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IXODES SCAPULARIS SAY ON WHITE-TAILED DEER (*Odocoileus virginianus*) FROM LONG POINT, ONTARIO

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Abstract: Ixodes scapularis Say was the only species of tick found on white-tailed deer, *Odocoileus virginianus*, collected at Long Point, Ontario from October 1972 to August 1973. Adults were most abundant from September 1972 to April 1973. Larvae were found throughout the study period except during February. Nymphs were scarce during winter months but fairly common during spring and summer. Most adults were found on the neck and shoulders. Larvae occurred mainly on lower regions of the body and nymphs mainly on the head, shoulders, forelegs and brisket.

INTRODUCTION

The present study is based on a detailed examination for ticks of white-tailed deer (*Odocoileus virginianus*) collected from Long Point, Ontario during 1972 and 1973. Deer were collected as part of a herd improvement program carried out by the Ontario Ministry of Natural Resources. An account of the lice collected from the deer has already been reported.[16]

MATERIALS AND METHODS

Deer were collected at Long Point, Ontario on Lake Erie. A description of the study area appears elsewhere.[2] Deer were aged by the cementum annuli technique.[7] The approximate ages and sex of deer collected were as follows:

Oct. 1972 — 4 + (M), 1 + (F), <1 (F), 1 (F), 10 + (F), 1 + (M).
Nov. 1972 — 9 + (F), 9 + (F), 1 + (M), 3 + (M), <1 (M).
Dec. 1972 — <1 (F), 1 + (M), 8 + (F), 4 + (M).
Feb. 1973 — 6 + (F), 2 + (F), <1 (F), 1 + (F), 5 + (F), <1 (F).
Mar. 1973 — 2 + (M), 1 + (M), 7 + (M), 5 + (F), 1 + (F).
Apr. 1973 — 1 + (M), 5 + (M), 6 + (F).
May 1973 — 7 + (F), 4 + (M), 3 + (F), ? (M), 4 + (F).
June 1973 — 4 + (M), 3 + (M), 3 + (M), 6 + (M), 6 + (M).
July 1973 — 6 + (F), <1 + (F fawn), ? (F).
Aug. 1973 — 1 + (M), 1 + (M), <1 (F fawn), <1 (F fawn), 1 + (M), <1 (F fawn).

Usually each deer was skinned within 1 hr of death. The hide was partitioned into 7 regions, namely rump, hindlegs and groin, back, belly, shoulders, forelegs and brisket, neck and head. Further details appear elsewhere.[16] Samples placed in plastic bags were kept cool in the field, and eventually frozen. Samples of the hide were thawed, measured, and digested in 4.5% KOH. The digest was passed through an 80 mesh Endecott sieve and the material remaining on the sieve was collected and preserved in glycerine-alcohol. Skin on the heads was not digested but washed in a detergent-water solution which was then passed

through an 80 mesh sieve. Sieved material was transferred to warm 4.5% KOH to dissolve hair removed during washing. Head skins were combed thoroughly with a nit comb and any ticks removed by hand. Areas of the head skin were estimated using deer from another area.[16]

Ticks collected were classified to sex and stage (larvae, nymphs, adults). Densities of ticks (i.e. ticks/cm^2) on the body were determined. The transformation $X^{0.1}$ was applied to the density data to normalize the distribution as much as possible. Statistical tests carried out included an analysis of variance called profile analyses and Scheffe's multiple comparison tests[13] conducted at the 0.05 level. Finally, the percentage of the total density of ticks was determined for each region of the body in any collecting period (e.g. all deer collected during November and December). Percent of total density was derived from the density of ticks on each designated region on individual deer. Deer were grouped, when possible, into two month periods and a mean density of ticks on each region was calculated. The mean density was expressed as a percent of the sum of the mean densities on all regions on deer in a two month period. Regions with the highest percentage of the total tick density in any period are referred to as *preferred sites.*

RESULTS

Adult *Ixodes scapularis,* the black-legged tick, the only species of tick collected, was most prevalent on deer from October 1972 to April 1973 although it was found throughout the study period (Table 1). Significantly higher densities of males were found from October to April than at other times of the year (Fig. 1, Scheffe's test).

Larvae were found throughout the study period except in February but significantly higher densities were found from March to August than at other times of the year (Table 1, Fig. 2, Scheffe's test).

Nymphs were scarce during the winter months from October to February but were fairly common during the spring and summer months (Table 1). Significantly higher densities were attained in May-June that at other times of the year (Fig. 2, Scheffe's test).

