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EFFECTS OF SEASON AND AREA ON ECTOPARASITES OF WHITE-TAILED DEER (*ODOCOILEUS VIRGINIANUS*) IN MISSISSIPPI[1]

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ABSTRACT: Nine species of ectoparasites (4 Acari, 2 Mallophaga, 1 Anoplura, 1 Diptera, and 1 Siphonaptera) were recovered from 126 white-tailed deer collected in northern, central, and southern Mississippi. Intensity and prevalence of adults of *Ixodes scapularis* and larvae, nymphs, and adults of *Amblyomma americanum* varied significantly over collection periods, but not between host sexes. *Lipoptena mazamae* occurred on deer from only one study area. Although individual deer were heavily parasitized by *Tricholipeurus parallelus* and *T. lipeuroides*, their prevalence was limited. *Hoplopsyllus* sp., *Solenopotes* sp., *Amblyomma maculatum*, and *Dermacentor albipictus* had prevalences of <10% and were not tested for area, host sex, and seasonal effects. The potential pathogenicity of these ectoparasite species are related to white-tailed deer in Mississippi.

Key words: White-tailed deer, ectoparasites, season effects, area effects, *Odocoileus virginianus*.

INTRODUCTION

Populations of white-tailed deer (*Odocoileus virginianus*) and demand for their harvest have increased dramatically in Mississippi in recent years (Jacobson et al., 1981). The attendant increased management intensity may require manipulation of population limiting factors or stressors. Ectoparasites have been identified as one such stressor in Oklahoma (Bolte et al., 1970). Knowledge of the intensity and temporal sequence of potential stressors is necessary to implement corrective management strategies.

Previous reports examined seasonal trends of ectoparasites on white-tailed deer in Texas (Samuel and Trainer, 1971, 1972) and Canada (Watson and Anderson, 1975, 1976). Others considered ectoparasites, particularly ticks, as factors in deer population bionomics due to direct morbidity and/or as disease vectors (Emerson, 1969; Bolte et al., 1970; Samuel and Trainer, 1970; Kellogg et al., 1971; Logan, 1972).

This study was conducted to identify seasonal trends of ectoparasites on deer from three areas in Mississippi and to evaluate ectoparasites as possible population stressors.

MATERIALS AND METHODS

Study areas were located in northern, central and southern Mississippi. The northern study area (33°35′N, 88°50′W) covered 43,105 ha in the interior flatwoods, upper coastal plain, and blackland soil resource areas (Cross et al., 1974) in parts of Noxubee, Oktibbeha, and Winston counties. This area consisted of contiguous parts of Noxubee National Wildlife Refuge, Mississippi State University's School Forest, and Tombigbee National Forest. The central study area (32°15′N, 89°20′W), Tallahala Wildlife Management Area in Bienville National Forest, covered 11,350 ha in the blackland soil resource area in parts of Scott, Newton, and Jasper counties. The southern study area (31°05′N, 89°05′W), the Leaf River Wildlife Management Area in Desoto National Forest, covered 17,800 ha in the lower coastal plain and coastal flatwoods soil resource in Perry County. Long-term weather patterns averaged across study areas were 185 cm and 16.5 C for total annual rainfall and average annual temperature, respectively.

Three doe deer were collected each month

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TABLE 1. Prevalence (%) and median and range of intensity of ectoparasites on white-tailed deer from northern, central, and southern Mississippi.

Parasite	Life stage[a]	North (n = 62)[b]			Central (n = 32)[c]			South (n = 32)[c]		
		Prevalence	Median	Range	Prevalence	Median	Range	Prevalence	Median	Range
Acarina										
Amblyomma americanum	A	59	5	1–57	81	10	2–76	69	17	2–68
	N	70	13	1–78	59	16[d]	2–92	81	28	2–124
	L	20	78	4–486	38	25	2–1,338	41	12	2–1,460
Ixodes scapularis	A	13	1	1–13	31	4[d]	2–22	50	10	2–102
Dermacentor albipictus	A	0	—	—	0	—	—	6	2	—
	N	0	—	—	0	—	—	3	4	—
A. maculatum	A	2	1	—	0	—	—	0	—	—
Mallophaga										
Tricholipeurus sp.	L	18	11	1–68	6	296	8–584	0	—	—
T. parallelus	A	23	4	1–34	38	8	2–594	22	6	2–36
T. lipeuroides	A	16	12	4–56	16[d]	4[d]	2–4,726	0	—	—
Anoplura										
Solenopotes sp.	A	0	—	—	9	2	2–16	6	2	2–4
Diptera										
Lipoptena mazamae	A	0	—	—	100[d]	66[d]	4–354	0	—	—
Siphonaptera										
Hoplopsyllus sp.	A	0	—	—	3	2	—	0	—	—

