Ticks (Acari: Ixodidae) Parasitizing Domestic Dogs in Southeastern Georgia[1]

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Abstract Ticks (Acari: Ixodidae) were collected from family-owned domestic dogs, *Canis familiaris* L., in Bulloch Co., GA, from 1996 to 2003 and from dogs maintained in a shelter in Emanuel Co., GA, in 2002 and 2003. A total of 2,466 ticks representing 9 species was recovered. The most frequently recovered species from family-owned dogs were the blacklegged tick, *Ixodes scapularis* Say (54.6% of all ticks from this group of dogs), and American dog tick, *Dermacentor variabilis* (Say) (27.7%). Collections from shelter-maintained dogs were dominated by the brown dog tick, *Rhipicephalus sanguineus* (Latreille) (73.6%). Except for 39 nymphs of the lone star tick, *Amblyomma americanum* (L.), 12 nymphs of *R. sanguineus,* 7 nymphs of the Gulf Coast tick, *Amblyomma maculatum* Koch, 1 nymph of *D. variabilis* and 72 larvae of the gopher tortoise tick, *Amblyomma tuberculatum* Marx, only adult ticks were present. Seasonally, *I. scapularis* adults were recorded from October through May and were most common in the fall; whereas, *A. americanum, A. maculatum, A. tuberculatum, D. variabilis,* and *Ixodes affinis* Neumann were all found only during the spring, summer and/or early fall. Two species of ticks collected during this study, *A. tuberculatum* and *I. affinis,* have Coastal Plain distributions in the southern U.S. and would only be expected to parasitize dogs within this region.

Key Words Ticks, Acari, Ixodidae, dogs, *Canis familiaris,* southeastern Georgia, seasonal abundance

The tick faunas parasitizing domestic dogs, *Canis familiaris* L., have previously been documented from a few selected regions of the southern United States including southeastern Oklahoma and northwestern Arkansas (Koch 1982), southeastern South Carolina (Clark et al. 1996) and northwestern Georgia (Goldberg et al. 2002). However, except for some records reported by Lavender and Oliver (1996), ticks associated with dogs in southeastern Georgia have not previously been recorded. A few tick species such as the American dog tick, *Dermacentor variabilis* (Say), brown dog tick (=kennel tick), *Rhipicephalus sanguineus* (Latreille), and lone star tick, *Amblyomma americanum* (L.), would be expected to parasitize dogs throughout most of the South. However, other tick species such as the Gulf Coast tick, *Amblyomma maculatum* Koch, and *Ixodes affinis* Neumann, have more restricted ranges and would be expected to parasitize dogs only in certain areas. Further, the seasonality of different tick species parasitizing dogs in this region, and a comparison of the tick

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faunas associated with dogs maintained in different settings, have never been addressed. We, therefore, completed a survey of ticks associated with dogs in southeastern Georgia by recording and comparing tick species composition on family-owned and shelter-maintained dogs including tick seasonality data for the former group. Because *R. sanguineus* can be common in confined kennel operations that house multiple dogs, we hypothesized that this tick would be more common on shelter-maintained dogs than on family-owned dogs. We also predicted that tick vectors of both canine and zoonotic pathogens would be common in our samples.

Materials and Methods

Using fine forceps, ticks were removed from family-owned dogs by LAD and by staff at Statesboro Animal Hospital, in Statesboro, Bulloch Co., GA, from October 1996 through November 2003. Ticks were recovered from dogs maintained in the Swainsboro Animal Shelter, Emanuel Co., GA, by JLS with assistance from shelter staff in 2002 and 2003. Both counties are located in the Coastal Plain physiographic region of Georgia. For seasonality data, ticks were removed by LAD from a single family-owned dog in Bulloch Co. from 1996 through 2003 and segregated by month. The dog was exercised in the same woodland, scrub and field areas each month and for approximately the same amount of time each day during this period. All collected ticks were temporarily stored in labeled vials containing 70% ethanol and later identified to species and developmental stage using a low-power binocular microscope and recorded.

Results

A total of 2,098 ticks (1,980 adults, 46 nymphs, 72 larvae), representing 9 species, was collected from family-owned dogs in Bulloch Co. from September 1996 through November 2003 (Table 1). A total of 368 ticks (355 adults, 13 nymphs), representing 5 species was collected from shelter-maintained dogs in Emanuel Co. in 2002 and 2003 (Table 2). The major difference in tick samples between dogs maintained in these settings was that *R. sanguineus* dominated the shelter collections (73.6% of all ticks) but was rarely recovered from family-owned dogs (0.1% of all ticks). Also, *I. scapularis* was the most common tick on family-owned dogs (54.6% of all ticks) but was rare (0.3%) on shelter-maintained dogs.

