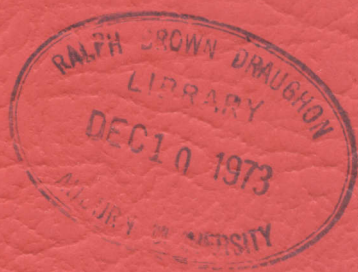


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# THE TICKS of ALABAMA (Ixodidae: Acarina)



AGRICULTURAL EXPERIMENT STATION  
AUBURN UNIVERSITY

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**THE TICKS of ALABAMA**  
**(Ixodidae: Acarina)**

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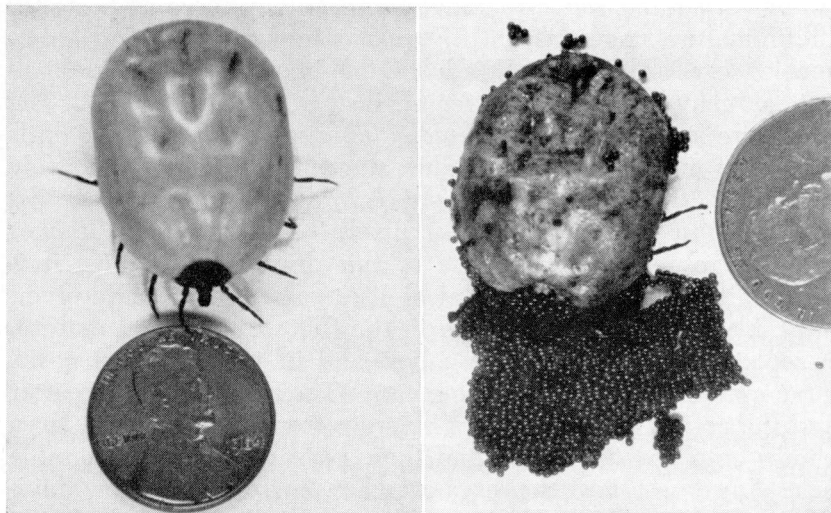
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# THE TICKS of ALABAMA (Ixodidae: Acarina)

JOSEPH C. COONEY and KIRBY L. HAYS<sup>1</sup>

## INTRODUCTION

THIS RESEARCH on the Ixodidae of Alabama was begun in 1963 and continued through the summer of 1966. Up to this time, the Alabama Ixodidae had received little individual attention, although Alabama records had been included in monographs by Cooley and Kohls (8), Bishopp and Trembley (6), and Clifford *et al.* (7). Because of the importance of this group as parasites of man and animals, this research was conducted to further knowledge concerning the species occurring in Alabama.



The relative sizes of a female *Amblyomma tuberculatum* and her egg mass compared to a penny.

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Keys have been constructed for identification of larvae, nymphs, and adults of Alabama genera and species. These keys are morphologically oriented so they can be utilized by non-specialists and specialists alike, to identify specimens occurring in Alabama.

## BIOLOGY

Ticks belong to the superfamily Ixodoidea of the order Acarina. This superfamily is divided into two families: (1) the Ixodidae, hard ticks and (2) the Argasidae, soft ticks. The hard ticks of the family Ixodidae can be distinguished from the soft ticks by the presence of the scutum, a hard dorsal shield which is not present in the Argasidae. The Ixodidae are more numerous in terms of numbers and species and are of more importance medically and economically. They parasitize a wide variety of homoiothermic hosts, including man. Very few mammal species are free of their attacks. Some species are also parasitic on poikilothermic animals. Of the 14 species known to occur in Alabama, 7 are almost entirely specific for certain animal hosts during the various life stages. The remainder of the species either feed on a selected group of hosts, or a wide range of animals as does *Amblyomma americanum*. Small animals may serve as hosts for the immature stages, as with *Dermacentor variabilis*, and larger species serve as hosts for the adult stage; in other species the small animals may serve as hosts for all instars (*Ixodes woodi*). The immature stages of *Haemaphysalis leporispalustris* feed on birds as well as mammals, but the adult stages feed almost exclusively on rabbits. The adults of *I. marxi*, *I. brunneus* and *A. tuberculatum* are host specific for tree squirrels, small birds, and gopher tortoises respectively. Because of this diversity in habits, it is difficult to characterize a typical life-cycle of ticks. However, most Alabama Ixodidae adhere to the following general pattern. A replete female drops from a host and in a few days deposits large numbers of eggs in a single mass. The female dies thereafter and the active six-legged larva emerges from the egg. The larva climbs onto low vegetation and there passively awaits a suitable host. Once on a host the larva attaches, engorges in a few days, and then drops from the host. After a quiescent period of several weeks, moulting occurs, and the 8-legged nymphal stage emerges. The nymph, as did the larva, climbs onto some vegetation and awaits a second host. Upon obtaining a suitable host and engorging, the replete nymph drops to the ground, undergoes a

quiescent period, and moults to the sexually mature adult. Mating among adults may occur before or after feeding either on or off the host. The female attaches to the host and engorges slowly over a long period of time finally becoming greatly distended. The engorged female of *A. tuberculatum* is probably the largest species of tick known.

Further notes on the bionomics of particular species will be included in the individual discussions.

## GEOGRAPHIC DISTRIBUTION

The Ixodidae occur in all parts of Alabama, a State which can conveniently be divided into four diverse major geologic regions. These regions are usually called the Coastal Plain, the Piedmont Plateau, the Appalachian Mountains, and the Limestone Valleys. Some species of ticks are widespread in the State while others appear to be restricted to one or two of these regions. However, this apparent limitation is probably not a result of edaphic and climatic conditions associated with the different regions but is probably more closely related to the distribution of specific host animals. *Amblyomma maculatum*, the Gulf Coast Tick, is restricted to the southern one-third of the State, and represents a geographically limited distribution since it parasitizes a wide range of animals which occur in all parts of the State. *Amblyomma tuberculatum* is found in only the deep sandy soil region of the southern counties and its distribution, not only in Alabama but throughout the southeastern United States, coincides with that of its host the gopher tortoise. The only collection of *Ixodes woodi* was from a woodrat found in a cave in northeastern Alabama. All previous collections of this species have been associated with woodrats. *Ixodes scapularis* has been collected in both the northern and southern counties, but is much more abundant in the south. *Dermacentor variabilis* and *A. americanum* are the most commonly encountered species, and they infest many hosts throughout the State.

## ECONOMIC IMPORTANCE

Of all the species of blood-sucking arthropods which attack man, none is more commonly feared than the tick. During a casual outing, a man may unknowingly become infested with hundreds of larvae, whose presence may remain undetected for

several days. The mere presence of ticks on a person often causes psychotic responses. Ticks firmly attach to the host when feeding, while most of the other blood-sucking arthropods only rest on the surface. This attachment complicates removal and in many instances causes secondary problems. Species of *Dermacentor*, *Rhipicephalus*, and *Haemaphysalis* have relatively short mouthparts and are easily removed. However, species of *Amblyomma* and *Ixodes* have long mouthparts and are difficult to remove.

Aside from annoyance, ticks may produce pathological conditions in man and animals which range from a mild dermatitis to severe anemia and paralysis. Several species of ticks transmit disease organisms to man and animals in nature, and many others have demonstrated this capability in the laboratory. Ticks can transovarially transmit certain pathogenic organisms to their offspring; thus, all stages are capable of transmitting infections. In the United States, ticks are important vectors of the following diseases: Colorado tick fever, Rocky Mountain spotted fever; tularemia; relapsing fever; and Q fever. They have also been incriminated with the transmission of anaplasmosis, toxoplasmosis, and some of the encephalitides. Human cases of tularemia and Rocky Mountain spotted fever are reported annually from Alabama, and it is probable that in the Gulf Coast counties, "maculatum disease," is present. This disease organism has been found in *Amblyomma maculatum* from two southeastern Mississippi counties which border Alabama.

## COLLECTION AND PRESERVATION TECHNIQUES

Most of the ticks reported herein were collected by removal from their hosts. The host animals usually were obtained by trapping, shooting, or were caught by hand. Immediately on collection, the smaller animals were placed in a plastic bag to which chloroform had been added. The bag was sealed, and the ectoparasites allowed to die. The dead or incapacitated ectoparasites were combed from the animals' fur and placed in vials of Hood's solution (modified). Ticks were hand picked from the dead or anesthetized larger carnivora, as well as from live domestic animals. Collections were also made using the standard techniques employed in flagging for ticks and in sweep net collection of insects.



Identifications of the adult and nymphal stages, and the larvae of some of the species were made by viewing whole specimens with a dissecting microscope and utilizing specific diagnostic morphological features. The remaining larvae were mounted on glass slides and viewed with a compound microscope to distinguish differences in setal patterns.