The preferred sites for adult *I. scapularis* were clearly the neck (G) and shoulders (E) (Table 2). Preferred sites for larvae (Table 3) were the lower regions of the body such as the belly (D), the hindlegs and groin (B), and forelegs and brisket (F). Preferred sites for nymphs (Table 3) were the head (H), forelegs and brisket (F), and shoulders (E).

TABLE 1. Numbers and Stages of **Ixodes scapularis** Collected From White-Tailed Deer From Long Point, Ontario 1972-1973.

Date	Deer Infected/Examined	Larvae*	Nymphs*	Adults*
Oct.	6/6	2	1	262
Nov.-Dec.	9/9	3	0	256
Feb.	6/6	0	0	15
Mar.-Apr.	8/8	87	5	43
May-June	7/9	135	22	7
July-Aug.	2/5 (adults)	71	73	2
July-Aug.	3/4 (fawns)	257	7	0

* Mean number per deer examined (including negative deer).

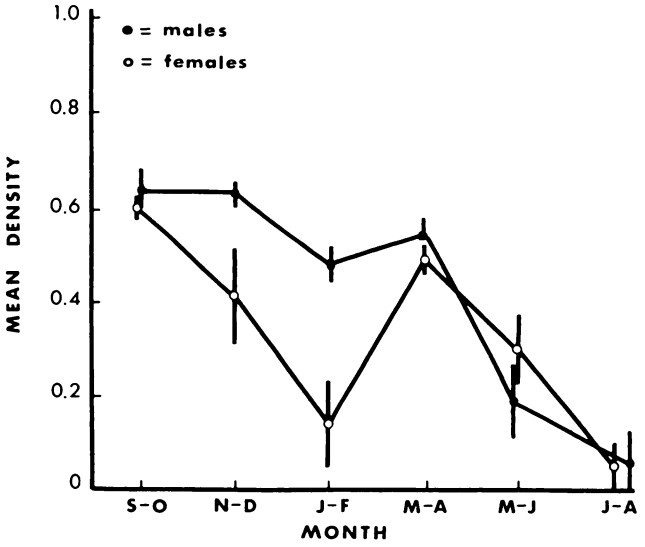

FIGURE 1. Mean density (ticks/cm^2) of adult male and female **Ixodes scapularis** collected from white-tailed deer (**Odocoileus virginianus**) from Long Point, Ontario, September, 1972 to August ,1973. Vertical bars represent the mean ± one standard error.

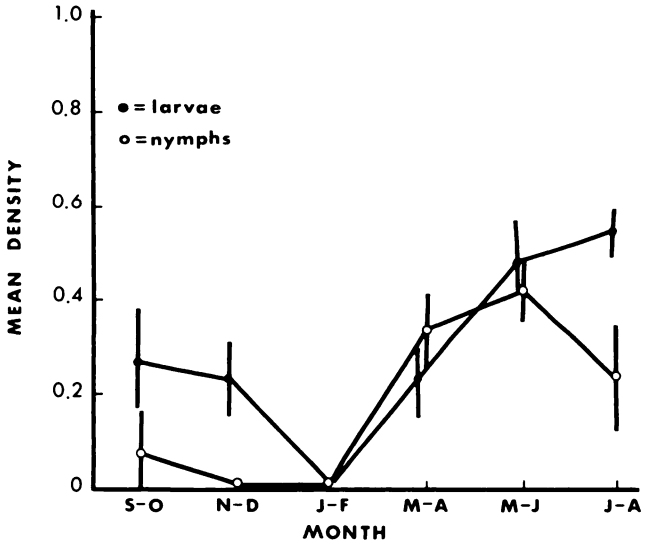

FIGURE 2. Mean density (ticks/cm^2) of larval and nymphal **Ixodes scapularis** collected from white-tailed deer (**Odocoileus virginianus**) from Long Point, Ontario, September, 1972 to August, 1973. Vertical bars represent the mean ± one standard error.

TABLE 2. Distribution of adult **Ixodes scapularis** on white-tailed deer from Long Point, Ontario, 1972-73*.