Seasonality data were sufficiently large for only 3 tick species (*D. variabilis, I. scapularis* and *A. maculatum*) for meaningful graphical and statistical interpretation (Figs. 1-3). In order to reduce the size of the graphs, data for each month of the year were combined for the 8-yr study. Although some of the annual graphs showed minor year-to-year seasonality differences (graphs not shown), these were not significant.

Discussion

All of the tick species we recovered from dogs in this study have previously been reported from southeastern Georgia (Wilson and Baker 1972). Lavender and Oliver (1996) recorded 4 species of ticks from dogs in Bulloch Co., GA (*A. americanum, D. variabilis, I. scapularis* and *R. sanguineus*), all of which we also collected. Koch (1982) and Goldberg et al. (2002) each collected the same 6 species from dogs in

Table 1. Ticks recovered from family owned domestic dogs in Bulloch Co., GA, Sept. 1996-Nov. 2003

Tick species	Total (stages) collected	% of Ticks
Ixodes scapularis	1,146 (612♂, 534♀)	54.6
Dermacentor variabilis	582 (270♂, 311♀, 1N*)	27.7
Amblyomma maculatum	170 (108♂, 56♀, 6N)	8.1
Amblyomma americanum	109 (25♂, 45♀, 39N)	5.2
Amblyomma tuberculatum	72 (72L*)	3.4
Ixodes affinis	14 (12♂, 2♀)	0.7
Rhipicephalus sanguineus	3 (3♀)	0.1
Haemaphysalis leporispalustris	1 (1♀)	<0.1
Ixodes cookei	1 (1♀)	<0.1
Total	2,098 (1,027♂, 953♀, 46N, 72L)	

* N = nymph(s), L = larvae.

Table 2. Ticks recovered from dogs at the Swainsboro Animal Shelter, Emanuel Co., GA, 2002-2003

Tick species	Total (stages) collected	% of Ticks
Rhipicephalus sanguineus	271 (105♂, 154♀, 12N*)	73.6
Amblyomma maculatum	48 (30♂, 17♀, 1N)	13.0
Dermacentor variabilis	46 (30♂, 16♀)	12.5
Amblyomma americanum	2 (1♂, 1♀)	0.5
Ixodes scapularis	1 (1♀)	0.3
Total	368 (166♂, 189♀, 13N)	

* N = nymph(s).

Oklahoma/Arkansas and northwestern Georgia, respectively (*A. americanum, A. maculatum, D. variabilis, Ixodes cookei* Packard, *I. scapularis,* and *R. sanguineus*), all of which we also collected. Clark et al. (1996) also recorded 6 species of ticks from dogs in southeastern South Carolina, including 5 of the 6 species reported by both Koch (1982) and Goldberg et al. (2002).

There are few previous records from dogs for 2 of the tick species we recorded, *I. affinis* and the gopher tortoise tick, *A. tuberculatum.* Both of these ticks are confined to the Coastal Plain of the southern (*A. tuberculatum*) or southeastern (*I. affinis*) United States (Durden and Keirans 1996, Keirans and Durden 1998). *Ixodes affinis* also occurs in the neotropical region (Durden and Keirans 1996). Adults of *A. tuberculatum* exclusively parasitize the gopher tortoise, *Gopherus polyphemus* (Daudin); whereas, nymphs and larvae of this tick are progressively less host specific with

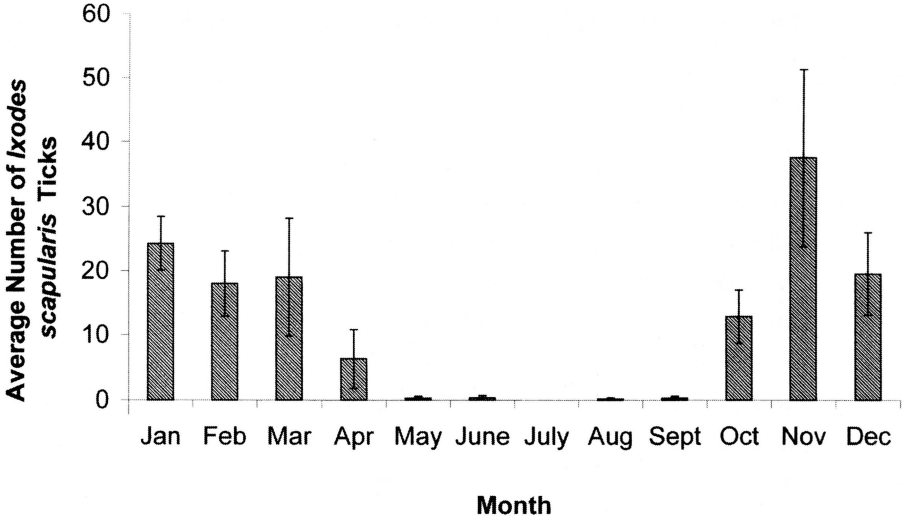

Fig. 1. Seasonality of adult *Ixodes scapularis* parasitizing domestic dogs in Bulloch Co., GA, 1996-2003 (95% standard error bars included).