## TAXONOMY

The first written accounts of ticks came from the writings of Aristotle between 384 and 322 B.C. According to Nuttall *et al.* (26) Aristotle wrote, "Ticks come out of the grass. The ass has no lice or ticks; oxen have both . . . among dogs Cynorhaestes are plentiful."

Pliny in A.D. 77, in Nuttall *et al.* (26), says that, "there is an animal (occurring) at the same season (summer?), living on blood, with its head always fixed, and swelling; (being) one of the animals which has no (anus) exit for its food, it bursts with overrepletion and dies from its actual nourishment. This animal never occurs on mules, (it is) frequent on cattle, (it occurs) sometimes on dogs, on which all (kinds of lice) are found; on sheep and goats the one only (is found)."

Since the writings of Aristotle and Pliny, the taxonomy and classification of ticks have received much attention. According to Banks (3), Latreille, in 1795, divided the ticks into two genera, *Argas* and *Ixodes*. Say, in 1821, described eight species of North American ticks, and Packard and Fitch described several more in 1869 and in 1871 respectively. Koch, in 1844, described a large number of species from all over the world.

George Marx was a serious student of ticks, and in 1892 he proposed that the ticks be placed as a group in a suborder of the Acari which he called Cynorhaesta, the oldest name for ticks since Homer. In 1896, George Neumann, began the publication of his revision of the Ixodidae of the world which, when completed, had four parts or books.

Banks (3) proposed a new classification of the Ixodidae based on the presence or absence of the anal groove. In the genus *Ixodes* this groove is present in front of the anus; in the others it is absent or exists as an arc behind the anus. Cooley and Kohls (8) paper is the latest monograph of the genus *Ixodes* in North America. In this publication, they described 41 distinct species of the genus.

Their studies revealed additional useful specific morphological characters and emphasized the importance of geographical distribution and variation in the differentiation of species.

Bequaert (4) monographed the ticks of the northeastern United States and Canada, and in his classification of the group retained Ixodoidea as the superfamily of the ticks. He divided this superfamily into two families — the Argasidae to include the genera *Argas* and *Ornithodoros*, and the Ixodidae consisting of *Ixodes*, *Amblyomma*, *Haemaphysalis*, *Dermacentor*, *Boophilus*, and *Rhipicephalus*. Since that time two additional genera of hard ticks, *Anocentor* and *Aponoma*, have been added to the family Ixodidae, and *Otobius* and *Antricola* have been included in the Argasidae. Other works including the distribution of North American ticks include Gregson's (14) survey "the Ixodoidea of Canada" and Arthur's (2) "Ticks: A Monograph of the Ixodoidea," which deals with the genera *Dermacentor*, *Anocentor*, *Cosmiomma*, *Boophilus*, and *Margaropus*, and Clifford *et al.* (7) contributed to tick taxonomy in their work on the larval ixodid ticks of the eastern United States.

The modern classification of ticks is difficult because closely related species are frequently descriptively very similar. Differences are difficult to detect, particularly in the genus *Ixodes*, and consist of ridges, depth and number of punctations, relative size of spurs, humps, and spines, and dentition of hypostomes which are often missing. Thus, it is important that all factors which may contribute to the identification of species, including host and locality, be given attention. Therefore, the keys in this paper have been made as simple as possible by using characters which are least variable and most obvious. In cases where actual specimens have not been seen, the keys have been constructed with characters of the species descriptions by Cooley and Kohls (8), Cooley (9,10), Kohls (19), Anastos and Smith (1), Hays and Lawrence (15), Arthur (2), and Clifford *et al.* (7). The ultimate taxonomic purpose of this paper is to provide a means whereby the trained entomologist and the non-specialist can easily identify specimens of Alabama Ixodidae.

## GLOSSARY

An alphabetical listing of terms used in the keys and descriptions is presented. General and common-use entomological terms are not included.

- ADANAL PLATES. In males the paired ventral plates bordering and usually laterad to the anal plate.
- ANAL GROOVE. A groove that partially surrounds the anus; anteriorly in *Ixodes*, posteriorly in the remaining genera.
- ANAL PLATE. In *Ixodes* the single ventral plate surrounding the anus.
- ANUS. The posterior opening of the alimentary tract situated ventrally on the median line posterior to coxae 4.
- ARTICLE. Each articulated segment of the appendages; the palpal articles are designated 1, 2, 3, or 4 with the basal article number 1.
- AURICULAE. Paired extensions or protuberances on either side of the ventral surface of the basis capitulum; they may be horn-like, ridgelike or protuberant.
- BASIS CAPITULUM (BASIS). The basal portion of the capitulum to which the mouthparts are attached and is movably attached to the body.
- CAPITULUM. The head or anterior portion of the tick including the mouthparts and the basis capitulum.
- CERVICAL GROOVES. Paired grooves lateral in the scutum and extending posteriorly from near the anterior margin.
- CHELICERAE. Paired mouthparts lying dorsal to the hypostome and used for piercing and cutting the hosts' skin.
- CORNUA. Postero-lateral projections of the basis capitulum usually best seen when viewed dorsally; ventral cornua may also occur in some species.
- COXAE. The basal segments of the legs are designated coxa I, II, III, and IV, beginning anteriorly.
- COXAL SPURS. Large or small posterior projections of the coxae; the internal spur is mediad and the external spur laterad.
- CRENULATIONS. The small denticles aligned diagonally or in transverse rows on the hypostomes of some males.
- DENTICLES. The individual recurved teeth on the ventral side of the hypostome, usually aligned in longitudinal rows.
- DENTITION. The arrangement of the denticles on the hypostome into files or longitudinal rows; the outermost row is file 1.
- DORSAL PROLONGATION. The postero-dorsal extension of the spiracular plate as in *Dermacentor variabilis*.
- DORSUM. The upper surface of the body.
- EMARGINATION. The "cutout" area of the scutum between the scapulae, into which the basis capitulum fits.

EXTERNAL SPUR. See coxal spurs.

EYES. The lenslike structures dorsally at the lateral angle of the scutum; absent in *Ixodes* and *Haemaphysalis*.

FESTOONS. The uniform rectangular areas separated by grooves along the posterior margin of the body, not occurring in the genus *Ixodes* or *Boophilus*.

FILES. See dentition.

GENITAL APERTURE. The sexual opening of the adult tick, situated ventrally on the midline between the coxae.

GOBLET. The small or large pores contained in the spiracular plate.

HYPOSTOME. The toothed central "hold-fast" structure of the mouthparts which is immovably attached to the basis capitulum.

INTERNAL SPUR. See coxal spurs.

LATERAL CARINAE. Lineal ridges along the lateral edges of the scutum.

MACULA. The sclerotized central portion of the spiracular plate surrounded by the goblets.

MARGINAL GROOVES. In females, grooves along the body margin extending posteriorly from the scutum.

MEDIAN PLATE. The middle ventral plate of *Ixodes* males extending from the genital to the anal aperture.

ORNAMENTATION. The coloration pattern of white or gray superimposed on the base color, particularly in *Dermacentor* and *Amblyomma*.

PALPI. Paired articulated appendages of the basis capitulum lying parallel to the hypostome; composed of 4 segments or articles.

POROSE AREAS. Paired, circular to ovoid depressed granular areas on the dorsum of the basis capitulum, in females.

PUNCTATIONS. Pits in the surface of the scutum; they may be large or small, deep or shallow, numerous or sparse.

SALIENT. A projecting edge.

SCAPULAE. The anterior marginal angles of the scutum at the side of the basis capitulum.

SCUTUM. The dorsal sclerotized plate completely covering the dorsum of males and covering the anterior dorsal portion of females, nymphs, and larvae.

SPIRACULAR PLATES. Paired respiratory structures usually situated laterad and behind coxae IV.

**TARSAL HUMP.** The terminal dorsal hump present on the tarsi of certain *Ixodes*.

**TARSUS.** The terminal leg segment.

**VENTER.** The undersurface of the body.

**VENTRAL CORNUA.** Posterior extensions or prolongations on the ventral marginal surface of the basis capitulum, as in *Haemaphysalis leporispalustris*.

## LIST OF INCLUDED SPECIES

- Amblyomma americanum* (Linnaeus)
- Amblyomma maculatum* (Koch)
- Amblyomma tuberculatum* Marx
- Boophilus annulatus* (Say)
- Dermacentor albipictus* Packard
- Dermacentor variabilis* (Say)
- Haemaphysalis chordeilis* (Packard)
- Haemaphysalis leporispalustris* (Packard)
- Ixodes banksi* Bishopp
- Ixodes brunneus* Koch
- Ixodes cookei* Packard
- Ixodes dentatus* Marx
- Ixodes marxi* Banks
- Ixodes scapularis* Say
- Ixodes texanus* Banks
- Ixodes woodi* Bishopp
- Rhipicephalus sanguineus* (Latreille)

## Family Ixodidae—Hard Ticks

Ticks with scutum almost completely covering the dorsum in males, limited to the anterior portion of the dorsum in females, nymphs, and larvae. Sexual dimorphism pronounced. Capitulum terminal and conspicuous. Integument smooth. The life-cycle includes three parasitic stages, all of which require a separate blood meal. Engorgement is accomplished over a period of days; the feeding time for repletion increases with each life stage. Females deposit large numbers of eggs, in one batch, and die. All of the known Alabama Ixodidae have previously been discussed in papers dealing with the Ixodidae in North America.