October	November December	February	March April	May June	July August
G(58)	G(69)	G(59)	G(48)	G(75)	E(99)
F(12)	E(14)	E(22)	E(37)	E(9)	B(1)
E(11)	H(10)	H(17)	H(8)	H(7)	H(0)
H(10)	F(4)	F(2)	F(6)	F(5)	F(0)
B(4)	D(<1)	D(0)	A(<1)	C(2)	C(0)
D(3)	B(<1)	B(0)	B(<1)	D(2)	D(0)
A(2)	A(<1)	A(0)	D(<1)	B(<1)	G(0)
C(1)	C(<1)	C(0)	C(<1)	A(0)	A(0)

* Body regions (A-H) ranked in order of decreasing infestation expressed as % of total density (in parentheses).
A—rump, B—hindlegs and groin, C—back, D—belly, E—shoulders, F—forelegs and brisket, G—neck, H—head.

TABLE 3. Distribution of larvae and nymphs of **Ixodes scapularis** on white-tailed deer from Long Point, Ontario 1972-73*.

October		November December	March April		May June		July August	
Larvae	Nymphs	Larvae	Larvae	Nymphs	Larvae	Nymphs	Larvae	Nymphs
B(29)	A(37)	D(53)	B(47)	H(34)	F(53)	F(59)	F(60)	F(60)
C(27)	B(25)	F(25)	F(38)	F(32)	B(15)	H(16)	D(8)	E(12)
A(20)	F(20)	G(11)	A(5)	G(16)	D(7)	B(14)	H(8)	A(11)
G(11)	C(18)	B(7)	D(5)	B(13)	A(7)	G(3)	B(7)	D(9)
E(7)	D(0)	H(4)	G(2)	D(5)	G(5)	C(2)	A(5)	H(7)
F(6)	E(0)	A(0)	E(2)	A(0)	C(5)	A(2)	G(5)	B(<1)
D(0)	G(0)	C(0)	C(1)	C(0)	H(5)	E(2)	E(5)	C(0)
H(0)	H(0)	E(0)	H(<1)	E(0)	E(3)	D(2)	C(2)	G(0)

* Body regions (A-H) ranked in order of decreasing infestation expressed as % of total density (in parentheses). Nymphs were not collected from October to December.
A—rump, B—hindlegs and groin, C—back, D—belly, E—shoulders, F—forelegs and brisket, G—neck, H—head.

DISCUSSION

I. scapularis previously has been reported only once from Canada, in Ontario on man.[14] In the United States adults are most commonly found on cattle, dogs, deer and hogs and immature stages on a variety of birds, lizards and mice.[9,5,8] Bishopp and Trembley[3] gave the range of *I. scapularis* as southern Massachusetts, southward to Florida and from Indiana and Iowa south to Louisiana and Texas. Hooker *et al.*[9] recorded it as a parasite of "deer" in addition to a number of other wild animals. Travis[15] reported it on *O. virginianus* in Florida and Cooley and Kohls[4] recorded it as a parasite of "deer" in Arkansas and Texas.

Bishopp and Trembley[3] referred 65 lots of specimens from white-tailed deer to this species and noted it was collected every month of the year but in the southern United States it was most abundant during the fall and spring.[3,8] This species drops from its host to pass both larval and nymphal moults. This tick may have been introduced to Long Point by birds migrating north, since the Point is on the flyway of numerous birds returning from the southern United States.

On Long Point, adult *I. scapularis* were most commonly found on deer during the fall and winter (September 1972 to April 1973). Females were most abundant from September to December and in March-April while males were most abundant throughout the winter. This bimodal pattern of activity on vertebrates is similar to that found for *I. ricinus*, a closely related species, on livestock in England.[10,1]

The increase of female populations in spring probably indicates they spend the winter on the ground as *I. ricinus* is reported to do in Germany.[14] Increased temperatures and photoperiod in spring may induce females to become more active and attach to deer on Long Point. In spring, deer move back into the deciduous forest which possibly is the winter habitat of female ticks.

In the present study, low adult populations on deer during summer may be related to increased temperatures and solar radiation. Harris[8] found adult *I. scapularis* were most active in the laboratory near 21 C. MacLeod[10] found that, outside the optimum range for activity, adults of *I. ricinus* became positively geotropic. Milne[11,12] demonstrated that adult *I. ricinus* became negatively phototropic in intense solar radiation.

At Long Point, female ticks may oviposit in the spring and fall. That females oviposit in spring is indicated by the increasing abundance of larvae on deer throughout the summer although inhibition of oviposition in late fall could account for the presence of some larvae on deer in early spring. Fawns may be particularly vulnerable to attack by larvae (Table 1). The presence of nymphs on deer in early spring indicates some immature stages of a fall generation passed winter on the ground, as is known to occur in *I. ricinus*[14] or possibly on small rodents which hibernate.