[a] A, adults; N, nymphs; L, larvae.
[b] Parasites recovered from 3 index areas (see text).
[c] Estimate of parasites on entire body; north not compared to central and south.
[d] Central and southern areas different ($P < 0.01$).

on each of the central and southern study areas during November 1976 to October 1977 and three doe and three buck deer on the north study area during April 1979 to March 1980. Deer in the yearling age class or older were shot in the neck with a large caliber rifle and wrapped in a plastic tarp containing a chloroform atmosphere. Deer were placed into 2-mo groupings to increase cell sample size for statistical analysis. The 2-mo groupings were selected based upon seasonal physiological events and environmental conditions. For example, December and January were paired because over 80% of breeding occurs during these months (Jacobson et al., 1981) and usually they are the two coldest months of the year.

Ectoparasites were recovered from deer of the central and southern study areas by visual inspection from one-half of the animal. The dividing line was the median sagittal plane. Sample counts were doubled to obtain an estimate of the total count. Ectoparasites were recovered only from certain "index areas" on the northern study area. Based upon our experiments from the central and southern study areas, the preferred location sites for ectoparasites of deer in Canada (Watson and Anderson, 1975, 1976), and the index site used for ticks and kedflies in Texas (Samuel and Trainer, 1970, 1972), the following index areas were examined: (1) the ear on the inside and outside distally from the lower notch; (2) a 15 × 15 cm area of the medial surface of one hind leg, with the proximal edge of the square bordering the midventral line of the body; and (3) an 8 × 8 cm area of the back at the base of the tail. Counts of ectoparasites from these three index areas were added together and used as an index of infection. Ectoparasite populations from the northern study area were not compared statistically to those from the other areas.

Ectoparasites were stored in 50% ethanol. Voucher specimens were deposited in the U.S. National Parasite Collection, Beltsville, Maryland, 20705, USA (Accession Nos. 78857–78864). The terms prevalence, intensity and mean intensity follow the definitions of Margolis et al. (1982).