## Key to the Genera of Alabama Ixodidae

1. Venter with a groove on either side of the anus, converging in front; festoons and eyes absent; scutum inornate.....*Ixodes* p. 12  
 Venter with a semicircular groove behind and partially enclosing the anus, or the groove is indistinct; festoons and eyes may be present; scutum may be ornate..... 2
2. Eyes absent; the second palpal segment laterally produced; scutum inornate.....*Haemaphysalis* p. 20  
 Eyes present; the second palpal segment not laterally produced..... 3
3. Scutum inornate; basis capitulum laterally produced..... 4  
 Scutum ornate; basis capitulum not laterally produced..... 5
4. Festoons present.....*Rhipicephalus* p. 23  
 Festoons absent.....*Boophilus* p. 23
5. Second segment of palpi about as long as wide; coxa I deeply bifid.....*Dermacentor* p. 24  
 Second segment of palpi twice as long as wide; coxa I not bifid.....*Amblyomma* p. 27

## Genus *Ixodes*

LONG OVAL SPECIES. Anal grooves embracing the anus anteriorly and usually uniting in a point or arch; usually extending posteriorly to the hind margin of the body. Inornate, lacking festoons and eyes. Capitulum ventral with many variations in auriculae, from faint ridges to robust horns. Palpi generally long and slender, the second segment usually twice as long as wide; the third almost as long. Male venter with seven non salient plates. Marked sexual dimorphism, especially in the hypostome; the denticles occurring in longitudinal files in the females, in the males with little distinction among the denticles, which usually occur as transverse crenulations instead of longitudinal files. Eight species occur in Alabama.

## Key to Females

1. Coxal spurs present on at least one of the coxae..... 3  
 Coxal spurs indistinct or absent..... 2
2. Scutum distinctly longer than wide; basis capitulum ventrally with broad, blunt, tooth-like auriculae.....*I. marxi* p. 18  
 Scutum slightly longer or not longer than wide; basis capitulum ventrally without or with barely indicated auriculae.....*I. texanus* p. 16
3. Scutum only slightly longer than wide..... 5  
 Scutum almost one and one-half times as long as wide..... 4
4. Lateral carinae distinct and prominent; basis capitulum without auriculae; dentition of the hypostome 2/2.....*I. woodi* p. 19

- Lateral carinae absent; basis capitulum with broad blunt auriculae; dentition of the hypostome 4/4, 3/3, and then 2/2 to the base.....*I. brunneus* p. 20
5. Lateral carinae absent; hypostome with dentition 4/4 apically, then 3/3, and 2/2 to the base.....*I. scapularis* p. 15
- Lateral carinae present; dentition of hypostome not as above.....6
6. Basis capitulum with distinct hornlike auriculae; dentition 6/6 apically, then 5/5, 4/4, and 3/3 at the base.....*I. dentatus* p. 15
- Basis capitulum with auriculae as small or indistinct lateral processes; apical dentition 3/3 or 2/2.....7
7. Basis capitulum dorsally with short but distinct cornua; dentition 3/3 apically and then 2/2 to the base.....*I. cookei* p. 17
- Basis without cornua; dentition 2/2.....*I. banksi* p. 19

### Key to Males

1. Coxa I with a long tapering internal spur.....5
- Coxa I with a short internal spur or wanting.....2
2. Hypostome not deeply notched apically; external spurs of coxae vestigial or wanting.....4
- Hypostome deeply notched apically; all coxae with small but distinct external spurs.....3
3. Coxa I with two equal spurs, internal spurs present on coxae II and III; in mounted specimens the hypostome has dentition 3/3.....
- .....*I. brunneus* p. 20
- Coxa I with the internal spur distinctly larger than the external spur, internal spurs wanting on coxae II and III; hypostome has the denticles arranged 4/4.....*I. woodi* p. 19
4. Hypostome faintly notched apically, in mounted specimens with distinct denticles arranged 3/3; spiracular plate diameter about .15 with sparse goblets; usually on tree squirrels.....*I. marxi* p. 18
- Hypostome rounded apically, in mounted specimens with denticles as transverse crenulations; spiracular plate diameter about .30 with numerous goblets; not usually on tree squirrels.....*I. texanus* p. 16
5. Median ventral plate equal to or slightly longer than anal plate; spiracular plate subcircular.....*I. cookei* p. 17
- Median ventral plate 1.4 to 4 times as long as anal plate; spiracular plate distinctly longer than wide.....6
6. Median ventral plate 1.4 times as long as anal plate; scapulae short and rounded; hypostome with distinct denticles, arranged 3/3.....
- .....*I. banksi* p. 19
- Median ventral plate more than twice as long as anal plate; scapulae long and pointed; hypostome with denticles arranged in transverse crenulations.....7
7. Median ventral plate little more than twice as long as anal plate; cornua small but distinct; hypostome with the lateral denticles not much longer than the median ones.....*I. dentatus* p. 15
- Median ventral plate four times as long as anal plate; cornua absent; hypostome with a few lateral denticles much larger than the median ones.....*I. scapularis* p. 15

## Key to Nymphs

1. External spurs well defined on all coxae ..... 3  
External spurs not present on all coxae ..... 2
2. Basis capitulum dorsally with the lateral margins parallel, ventrally with faint suggestions of auriculae; scutum wider than long.....*I. texanus* p. 16  
Basis capitulum dorsally with the lateral margins divergent posteriorly, ventrally with auriculae as rounded salient lobes; scutum longer than wide ..... *I. marxi* p. 18
3. Coxa I with a long, pointed, internal spur ..... 4  
Coxa I without a long, pointed, internal spur ..... 5
4. Auriculae as small lobes, not raised over the general surface of the basis capitulum; hypostome with dentition 4/4, apically.....*I. dentatus* p. 15  
Auriculae as faint ridges; hypostome with dentition 2/2.....*I. banksi* p. 19
5. Hypostome with dentition 3/3 and then 2/2 to the base ..... 6  
Hypostome with dentition 2/2 ..... 7
6. Cornua large and directed laterally; auriculae as large lateral projections ..... *I. brunneus* p. 20  
Cornua long, pointed and directed posteriorly; auriculae small and pointed ..... *I. scapularis* p. 15
7. Posterior dorsal margin of basis sinuous; palpal article 1 with a long posterior spur and a mild anterior spur; auriculae as distinct lateral extensions ..... *I. cookei* p. 17  
Posterior dorsal margin of basis straight; palpal article 1 with a distinct posterior horn, anterior spur absent; auriculae as short rounded teeth ..... *I. woodi* p. 19

## Key to Larvae

The larva of *Ixodes woodi* is unknown.

1. Coxae II and III without spurs; dentition of hypostome always 2/2..... 2  
Coxae II and III with spurs; dentition of hypostome variable ..... 4
2. Coxa I without spurs ..... *I. banksi* p. 19  
Coxa I with spurs ..... 3
3. Basis capitulum ventrally without auriculae; palpal articles II and III about equal in length ..... *I. texanus* p. 16  
Basis capitulum ventrally with laterally extending auriculae at the margins; palpal article II longer than III (on gray squirrels).....*I. marxi* p. 18
4. Hypostome with apical dentition 3/3; coxa I or II with a small protuberance at the lateral margin of the segment; tarsus I long and gradually tapering distally ..... 5  
Hypostome with apical dentition 2/2; coxa I and II without protuberance; tarsus I long and tapering abruptly distally ..... *I. cookei* p. 17
5. Hypostome with dentition 3/3 and then 2/2 to the base; basis capitulum ventrally with triangular auriculae; coxa I with a small triangular internal spur ..... 6  
Hypostome with dentition 3/3 to the base; basis capitulum ventrally without auriculae; coxa I with a long pointed triangular internal spur ..... *I. dentatus* p. 15



6. Basis capitulum dorsally with the posterior margin straight, ventrally with large projecting triangular auriculae; palpal article 2 longer than 3; on birds.....*I. brunneus* p. 20  
 Basis capitulum dorsally with the posterior margin straight but indented slightly at the lateral angles, ventrally with the lateral edge of the basis indented and with small triangular auriculae; palpal articles 2 and 3 about equal in length.....*I. scapularis* p. 15

### *Ixodes scapularis* Say, 1821

“The Black Legged Tick”

This species can be recognized by the characters cited in the keys. It is not important in the transmission of any known disease; however, it is important as a parasite of large numbers of animals. It occurs primarily in the southeastern United States and Texas, Arkansas, and Louisiana.