Retardation of oviposition and metamorphosis has been demonstrated in *I. ricinus*.[14] Harris[8] found that optimum temperatures for activity of immature *I. scapularis* was about 26 C. This corresponds closely to ambient temperatures observed on Long Point during the summer.[2]

Adult ticks were found primarily on the neck and shoulders of deer throughout the study period. Attachment of adults to the head, neck and forebody was probably related to deer movement and grazing. While deer are bedded down or moving about their lower body regions are most susceptible to tick attachment. Since leg and posterior body regions are only lightly infested throughout the year the tick may migrate to most favourable sites. Adults may move onto the shoulders and neck where hair density provides shelter from the environment (solar radiation and temperature) and reduces the effectiveness of grooming of the deer. Wilkinson[17] found that 'prairie' and 'montane' *Dermacentor andersoni* moved to certain favoured sites on cattle. Wilkinson found ambient temperature affected movement of adults and solar radiation intensity affected site selection in both strains. Galuzo[6] noted seasonal and diurnal movement of *Dermacentor* spp. and *Boophilus calaratus* to regions on the host which provide increased protection from intense solar radiation.

In spring and summer at Long Point larvae and nymphs infested primarily the head, groin, brisket and legs of deer. Prevalence of immature stages on lower body regions during warmer months may be the result of their reduced mobility and the shelter afforded them by the trunk of the deer. Dense hair on the back, rump and neck may provide protection from the environment for immature ticks during colder months.

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LITERATURE CITED

1. ARTHUR, D. R. 1973. Host and tick relationships: a review. J. Wildl. Dis. 9: 74-84.
2. BAKER, M. R. and R. C. ANDERSON. 1975. Seasonal changes in abomasal worms (*Ostertagia* spp.) in white-tailed deer (*Odocoileus virginianus*) at Long Point, Ontario. Can. J. Zool. 53: 87-96.
3. BISHOPP, F. C. and H. L. TREMBLEY. 1945. Distribution and hosts of certain North American ticks. J. Parasit. 31: 1-54.
4. COOLEY, R. A. and G. M. KOHLS. 1945. The genus *Ixodes* in North America. Nat. Inst. Hlth. Bull. (184), U.S. Public Health Service.
5. EADS, R. B. 1949. Notes on *Ixodes scapularis* Say with an additional lizard host. Ent. News 60: 238-240.
6. GALUZO, I. G. 1943. The physical conditions of the development of ticks on the surface of the body of the host. Izv. kazakh. Fil. Akad. Nauk. No. 2: 97-105. Seen in summary only, Rev. App. Ent. (B) 35: 113.
7. GILBERT, F. F. 1966. Aging white-tailed deer by annuli in the cementum of the first incisor. J. Wildl. Manage. 30: 200-202.
8. HARRIS, R. L. 1959. Biology of the black-legged tick. J. Kans. Ent .Soc. 32: 61-68.
9. HOOKER, W. A., F. C. BISHOPP and H. P. WOOD. 1912. The life history and bionomics of some North American ticks. Bull. 106. Bur. Ent. U.S.D.A. 239 pp.
10. MacLEOD, J. 1939. The seasonal and annual incidence of the sheep tick, *Ixodes ricinus* L. in Britain. Bull. Ent. Res. 30: 103-118.
11. MILNE, A. 1945. The ecology of the sheep tick, *Ixodes ricinus* L. The seasonal activity in Britain with particular reference to northern England. Parasitology 36: 142-152.
12. MILNE, A. 1949. The ecology of the sheep tick, *Ixodes ricinus* L. Some further aspects of activity, seasonal and diurnal. Parasitology 38: 27-33.
13. MORRISON, D. F. 1967. *Multivariate statistical methods.* McGraw Hill Co., New York.
14. NUTTALL, G. H. F. and C. WARBURTON. 1911. Ticks. A monograph of the Ixodoidea. Part II. The Ixodidae. Cambridge Univ. Press, London.
15. TRAVIS, B. V. 1941. Examinations of wild animals for the cattle tick *Boophilis annulatus microplus* (Can.) in Florida. J. Parasit. 27: 465-467.
16. WATSON, T. G. and R. C. ANDERSON. 1975. Seasonal changes in louse populations on white-tailed deer (*Odocoileus virginianus*) Can. J. Zool. 53: 1047-1054.
17. WILKINSON, P. R. 1972. Sites of attachment of 'prairie' and 'montane' *Dermacentor andersoni* (Acarina: Ixodidae) on cattle. J. Med. Ent. 9: 133-137.

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