of attack by *Culicoides* spp. in wooded areas compared to open pastures. If anything, the exposure to biting midges at the study site described was greater in the pasture. This suggests that the Angus calf at Tuskegee probably was not



Figs. 1 and 2. Animal-baited drop traps for collecting *Culicoides* adults attracted to cattle. 1. Collecting cage raised to expose Holstein bull to attack by biting flies. 2. Drop trap lowered, allowing collectors to aspirate the insects trapped within.

Table 1. Comparison between *Culicoides* spp. collected from Holstein bulls in an open pasture and bordering woods, Auburn, AL, May–October 1982. Species listed in order of number of specimens collected.

Species	Total specimens	Open Pasture		Woods	
		No.	(%)	No.	(%)
<i>C. stellifer</i> (Coquillett)	372	292	(78)	80	(22)
<i>C. paraensis</i> (Goeldi)	287	197	(69)	90	(31)
<i>C. obsoletus</i> (Meigen)					
<i>sanguisuga</i> (Coquillett)	172	113	(66)	59	(34)
<i>C. debilipalpis</i> Lutz	50	32	(64)	18	(36)
<i>C. biguttatus</i> (Coquillett)	45	37	(82)	8	(18)
<i>C. venustus</i> Hoffman	24	18	(75)	6	(25)
<i>C. variipennis</i> (Coquillett)	11	8	(73)	3	(27)
<i>C. guttipennis</i> (Coquillett)	9	5	(56)	4	(44)
<i>C. arboricola</i> Root and Hoffman	8	2	(25)	6	(75)
<i>C. spinosus</i> Root and Hoffman	6	4	(66)	2	(34)
<i>C. haematopotus</i> Malloch	5	4	(80)	1	(20)
<i>C. piliferus</i> Root and Hoffman	3	2	(66)	1	(34)
Totals	992	714		278	

more frequently attacked by *Culicoides* spp. in the woods during the collection hours than it would have been had the animal remained in the pasture.

Infections in white-tailed deer (*Odocoileus virginianus*) have been well documented in serologic surveys and by virus isolations from wild deer in several southeastern states including Alabama (Couvillion et al. 1981). White-tailed deer were abundant at the Tuskegee site where they may be serving as a reservoir population for BTV. It is thus possible that, while lost in the woods, the calf experienced greater exposure to BTV-infected *Culicoides* females which had previously fed on infected wild deer. The significance of wild deer in the epidemiology of bluetongue in domestic livestock remains largely unresolved.

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