Alabama distribution: Bibb, Barbour, Clarke, Escambia, Pickens, Winston, and Colbert counties. Specimens were taken in both the northern and southern portions of the State with numbers progressively reduced toward the northern region. Specimens were taken in April, May, July, November, December, and January. Adults were collected mainly during the fall and spring. These records agree with those of Bishopp and Trembley (6) who state that in the South *I. scapularis* is most abundant during the fall and spring and that the immature stages are found more commonly on hosts in the summer than are the adults. Five pairs of adults, three on whitetailed deer and two on a bobcat, were taken while in the copulatory position during November and December. These records demonstrate that *I. scapularis* mates on the host and that breeding may continue on into the winter in the southern United States.

Specimens examined: 31 males, 68 females, 6 nymphs.

Hosts: This species parasitizes a wide range of animal hosts including reptiles, birds, and mammals. The adults are primarily parasites of larger Alabama mammals with the whitetailed deer apparently the preferred host. Specimens occur on deer mainly in the perianal region and on the inner surfaces of the ears. The bobcat, as well as domestic dogs and cats, are commonly parasitized. Ticks were also recovered from the clothing of the authors.

The immature stages, according to the records of Bishopp and Trembley (6), and Clifford *et al.* (7), occur on smaller mammals, particularly the smaller rodentia, reptiles, and birds. Five nymphs were taken from the axillary region of a southeastern five-lined skink. Other Alabama records are shown in Table 1.

### *Ixodes dentatus* Marx, 1899

“The Rabbit Ixodes”

This small species of *Ixodes* appears to have little economic importance although it could serve as a vector of tularemia among rabbits. However, it occurs on rabbits in sufficient numbers to cause annoyance, irritation, and

possible anemia. It is distributed along the Atlantic Coast from Massachusetts to Alabama with the majority of collections coming from the Middle Atlantic states. Isolated records have been reported from as far inland as Iowa.

Alabama distribution: Barbour, Butler, Chambers, DeKalb, Jackson, Lee, and Macon counties. *Ixodes dentatus* is widespread in Alabama having been reported from both northern and southern ends of the State.

Seasonal distribution: All stages of this species were collected on hosts during all seasons of the year indicating that it remains active the year round.

Specimens examined: 9 males, 13 females, 19 nymphs and 132 larvae.

Hosts: In Alabama *Ixodes dentatus* is primarily a parasite of cottontail and swamp rabbits. The adult stage was collected exclusively from these hosts; however, the immature stages were occasionally taken on small rodents. One swamp rabbit alone harbored 115 specimens of *I. dentatus*, along with 169 specimens of *Haemphysalis leporispalustris*, with whom it appears compatible, since both species were found closely associated on the same host. Of 19 collections of *I. dentatus*, *H. leporispalustris* was coexistent on 79 per cent of the hosts.

Clifford *et al.* (7), found that in Maryland, birds are an important host for the larvae; however, in Alabama this was not found to be true, probably because of the relative sparseness of bird collections. The collection of a nymph from a raccoon was believed to be an accidental occurrence, but later the authors saw several nymphs from raccoons from Kentucky and Tennessee. These records may also constitute the first report of this species from Kentucky and/or Tennessee. Additional host records are presented in Table 1.

### *Ixodes texanus* Banks, 1908

#### "The Raccoon Tick"

*Ixodes texanus* is known only from wild animals, the raccoon being the preferred host. It may cause irritation and annoyance to heavily infested hosts. Raccoons have been collected in Kentucky in which the ears were virtually covered with engorging nymphs and larvae, and the neck and shoulders covered with scabs where *I. texanus* had detached.

Alabama distribution: Barbour, Chambers, Clarke, Jackson, Lee, Macon, Tallapoosa, and Washington counties. *Ixodes texanus* is widely distributed in all areas of Alabama.

Seasonal distribution: Specimens were taken in January, February, March, April, October, November, and December. Our records do not show *Ixodes texanus* during the summer months, because most of the raccoons were collected during the normal Alabama trapping season which extends from November through February. However, raccoons collected in early and mid-summer in Kentucky and Tennessee were heavily infested by this tick. There was no noticeable preponderance of one life stage at a particular time

TABLE 1. ALABAMA HOST RECORDS OF *Ixodes scapularis*, *Ixodes dentatus*, AND *Ixodes texanus*

Host	Number examined	Number of ticks			Average/host		
		Larva	Nymph	Adult	Larva	Nymph	Adult
<i>Ixodes scapularis</i>							
<b>Mammalia</b>							
Bobcat.....	8	0	0	8	0.00	0.000	1.00
Cat.....	8	0	0	3	0.00	0.000	0.38
Dog.....	46	0	0	16	0.00	0.000	0.35
Raccoon.....	59	0	1	0	0.00	0.020	0.00
White-tailed deer.....	56	0	0	71	0.00	0.000	1.27
<b>Reptilia</b>							
S.E. 5-lined skink.....	1	0	5	0	0.00	5.000	0.00
<i>Ixodes dentatus</i>							
<b>Mammalia</b>							
Eastern cottontail rabbit.....	145	8	11	17	0.06	0.080	0.12
Marsh rice rat.....	77	5	0	0	0.06	0.000	0.00
Raccoon.....	59	0	1	0	0.00	0.020	0.00
Swamp rabbit.....	9	118	7	5	13.11	0.780	0.56
Wood rat.....	23	1	0	0	0.04	0.000	0.00
<i>Ixodes texanus</i>							
<b>Mammalia</b>							
Gray squirrel.....	280	0	1	0	0.00	0.004	0.00
Opossum.....	73	0	0	1	0.00	0.000	0.01
Raccoon.....	59	33	128	54	0.56	2.170	0.92

of the year. All stages were represented equally during the winter months, indicating that activity is continuous.

Specimens examined: 2 males, 53 females, 129 nymphs, and 33 larvae.

Hosts: All life stages of *Ixodes texanus* complete development on the raccoon. In our collections only two specimens of *I. texanus* came from animals other than the raccoon. *I. texanus* and *I. cookei* were often taken together on the same host. Normal infestations ranged from 2-10 per animal; however, on one occasion 6 females and 50 nymphs were taken from the ears of a single raccoon.

Bishopp and Trembley (6), reported *I. texanus* from bobcat, weasel, and squirrel, and Cooley and Kohls (8) reported it from woodchuck, marten, mink, fox squirrel, pine squirrel, and dog. Clifford *et al.* (7), reported the larva from a cottontail rabbit and Bishopp and Trembley (6), recorded 158 larvae from a weasel; all of our larval collections were from raccoons. Alabama host records are shown in Table 1.

### *Ixodes cookei* Packard, 1869

This moderate size tick, often closely associated on the host with *I. texanus*, can be distinguished from it in the adult and nymphal stages, by the presence of coxal spurs which are indistinct or absent in *I. texanus*. In the larvae, coxae II and III have spurs while in *I. texanus* they are wanting.

This species is not of great economic importance, as it is not known to transmit diseases and usually confines its attacks to wild animals, although

TABLE 2. ALABAMA HOST RECORDS OF *Ixodes cookei*

Host	Number examined	Number of ticks			Average/host		
		Larva	Nymph	Adult	Larva	Nymph	Adult
<b>Mammalia</b>							
Cat.....	8	0	2	1	0.00	0.25	0.12
Dog.....	46	0	1	0	0.00	0.02	0.00
Gray fox.....	17	0	1	0	0.00	0.06	0.00
Longtail weasel.....	2	0	0	1	0.00	0.00	0.50
Mink.....	46	56	50	10	1.22	1.09	0.22
Opossum.....	73	0	2	2	0.00	0.03	0.03
Raccoon.....	59	7	45	10	0.12	0.76	0.17
Red fox.....	9	8	12	3	0.89	1.33	0.33
River otter.....	4	0	1	1	0.00	0.25	0.25
Spotted skunk.....	6	46	15	3	7.67	2.50	0.50
Striped skunk.....	11	0	3	7	0.00	0.27	0.64
Woodchuck.....	8	12	0	0	1.50	0.00	0.00

a number have been collected from dogs. It is one of the most widely distributed ticks in the United States.

Alabama distribution: Barbour, Chambers, Cleburne, Coosa, Cullman, DeKalb, Henry, Houston, Jackson, Lee, Macon, Marshall, Talladega, and Tallapoosa counties. *Ixodes cookei* is widely distributed in Alabama and occurs in all areas of the State.

Seasonal distribution: All stages were collected throughout the year indicating year-round developmental activity.