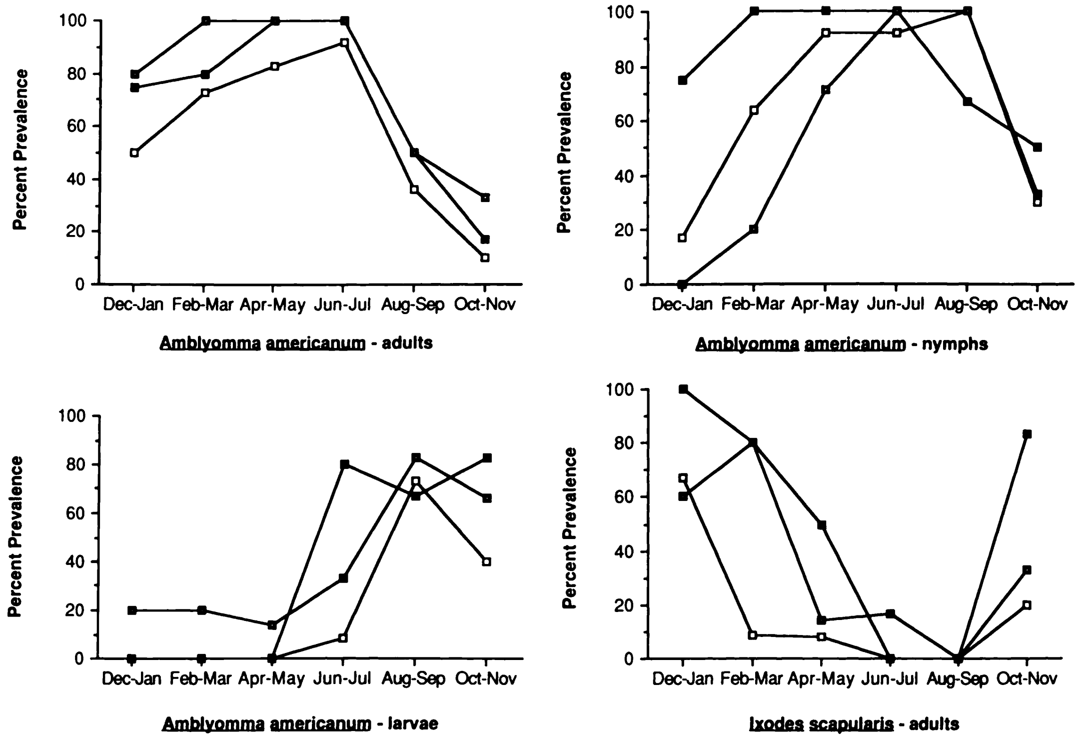

FIGURE 1. Significant ($P < 0.01$) bimonthly changes in prevalence of *Ambloyomma americanum* and *Ixodes scapularis* on white-tailed deer from northern (-□-), central (-■-), and southern (-■-) Mississippi.

Intensity and prevalence data were analyzed statistically for a given species only when the prevalence of that species on deer from a study area exceeded 10%. Intensity data for each species were independently rank-transformed (Conover and Iman, 1981) prior to analysis using Statistical Analysis Systems (SAS Institute Inc., 1982) following the methods of Gaines et al. (1984). The rank transformation was used and the median was selected as the appropriate measure of central tendency because the data exhibited high levels of skewness and kurtosis within groups and heterogeneity of variance among groups. The effects of sex and collection period on ectoparasites from the northern study area and the effects of area and collection period on ectoparasites from the central and southern study areas were evaluated using two-way ANOVA of rank-transformed intensity data and chi-square analysis of prevalence data.

RESULTS AND DISCUSSION

Nine species of ectoparasites (4 Acari, 2 Mallophaga, 1 Anoplura, 1 Diptera, and 1 Siphonaptera) were recovered from 126 white-tailed deer from northern, central and southern Mississippi (Table 1). Host sex did not affect ectoparasites on the northern study area so data from both sexes were combined. Data from the central and southern study areas are presented separately because of area differences in counts and/or prevalences between the two areas for four of the species (Table 1).

Four ectoparasite species with prevalences of <10% (*Hoplopsyllus* sp., *Solenopotes* sp., *Dermacentor albipictus*, and *Amblyomma maculatum*) were not analyzed for treatment effects (Table 1). The flea, *Hoplopsyllus* sp., has not been reported previously from white-tailed deer and is considered an accidental parasite. These four ectoparasite species are considered insignificant pathogenic agents for deer in Mississippi due to low prevalences and intensity of infection.