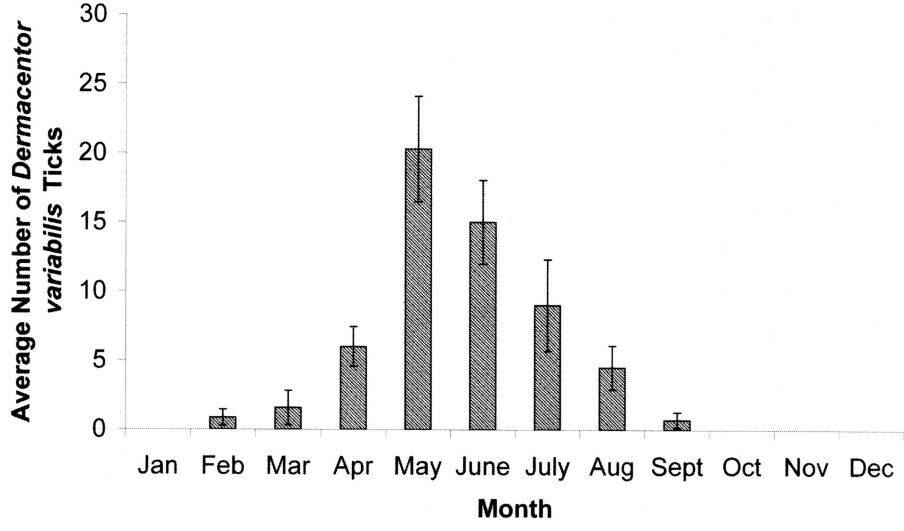

Fig. 2. Seasonality of adult *Dermacentor variabilis* parasitizing domestic dogs in Bulloch Co., GA, 1996-2003 (95% standard error bars included).

larvae (the only stage that we recovered from dogs) being recorded from a variety of reptiles, birds and mammals (Cooney and Hays 1972, Keirans and Durden 1998). Adults of *I. affinis* parasitize larger mammals such as white-tailed deer, *Odocoileus virginianus* (Zimmermann), bobcat, *Felis rufus* (Schreber), raccoon, *Procyon lotor*

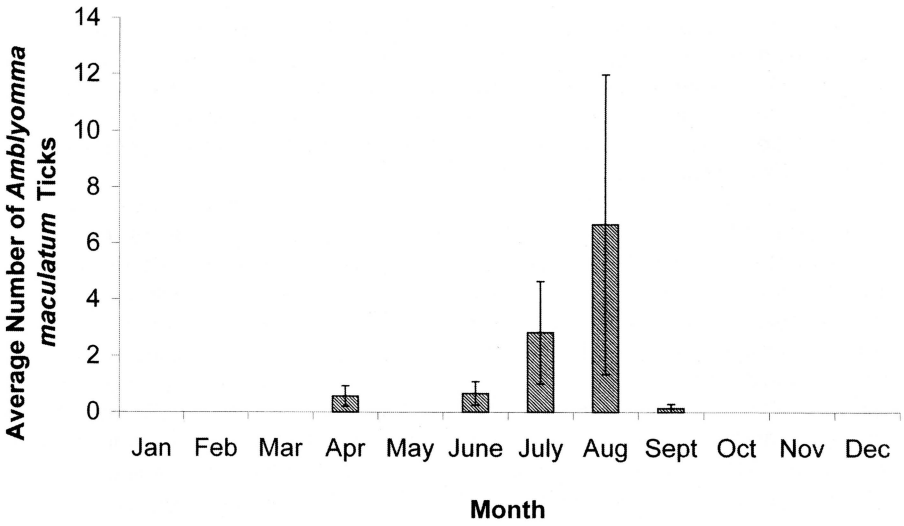

Fig. 3. Seasonality of adult *Amblyomma maculatum* parasitizing domestic dogs in Bulloch Co., GA, 1996-2003 (95% standard error bars included).