Specimens examined: 5 males, 32 females, 131 nymphs, and 129 larvae.

Hosts: *Ixodes cookei* is a non-specific parasite, infesting a large number of wild mammals, sometimes dogs, and occasionally man. The number of specimens per host is usually moderate, and all life stages can occur on the same host animal. In one case, however, one female, two nymphs, and 44 larvae were taken on the same animal; in another instance, 27 specimens were taken from each of two minks. Host data from Alabama collections are presented in Table 2.

### *Ixodes marxi* Banks, 1908

#### "The Squirrel Tick"

*Ixodes marxi* is a large species of *Ixodes* which is usually parasitic on squirrels. It is of no known economic importance and is not known to transmit disease organisms. It can be readily distinguished from other members of the genus by the characters in the keys and its specificity for squirrels. It has been reported both east and west of the Mississippi River, with the great majority of collections coming from the eastern United States.

Alabama distribution: Chambers, Jackson, and Macon counties. Sufficient data were not available to determine the complete distribution of *I. marxi* in Alabama since most of the squirrels were collected in the above counties. *I. marxi* is also a relatively rare species and many collections of animals would be necessary to obtain sufficient data to plot its distribution in Alabama. It probably occurs statewide since specimens were collected in both northern and southern counties.

Seasonal distribution: Specimens were taken only during October, November, and December; probably because most of the known host animals (squirrels) were collected during this period, although some collections were also made during the spring and summer. Larvae, nymphs, and females were collected on this host; no males were collected.

Specimens examined: 4 females, 1 nymph, and 7 larvae.

Hosts: *Ixodes marxi* was taken only from gray squirrels. The largest number taken on one squirrel was three females. Bishopp and Trembley (6) reported that this species is relatively rare and their data agree with our records from gray squirrels. From 280 gray squirrels examined, only 12 ticks were recovered. These ticks were found mainly on the ears although some specimens were combed from other parts of the body.

The records of Bishopp and Trembley (6) and Clifford *et al.* (7) list only species of squirrels as hosts. Lawrence, Hays, and Graham (22) listed squirrels as hosts with the exception of a chipmunk. Cooley and Kohls (8) listed only squirrels and squirrel nests as records for this species; however, they cited a record of *I. marxi* from a raccoon in Montgomery County, Alabama, by Nuttall *et al.* (26). Gregson in 1956 states that from records, *I. marxi* apparently also attaches to rabbits. Large numbers of rabbit hosts were examined in our collections, but none harbored *I. marxi*.

### *Ixodes woodi* Bishopp, 1911

"The Woodrat Tick"

This moderate sized species is of no known medical or economic importance. Collections are rare and all have been associated with woodrats. *Ixodes woodi* has been reported from Texas, Colorado, Indiana, and California. Our collection extends the known range of *I. woodi* into the southeastern United States.

Specimens examined: 1 female.

The one female of *I. woodi* was taken in March on a woodrat from a cave in Jackson County, Alabama. Only 23 specimens of woodrats were collected; possibly more *I. woodi* could have been obtained had this host been more thoroughly studied in Alabama.

### *Ixodes banksi* Bishopp, 1911

The females of *Ixodes banksi* and *I. cookei* are closely related but can be separated by examining the basis capitulum which possesses cornua only in *I. cookei*. The males of *I. banksi* are similar to *I. woodi* but can be distinguished in that *I. woodi* has a deeply notched hypostome with the dentition 4/4, and *I. banksi* has a dentition of 3/3 with the hypostome slightly notched.

*I. banksi* is a little known species and is of no known medical or economic importance; it has been reported from wild animals only. However, Lawrence *et al.* (21) reported that the appearance of this tick in Ontario and the Upper Peninsula of Michigan coincided with the reports of widespread mortality among beavers in these areas. Natural infections of tularemia were not demonstrated in wild-caught *I. banksi*. Nevertheless, this tick was successfully infected with *Pasteurella tularensis* (SCHU strain) in the laboratory.

*I. banksi* is scantily distributed in the United States; literature reveals only a few state records; however these extend from the Canadian to the Mexican border states.

Specimens examined: 4 males.

All four specimens were collected on the same day in June from the clothing of field workers in Lee County, Alabama. The collections were made along a small stream presumably inhabited by beavers and muskrats. According to Lawrence *et al.* (22), the usual hosts of *I. banksi* appear to be semi-aquatic mammals, principally beavers and muskrats.

### *Ixodes brunneus* Koch, 1844

#### "The Bird Ixodes"

*Ixodes brunneus* is an unusual appearing moderate-to-large size species of *Ixodes*. It is of no known medical or economic importance and confines its attacks to birds. There are, however, records of distressed and dying birds whose only symptom was the presence of an engorged female tick attached to the neck or head. The ticks are taken mainly on migratory birds which probably accounts for its intercontinental distribution. It occurs in North America, Europe, and Africa; distribution in the United States is primarily along the coast lines which may be influenced by migratory patterns of birds.

Alabama distribution: Bibb and Lee counties.

Seasonal distribution: Four engorged females were collected during the months of February and May. The presence of engorged females during February, indicating an extended feeding period through the winter months, agrees with statements by Bishopp and Trembley (6) to the effect that the parasites apparently remain attached for long periods of time. However, it is also conceivable that the ticks had been transported from a warmer climate during an early migration. Only incidental collections of birds were made; consequently data were not sufficient to determine distributional patterns.

Specimens examined: 4 females.

Hosts: Our specimens were taken from song birds: three engorged females from a blue jay and one engorged female from a palm warbler. The warbler when collected was obviously distressed and in poor condition. It was found helpless, lying on the ground with a nearly engorged female attached. D'Urban (12) reported two such cases of birds in a very weakened condition with engorged ticks attached around the eyes and on top of the head. Thomas (30) and Worth (32) reported similar cases.

According to Bishopp and Trembley (6), it is unusual to find more than a few specimens on any given host. In their records, they list 25 species of birds as hosts, most of which were songbirds, although one record is from a barred owl. Clifford *et al.* (7) reported the wild turkey as a host for this species.

### Genus *Haemaphysalis* Koch, 1844

Venter with a curved groove behind the anus, and from this a median furrow to the posterior margin of the body. Basis capitulum subrectangular.

Palpi short and broad, the second segment extended laterally. Scutum inornate; without eyes. Abdomen with festoons. Male with no ventral plates or shields. The two species of this genus in the United States are small.

### Key to Adults, Nymphs, and Larvae

1. Ventral cornua present..... *H. leporispalustris* p. 21  
 Ventral cornua absent..... *H. chordeilis* p. 22

### *Haemaphysalis leporispalustris* (Packard), 1869

“The Rabbit Tick”

The rabbit tick is a common, small species and is probably the most widely distributed species of tick in the United States. It does not ordinarily attack domestic animals or man; however, it becomes so abundant on wild rabbits and ground birds that it may weaken if not kill them. It is also an important vector of tularemia and probably Rocky Mountain spotted fever among wild animal populations, and for these reasons should be listed as important to man.

Alabama distribution: Baldwin, Barbour, Bibb, Butler, Chambers, Clarke, Cleburne, Colbert, Covington, DeKalb, Henry, Houston, Jackson, Lauderdale, Lawrence, Lee, Macon, Pickens, Russell, and Winston counties. *H. leporispalustris* is widely distributed over Alabama and was taken in numbers from all areas of the State.

Seasonal distribution: Specimens were collected in every month except May and all life stages were common in all seasons of the year.

Specimens examined: 222 males, 160 females, 328 nymphs, and 505 larvae. *H. leporispalustris* was the most abundant species in our collections in terms of number of specimens examined.

Hosts: *H. leporispalustris*, especially the adult, is primarily a parasite of rabbits. In our collections, it was recorded only once from a different host species; two males were taken from a dog. On the other hand, the immature stages were taken from a number of mammals and from two avian hosts. Large numbers of larvae were taken on bobwhite quail during the month of September with 73 larvae and 1 nymph being taken from a single bird. Bishopp and Trembley (6) reported that they have observed quail and meadowlarks so heavily infested with this tick that they were emaciated. They believe that some of the young birds may be killed by loss of blood from gross infestation.