The ticks, *Ixodes scapularis* and *Am-*

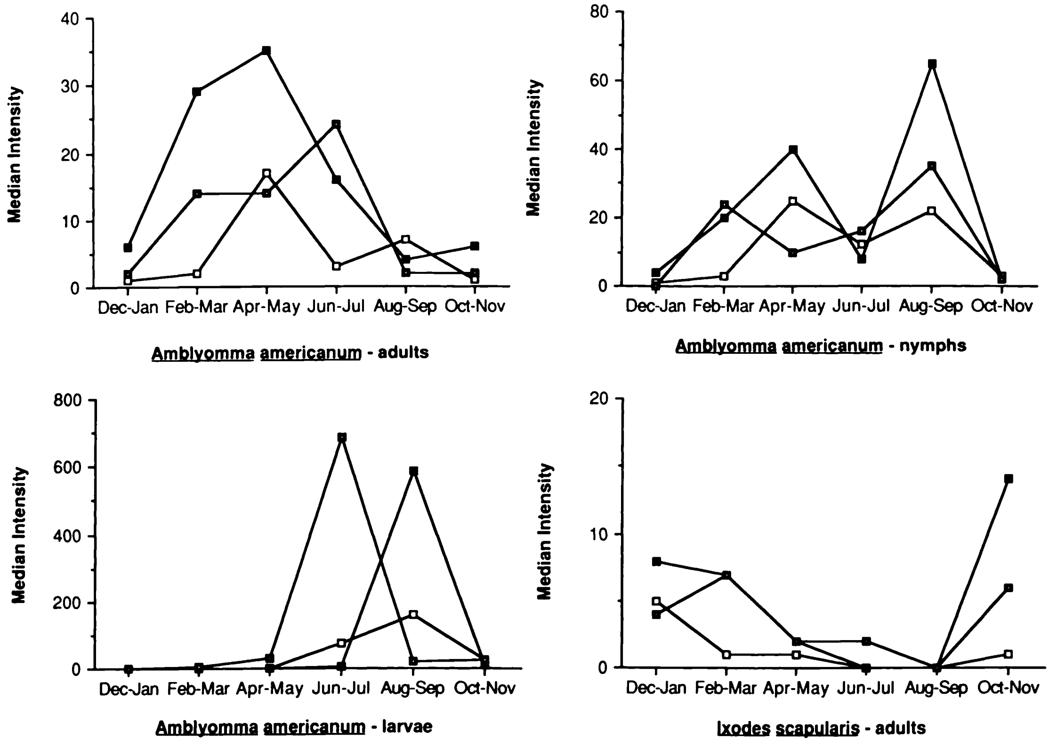

FIGURE 2. Significant ($P < 0.01$) bimonthly changes in median intensity of *Amblyomma americanum* and *Ixodes scapularis* on white-tailed deer from northern (-□-), central (-◘-), and southern (-■-) Mississippi.

blyomma americanum, exhibited distinct seasonal patterns ($P < 0.01$) of prevalence and intensity on all three study areas (Figs. 1, 2) Adult *I. scapularis* occurred in relatively low numbers and primarily during the colder collection periods (October–November through February–March). A similar seasonal pattern was reported for *I. scapularis* in Ontario, although counts were much higher in that study (Watson and Anderson, 1976). The higher prevalence of *I. scapularis* on white-tailed deer throughout the southeast reported by Kellogg et al. (1971) probably occurred because they sampled only during the fall hunting season.

Amblyomma americanum was the predominant ectoparasite species recovered (Table 1). All life history stages were recovered throughout the year, although seasonal patterns of abundance varied and prevalence (Fig. 1) and intensity (Fig. 2) were significantly different ($P < 0.01$). Peak numbers of all *A. americanum* life history stages occurred during warmer collection periods. Drummond (1967) reported a late winter through summer infection period for *A. americanum* on cattle in Texas.

It is difficult to interpret the direct pathogenic impact of ticks on white-tailed deer populations in Mississippi. There are neither controlled experimental evidence nor other estimates of tick populations on deer in the southeast for comparison. Ticks can produce dermatitis with possible secondary infection, exsanguination, and paralysis (James and Harwood, 1969). Kellogg et al. (1971) reported intradermal hemorrhage, small abscesses at attachment sites, hair loss, moderate skin thickening and infrequent hematomas to the ear pinna associated with some unquantified tick infections. The pathology described by

Kellogg et al. (1971) was commonly present on deer sampled during the spring and summer in our study. Tick parasitism and secondary bacterial infection of their feeding sites could have partially contributed to the leucocytosis and decreased packed cell volume observed in another phase of this study (Demarais, 1984).

Changes in prevalence and intensity of chewing lice over time were similar to those reported by Watson and Anderson (1975). *Tricholipeurus lipeuroides* were recovered during the winter and *T. parallelus* were recovered during the spring and summer. Mammals, unless heavily infected, generally are not affected by chewing lice (James and Harwood, 1969). The numbers of lice recovered were lower than reported previously for white-tailed deer in Canada (Watson and Anderson, 1975). Chewing lice probably have little effect on this deer population.

The sporadic distribution of the deer kedfly *Lipoptena mazamae* concurred with the results of Bequaert (1957). *Lipoptena mazamae* occurred only on deer from the central study area where all deer were infected. Deer kedflies are thought to cause annoyance (Kellogg et al., 1971) and possible anemia and mechanical damage (Strickland et al., 1981). These parasites should be considered a potentially continuous problem at the central study area due to their high abundances.

Results from this study should be placed into perspective relative to the management of Mississippi's white-tailed deer resource. Parasitism by lone star ticks and/or kedflies may be a possible population stressor during warm months in certain regions of Mississippi. If this is a valid conclusion, reduction of the stressor input would have a beneficial effect on deer populations. Controlled burning holds promise for control of lone star tick populations in some habitats (Jacobson and Hurst, 1979). However, the net benefit of ectoparasite control on the study areas probably would be negligible. The best alternative may be to maintain population density within the habitat carrying capacity since healthy deer are most able to cope with minor parasite problems (Nelson et al., 1975; Strickland et al., 1981).

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