(L.), and occasionally dogs (Durden and Keirans 1996). Although *A. maculatum* is also a southern tick in North America, its range extends further north than that of both *A. tuberculatum* and *I. affinis.* Further, immature stages of *A. maculatum* sometimes attach to migrating birds and can be carried much further north (Keirans and Durden 1998). With the exception of the single rabbit tick, *Haemaphysalis leporispalusris* (Packard), the remaining tick species that we collected would be expected to parasitize dogs in the southern United States. Notably, 2,335 of the 2,446 ticks we recovered (94.7%) were adults.

The difference between the tick faunas associated with family-owned versus shelter-maintained dogs was mainly due to the large proportion of *R. sanguineus* associated with the latter group of dogs (Table 2). *Rhipicephalus sanguineus* is known to become established in kennel settings, often in large numbers (Strickland et al. 1976), and this tick evidently was well established at the shelter facility that we sampled. Conversely, the households where the family-owned pets were maintained evidently were not conducive to this tick becoming established in those settings. Instead, the tick fauna that we recorded from family-owned dogs suggested that these dogs were parasitized by ticks that had been questing on vegetation (or in sandhill scrub habitat for *A. tuberculatum* larvae) while the pets were walked or allowed to exercise.

Some of the ticks collected in this study showed clear seasonal trends. Adults of *I. scapularis* were recovered from dogs in all months except July but were most abundant from October through March with a peak in late Fall (November) (Fig. 1). Adults of *D. variabilis* were collected from February through September and showed a unimodal seasonality with a peak in May (Fig. 2). Adults of *A. maculatum* were recorded in only 4 months and showed a distinct late summer (July/August) peak (Fig. 3). We collected *R. sanguineus* from shelter dogs in all sampling months. Similarly, Koch (1982) recorded *R. sanguineus* (mainly adults) from dogs in Oklahoma/

Arkansas in all months except December. Koch (1982) also recovered *A. americanum* (larvae, nymphs and adults) from dogs in all months but recorded very few adults of this species from August through December. In agreement with our findings, Koch (1982) recorded only adults of both *D. variabilis* and *I. scapularis* on dogs, with seasonalities in his study extending from March through September and from October through May, respectively.

Some of the ticks collected in this study are known vectors of canine or zoonotic pathogens; whereas, others can cause tick paralysis. In eastern North America, *D. variabilis* is the principal vector of *Rickettsia rickettsii* (Wolbach), the causative agent of Rocky Mountain spotted fever. Certain individual females of this tick can also cause tick paralysis, and some females of *D. variabilis* that were recovered from dogs by veterinary workers during this study were implicated in cases of canine tick paralysis (W. B. Morgan, pers. comm.). Other tick species that we collected (*I. scapularis* and *A. maculatum*) can also cause tick paralysis on rare occasions (Strickland et al. 1976). In addition, *I. scapularis* can transmit several pathogens including *Borrelia burgdorferi* Johnson, Schmid, Hyde, Steigerwalt & Brenner, the etiologic agent of Lyme disease, *Anaplasma* (formerly *Ehrlichia*) *phagocytophila* (Foggie), an agent of Human Granulocytic Ehrlichiosis (HGE), and *Babesia microti* (Franca), an agent of human babesiosis (Durden and Keirans 1996). Similarly, *A. americanum* can transmit *Ehrlichia chaffeensis* Anderson, Dawson, Jones and Wilson, an agent of Human Monocytic Ehrlichiosis (HME), *Ehrlichia ewingii* Anderson, Greene, Jones and Dawson, an agent of canine (and rarely human) ehrlichiosis, and *Borrelia lonestari* Barbour, Maupin, Teltow, Carter & Piesman, the putative agent of Southern Tick Associated Rash Illness (STARI) (Paddock and Childs 2003). Further, *A. maculatum* can transmit *Hepatozoon americanum* Vincent-Johnson, Macintire, Lindsay, Lenz, Baneth and Shkap to dogs (Mathew et al. 1998). *Rhipicephalus sanguineus* is the principal vector of *Ehrlichia canis* (Donatien and Lestoquard) and is a potential vector of *Ehrlichia platys* French and Harvey, both of which are agents of canine ehrlichiosis, and of *Babesia canis* (Piana and Galli Valerio), the principal agent of canine babesiosis (Strickland et al. 1976, Kordick et al. 1999). Recent evidence suggests that some ticks may also be vectors of pathogenic canine-associated bartonellae (Kordick et al. 1999, Chang et al. 2001). Given the role of several different species of dog-associated ticks as vectors of pathogenic agents or as causes of tick paralysis, it is important to document the tick communities that parasitize dogs in different geographical regions.

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