Rabbits are often grossly infested. Fifteen males, 10 females, 10 nymphs, and 17 larvae were taken from two cottontails in August. In November one swamp rabbit harbored 1 male, 32 nymphs, and 136 larvae. These infestations do not compare numerically with those reported by other workers. Hooker *et al.* (17) recorded the collection of 1,033 specimens, many of which were engorged females, on two snowshoe hares. Greene, Bell, and Evans (13), as reported by Bishopp and Trembley (6), recorded infestations of this hare averaging almost 5,000 ticks per animal. Bishopp and Trembley (6) reported the immature stages from 18 species of mammals and 67

TABLE 3. ALABAMA HOST RECORDS OF *Haemaphysalis leporispalustris*

Host	Number examined	Number of ticks			Average/host		
		Larva	Nymph	Adult	Larva	Nymph	Adult
<b>Mammalia</b>							
Bobcat.....	8	0	1	0	0.000	0.12	0.00
Cotton mouse.....	177	1	0	0	0.006	0.00	0.00
Cotton rat.....	333	1	0	0	0.003	0.00	0.00
Dog.....	46	0	0	2	0.000	0.00	0.04
Eastern cottontail rabbit.....	145	233	316	338	1.610	2.18	2.33
Fox squirrel.....	15	1	0	0	0.070	0.00	0.00
Raccoon.....	59	0	1	0	0.000	0.02	0.00
Swamp rabbit.....	9	136	3	42	15.110	0.33	4.67
<b>Aves</b>							
Bobwhite quail.....	40	132	7	0	3.300	0.18	0.00
Crow.....	5	1	0	0	0.200	0.00	0.00

species of birds; adults were reported from 10 species of mammals and just six species of birds. Had collections included more birds, more species as hosts would have likely been recorded. Additional Alabama host records are presented in Table 3.

### *Haemaphysalis chordeilis* (Packard), 1869

#### "The Bird Tick"

*Haemaphysalis chordeilis* was not represented in our collections; however, it is included here because of the strong probability that it does occur in Alabama. Tick collections from avian hosts were not emphasized and only a few incidental ones were made, which probably accounts for our failure to obtain this species in the State. It has been reported by Clifford *et al.* (7) from the neighboring states of Georgia and Florida. Its distribution is widespread in the eastern and southern United States, especially in the Gulf Coast and Atlantic Coast regions.

*Haemaphysalis chordeilis* is a small species, closely related to *H. leporispalustris*, from which it can be readily separated by the following characters: the former is found mostly on birds, while the latter is found mostly on rabbits. Adults, nymphs, and larvae of *H. leporispalustris* possess ventral cornua which are lacking in *H. chordeilis*. Males have a short internal spur on coxa IV in *H. leporispalustris* while this spur is very long in *H. chordeilis*.

Hosts: According to Bishopp and Trembley (6), birds are the preferred hosts of all stages of this species; hence the common name "bird tick." Ground inhabiting birds such as grouse, meadowlarks, quail, and turkeys are the most commonly parasitized hosts; numerous song birds also serve as hosts as well as an occasional mammal. Bishopp and Trembley (6) and Cooley (10) report that the bird tick often heavily infests and causes deaths of young grouse and turkeys in various parts of the United States. For these reasons it should be considered of economic importance to man.



### Genus *Rhipicephalus* Koch, 1844

Venter showing a curved groove behind anus with a median line to the posterior margin of the body. Scutum usually inornate; eyes present. Abdomen with festoons, basis capitulum extended laterally into sharp points. Palpi short and broad. Coxa I deeply bifid. Sexual dimorphism slight. Only one species is known from the United States.

#### *Rhipicephalus sanguineus* (Latreille), 1806

“The Brown Dog Tick”

The brown dog tick is the only species of this genus known to occur in the United States. According to Matheson (24), it was probably introduced into the United States in Texas. Since that time, it has spread rapidly due to the transportation of dogs by man, from one part of the country to another, and occurs in virtually all of the eastern states as well as California, Nebraska, Kansas, Arizona, and several others.

*Rhipicephalus sanguineus* is becoming one of our most annoying and economically important species. It often invades homes to the extent that artificial control measures are required. Not only does it cause dogs much discomfort and loss of blood, but it has been reported by Cooley (10) to transmit canine piroplasmiasis among dogs in the southern United States. It is also suspected as a vector of Rocky Mountain spotted fever. Miller (25) listed 11 diseases of man and animals which it is capable of transmitting. Fortunately, it does not readily attach to man; however, man's close association with its normal host makes it a potentially dangerous species.

Alabama distribution: Cullman, Houston, Lee, Marshall, Macon, and Russell counties. This area does not necessarily constitute its distribution in Alabama since dogs were not examined from all parts of the State.

Seasonal distribution: Specimens were collected from April through October.

Specimens examined: 55 males and 35 females.

Hosts: All collections were made from dogs except one male which was taken from the clothing of a man. Bishopp and Trembley (16) and Clifford *et al.* (7) list the dog as the almost exclusive host for this species in the United States.

### Genus *Boophilus* Curtice, 1891

Description according to Cooley (10).

Scutum inornate. Anal groove obsolete in female, faint in male. Basis capitulum definitely hexagonal or in male sometimes lacking lateral points. Hypostome with dentition 3/4 or 4/4. Palpi short. Abdomen without festoons. Coxa I with one or two spurs and with a long anterior process. Only two species of this genus occur in the United States, *Boophilus annulatus* and *B. microplus* which are limited to a few localized areas in Louisiana and Florida respectively. *Boophilus annulatus* will be discussed here since prior to eradication measures it occurred in Alabama.

***Boophilus annulatus* (Say), 1821**

"The Cattle Fever Tick"

*Boophilus annulatus* was widely distributed in the southern United States, including Alabama, at about the beginning of this century. It was responsible for epizootics of Texas cattle fever, which was very destructive to cattle and often resulted in the loss of complete herds. Eradication measures have reduced its numbers to near extinction in the United States. However, it is still present in Mexico and constant surveillance must be maintained along the United States-Mexican border to prevent reintroduction.

Cattle are the usual hosts of this tick, but early authors also listed deer, horse, mule, sheep, goat, and bison.

**Genus *Dermacentor* Koch, 1844**

Moderate size. Scutum usually ornate. Anal groove encircling the anus behind; a median line extending from this to the margin of the body. Basis capitulum subrectangular, not angulate on the sides, broader than long. Palpi short and broad, the second joint barely longer than broad. Hypostome dentition usually 3/3. Eyes usually present. Festoons present except in distended females. Coxa I strongly bifid; coxa IV of male much larger than other coxae. Spiracular plate suboval or comma-shaped with the goblets variable.

**Key to Males and Females**

1. Spiracular plate with a distinct dorsal prolongation; goblets small and numerous.....*D. variabilis* p. 25  
Spiracular plate without prolongation; goblets larger and less numerous  
.....*D. albipictus* p. 26

**Key to Nymphs**

1. Basis capitulum drawn laterally into sharp points, triangular. Spiracular plate with many small goblets.....*D. variabilis* p. 25  
Basis capitulum subquadrate, not drawn laterally into sharp points; spiracular plate with a few large goblets.....*D. albipictus* p. 26

**Key to Larvae**

1. Basis capitulum drawn out into sharp points laterally; coxa I with a large triangular spur.....*D. variabilis* p. 25  
Basis capitulum bluntly pointed or rounded at the sides; coxa I with a broadly rounded spur.....*D. albipictus* p. 26

*Dermacentor variabilis* (Say), 1821

## "The American Dog Tick"

The American dog tick is a moderate sized ornate species, probably the most commonly encountered tick in Alabama. It is widely distributed in the United States with the exception of the Rocky Mountain region where it is replaced by *Dermacentor venustus* (= *D. andersoni*). It is the principal vector of Rocky Mountain spotted fever in the eastern United States, and is also important in the transmission of tularemia. It is particularly important to man because of his close association with the preferred host, the domestic dog, on which it causes annoyance, irritation, possibly anemia, and unsightly sores which may become the site of secondary infections. This tick often causes problems in homes, when engorged females drop from the dog in the house. *D. variabilis* readily attaches to man and is important not only as a vector of pathogenic organisms, but has often been responsible for causing tick paralysis in man as well as in animals. It is probably the most economically and medically important species of tick in the eastern United States.

Alabama distribution: Baldwin, Barbour, Bullock, Chambers, Clarke, Clay, Cleburne, Colbert, Covington, DeKalb, Escambia, Henry, Houston, Jackson, Lauderdale, Lawrence, Lee, Limestone, Macon, Madison, Morgan, Randolph, Russell, Walker, Washington, Wilcox, and Winston counties. *Dermacentor variabilis* is widely distributed in Alabama and was taken in all areas of the State.

Seasonal distribution: Specimens were collected in all months of the year. Adults were more often encountered in the summer months; females were obviously more often present in spring and early summer than at any other time. Populations declined rapidly after mid-summer and were virtually non-existent by early fall. No adults were taken during January and February. Nymphs were taken in every month except December; larvae in all months except May, June, and July.

Specimens examined: 238 males; 178 females; 86 nymphs; and 296 larvae.

Hosts: *Dermacentor variabilis* is a nonspecific ectoparasite and was taken on a large number of mammals in Alabama; however, the adults prefer to feed on dogs and are taken on this host in greatest numbers. The immature stages were not taken on dogs but were obtained primarily from small rodents; the only other hosts recorded for the larval stage were rabbits, from which only six larvae were taken. Two nymphs were taken on rabbits and four were taken on raccoons; all other nymphal collections were from rodents.

Adults were taken on a considerable number of the larger mammals and often on man. Infestations per host were never extremely heavy, although once 24 adults were taken from a bobcat. In another instance, 21 adults were collected from a dog. Adults were also taken on tick drags or flags.

The immature stages were less abundant per host. The greatest number taken on a single host was 15 larvae and 1 nymph from a cotton mouse. At another time, 43 larvae were taken from 3 cottonrats. Clifford *et al.* (7) listed

TABLE 4. ALABAMA HOST RECORDS OF *Dermacentor variabilis*

Host	Number examined	Number of ticks			Average/host		
		Larva	Nymph	Adult	Larva	Nymph	Adult
<b>Mammalia</b>							
Bobcat.....	8	0	0	30	0.00	0.000	3.75
Cat.....	8	0	0	1	0.00	0.000	0.12
Cotton mouse.....	177	109	18	0	0.62	0.100	0.00
Cotton rat.....	333	108	44	0	0.32	0.130	0.00
Cow.....	43	0	0	1	0.00	0.000	0.02
Dog.....	46	0	0	91	0.00	0.000	1.98
Domestic rabbit.....	20	0	0	1	0.00	0.000	0.05
Eastern cottontail rabbit.....	145	3	2	0	0.02	0.100	0.00
Golden mouse.....	19	2	2	0	0.10	0.100	0.00
Gray fox.....	17	0	0	2	0.00	0.000	0.12
Gray squirrel.....	280	6	2	16	0.02	0.007	0.06
Man.....	---	0	0	35	---	---	---
Old-field mouse.....	48	10	1	0	0.21	0.020	0.00
Opossum.....	73	0	0	106	0.00	0.000	1.45
<i>Peromyscus</i> sp.....	24	2	3	0	0.08	0.120	0.00
Pine mouse.....	9	0	1	0	0.00	0.110	0.00
Raccoon.....	59	0	4	103	0.00	0.070	1.74
Rice rat.....	77	46	8	0	0.60	0.100	0.00
Striped skunk.....	11	0	0	1	0.00	0.000	0.09
Swamp rabbit.....	9	3	0	0	0.33	0.000	0.00
White-tailed deer.....	56	0	0	1	0.00	0.000	0.02
Woodchuck.....	8	0	0	7	0.00	0.000	0.88
Wood rat.....	23	6	1	0	0.26	0.040	0.00
<b>Aves</b>							
Bobwhite quail.....	40	1	0	0	0.02	0.000	0.00

records for the larvae, similar to ours, from the eastern United States. However, neither their records nor those of Bishopp and Trembley (6) and Arthur (2) cited birds as hosts for the larvae. A record was also made of a larva taken from a Bobwhite quail. Additional host data are presented in Table 4.

**Asymmetry of Structures:** Of particular interest was the occurrence of a spiracular plate deformation in one of our male specimens. The left plate was normal, but the one on the right side was circular and about  $\frac{1}{3}$  the size of the normal plate; it also lacked the strong dorsal prolongation of normal plates. Cooper and Robinson (11) noted an abnormality in the symmetry of the spiracles of a female of *Amblyomma longirostrum*. Warburton and Nuttall (31) discussed the occurrence of abnormalities in ticks including other structures especially in the genus *Dermacentor*.

### *Dermacentor albipictus* Packard, 1869

#### "The Winter Tick"

The "winter tick," *Dermacentor albipictus*, was not collected in our survey, but it is listed because of the possibility that it does occur in Alabama. Most of our collections of deer, the preferred host in the eastern United

States, were made during the time of year when the parasites are not on the host, and might account for failure to obtain this species. Collections were also made of this tick from whitetail and fallow deer in the neighboring states of Kentucky and Tennessee, and collections from Georgia and Mississippi are included in the literature. These records lead one to believe that its distribution includes Alabama, at least in northern sections. It is a widely distributed tick in the United States; however, the distribution is irregular. It appears to reach maximum numbers in the northern states.

The winter tick is a pest of importance on horses, cattle, and wild, hoofed mammals. According to Bishopp and Trembley (6), horses, particularly colts on the range, are often so heavily infested as to be weakened or even killed by it. They further state that moose and elk die from gross infestation combined with feed shortages in late winter and early spring. The records of Bishopp and Trembley (6) list a cat as the host for several nymphs and adults; all other records were from hoofed mammals. Collections made in Kentucky and Tennessee were from deer only. It was not uncommon to collect 20 to 25 engorged females from a single host.

*Dermacentor albipictus* is a one-host tick and its seasonal activity is confined to the late fall, winter, and early spring. The tick remains on the host for 1-2 months, which provides an excellent opportunity for its shipment from one part of the country to another, particularly in relation to wildlife translocation programs.

*Dermacentor albipictus* is similar to *D. variabilis*, but can be separated using the following characteristics: (1) in adults of *D. variabilis* the spiracular plate has a distinct dorsal prolongation and the goblets are small and numerous; in *D. albipictus* the goblets are large and less numerous and no prolongation is present; (2) the nymphs of *D. variabilis* have the basis capitulum drawn laterally into sharp points, while in *D. albipictus* the basis is subquadrate and not drawn out laterally; (3) the basis capitulum of the larval stages is similar to that of the respective nymphs, and coxa I of *D. variabilis* has a large triangular spur, while in *D. albipictus* it is broadly rounded.

### Genus *Amblyomma* Koch, 1844

Venter with a distinct curved groove behind the anus and a more or less distinct median furrow behind. Scutum usually ornate; eyes present. Festsoons present except in engorged females and nymphs. Basis capitulum relatively small and variable in form; palpi long and slender, second joint about twice as long as wide, third much shorter than the second. No adanal plates found on the male venter. Spiracular plates subtriangular or comma-shaped. Body generally round oval, medium to large in size and includes the largest tick species. This is the second largest genus in Alabama, having three representatives in the State.

### Key to Females

1. Coxa I with a large, pointed, external spur and a much smaller pointed, internal spur; hypostome with dentition 3/3..... 2

- Coxa I with two subequal, short, rounded spurs; hypostome with dentition 4/4.....*A. tuberculatum* p. 31
2. Scutum with a large whitish conspicuous spot in the posterior area.....  
.....*A. americanum* p. 28
- Scutum with white markings in an extensive pattern. *A. maculatum* p. 30

### Key to Males

1. Coxa I with a long pointed external spur, internal spur if present much shorter.....2  
Coxa I with subequal, short, broad, rounded spurs.....  
.....*A. tuberculatum* p. 31
2. Coxa I with a distinct, moderately long internal spur; scutal ornamentation limited to symmetrical, isolated, whitish spots.....*A. americanum* p. 28  
Coxa I lacking a distinct internal spur, if present very small and faint; scutal ornamentation consisting of numerous, anastomosing whitish, longitudinal and diagonal bands.....*A. maculatum* p. 30

### Key to Nymphs

1. Scutum ornate; hypostome with dentition 3/3; coxa II with two subequal short, flat, rounded spurs.....*A. tuberculatum* p. 31  
Scutum inornate; hypostome with dentition 2/2; coxa II with just one spur.....2
2. Basis capitulum dorsally subrectangular, broad and short, without auriculae ventrally; coxa I with two spurs, coxae III and IV with spurs.....  
.....*A. americanum* p. 28  
Basis dorsally triangular with the lateral points protruding outside of the scapulae, ventrally with auriculae; coxa I with one spur, coxae III and IV lacking spurs.....*A. maculatum* p. 30

### Key to Larvae

1. Basis capitulum dorsally subtriangular with the lateral margins acute and extending outside the scapulae; coxa I with one large triangular spur.....  
.....*A. maculatum* p. 30  
Basis capitulum dorsally with lateral margins rounded; coxa I with two spurs.....2
2. Basis capitulum subrectangular dorsally, short and broad, rounded at the sides; eyes not circular and not raised above level of the scutum; internal spur on coxa I projecting mesad; scutal length 0.23-0.27 mm.....  
.....*A. americanum* p. 28  
Basis capitulum roughly subtriangular dorsally with the lateral margins rounded and the posterior margin convexly curved; eyes circular and raised above the level of the scutum; internal spur of coxa I projecting posteriorly; scutal length 0.38-0.42 mm.....*A. tuberculatum* p. 31

### *Amblyomma americanum* (Linnaeus), 1758

#### "The Lone Star Tick"

The lone star tick is one of the most economically and medically important species in the United States. It attacks man readily in all stages

and thus is an important potential vector of human diseases. Parket *et al* (27) reported recovering the rickettsia of Rocky Mountain spotted fever from a lot of 114 unfed nymphs of *A. americanum*. In the laboratory, *A. americanum* has successfully transmitted Rocky Mountain spotted fever to a number of animals. This evidence established this tick as the third vector of Rocky Mountain spotted fever to man in this country. Nymphs have also been found infected with the rickettsia of Q fever by Parker and Kohls (27). Kokernot *et al.* (20) isolated a previously unknown virus from *Amblyomma americanum* taken in southwest Kentucky, and designated it "Lone Star" virus. Tularemia is transmitted among wild animals by the bite of infected *A. americanum*, and transovarial passage of the bacterium has been demonstrated in the laboratory.

Aside from its importance as a disease vector, *A. americanum* causes much irritation and annoyance to man from the bite alone. The unusually elongate mouthparts possessed by members of this genus make their removal from a host extremely difficult and often the hypostome is broken from the tick and remains imbedded in the skin, predisposing the host to secondary infection. Outdoor recreation in high density areas has occasionally been discontinued or severely limited because of the numbers of this species, and wildlife inhabiting similar areas are often adversely affected.

*Amblyomma americanum* is widely distributed in the southern portion of the United States from Texas to the Atlantic Coast. According to Bishopp and Trembley (6), it is most plentiful along the South Atlantic coast and in parts of Oklahoma, Arkansas, and Missouri. It has also been reported by Clifford *et al.* (7) in many of the middle Atlantic States as well as some of the more northern states. The high populations seen in southwestern Kentucky seem to be associated with high populations of fallow deer.

Alabama distribution: Bibb, Clarke, Colbert, Conecuh, Covington, Houston, Lawrence, Lee, Marengo, Pickens, Sumter, Wilcox, and Winston counties.

Seasonal distribution: Specimens were taken in 9 months including all four seasons. Adults and nymphs were collected during all seasons of the year, although both were more numerous during the warmer months. The larval stages were more numerous during the spring and early summer than at any other time. Drag records from southwestern Kentucky and northwestern Tennessee involving approximately 15,000 individual larval ticks showed that in this area, larval activity began to decrease in September and had ceased altogether by October 15th. These specimens are not included in our Alabama survey.

Specimens examined: 62 males; 49 females; 61 nymphs; 15 larvae.

Hosts: *Amblyomma americanum* is a non-specific parasite and feeds on a wide range of mammals and birds. It was found especially abundant on white-tail deer in our survey, and was also recorded from several other species of wild and domestic mammals. Seventeen nymphs were taken from wild turkeys; no other stage was taken off this host. Clifford *et al.* (7) listed records of larvae from the bobwhite quail, owl, and sparrow hawk. They also cited records of the larva from the following: cottonrat, mink, fox squirrel, gray squirrel, and raccoon.

The records of Cooley and Kohls (8) and Bishopp and Trembley (6) included a wide range of both domestic and wild mammals and birds. They

include 26 species of mammals and 10 bird species. Only five species of mammals and the wild turkey were found parasitized in our collections. Specimens were also collected from man and from drags. Alabama host records are listed in Table 5.

### *Amblyomma maculatum* Koch, 1844

#### "The Gulf Coast Tick"

The Gulf Coast tick is a medium-to-large sized species. It is most abundant along the Gulf and the South Atlantic coasts. Bishopp and Hixson (5) state that this tick is seldom found more than 100 miles inland and that its distribution suggests requirements of rather high rainfall, temperature, and humidity. In Alabama it was taken only in the southern  $\frac{1}{3}$  of the State with most of the specimens from the two southern border counties of Baldwin and Houston. The northernmost collection was made in Barbour County, approximately 125 miles inland. In numbers, *A. maculatum* is relatively rare in Alabama since only two Alabama counties border on the Gulf, and the remaining southern tier counties are from 40-90 miles inland. The juxtaposition of these counties and the Gulf Coast may account for its sparseness in the State. Cooley and Kohls (8) cited records from as far inland as Memphis, Tennessee, and East St. Louis, Missouri. According to Bishopp and Trembley (6), these were probably introductions by livestock since some of them were on cattle that had been received recently from coastal areas.

The Gulf Coast tick is of economic importance because it readily attacks man and livestock. Of the ten specimens collected in Alabama, two were from man. Hunter and Bishopp (18) reported that this species is more inclined to attack human beings than any other species in this country, except possibly the Rocky Mountain spotted fever tick. Bishopp and Trembley (6) stated that the Gulf Coast tick is an important pest of livestock in the states bordering the Gulf of Mexico. The adults attach inside the ears of animals and, when numerous, produce inflammation and swelling. This may predispose the animal to secondary infections. They further state that it may also cause the destruction of the supporting cartilage of the ears which causes a condition popularly known as "gotch ear." Philip and White (28) discovered one strain of Q fever and one of "maculatum disease" in specimens of this species, which were collected along the Gulf Coast of Mississippi, in close proximity to the coastal counties of Alabama.

Alabama distribution: Barbour, Baldwin, and Houston counties.

Seasonal distribution: The adult stages were collected during June, July, and August; the nymphs, only in April. More data are necessary to establish seasonal patterns for this species in Alabama.

Specimens examined: 6 males; 2 females; 2 nymphs. Larvae were not represented in the collections.

Hosts: *Amblyomma maculatum* attacks a wide range of mammals and birds. According to Cooley and Kohls (8), the adults are more common on the larger mammals, both wild and domestic. The hosts are similar to those listed for the adults of *A. americanum*, with sheep, horses, mules, and cat-



the most often infested. The larvae and nymphs, as reported by Bishopp and Trembley (6), engorge mainly on ground-inhabiting birds, although they are found also on small mammals. They listed 21 species of birds as being parasitized, mainly by the immature stages.

Collections in Alabama were few and included the following: cottonrat, dog, and man. Four specimens were collected by sweeping vegetation. Additional host data are presented in Table 5.

### *Amblyomma tuberculatum* Marx, 1894

#### "The Gopher Tortoise Tick"

The gopher tortoise tick, *Amblyomma tuberculatum*, is a large unusual species. It is host specific in the adult and nymphal stages to the gopher tortoise, *Gopherus polyphemus*. Engorged specimens have been seen which, including the hypostome, measured 25 mm long and 18 mm in width. We have not seen measurements of other species in excess of these and, therefore, believe this to be the largest species of tick in the United States and possibly the largest known.

The species is of minor medical and economic importance since it does not normally attach to man and confines its attacks in the adult and nymphal stages to the gopher tortoise. However, Bishopp and Trembley (6) reported that the larvae of this species have, in some instances, been known to infest domestic chickens in considerable numbers. Hooker (16) reported collections of large numbers of engorged larvae from rabbits and dogs, and in smaller numbers from cattle and birds, namely, the owl and the hawk. Rogers (29) demonstrated that the larva will attach to man in nature, but at Auburn researchers were successful in getting the adult to attach to man in the laboratory.

*Amblyomma tuberculatum* is restricted in distribution to the sandy coastal areas of Alabama, Florida, Georgia, Mississippi, and South Carolina. Its range is co-extensive with that of the gopher tortoise which lives only in deep sandy soil. In Alabama, *A. tuberculatum* is found in only the southern counties. According to local reports in Alabama and South Carolina, the gopher tortoise is decreasing in numbers and has been virtually eliminated from numerous areas in which it was originally common. Gopher tortoises can be easily trapped or extracted from their burrows and are extremely susceptible to predation by man, and conceivably are in danger of becoming extinct.

Alabama distribution: Clarke, Covington, and Houston counties. *Amblyomma tuberculatum* is probably present, in addition to the above mentioned counties, in the remaining southern counties having ecology similar to those mentioned previously. The tick probably occurs wherever the gopher tortoise occurs.

Specimens were also collected in Florida and Georgia. Of particular interest was the occurrence of a large population of gopher tortoises in an ecologically isolated area of deep sandy soil in the vicinity of Junction City, Georgia, in Marion County. This population was approximately 250 miles inland from either the Gulf or Atlantic coasts. Tortoises from this area were parasitized with adults and nymphs of *A. tuberculatum*.

Seasonal distribution: Tortoises were collected from April through September. Females and nymphs were most abundant during late spring and summer, becoming much reduced in late summer. Males were present throughout the collection period but were more abundant in late summer. This abundance of males during the late summer tends to indicate that the males feed for extended periods of time. This was verified in laboratory studies. No larvae were collected; all larvae examined were laboratory reared.

Specimens examined: 53 males; 13 females; 74 nymphs; 176 larvae.

Hosts: *Amblyomma tuberculatum* is a unique species in that it is host-specific for the gopher tortoise in the adult and nymphal stages. They usually attach on the neck, tail, perianal region, and legs; however, they have been observed feeding through the sutures of the plastron. Bishopp and Trembley (6) state that the nymphs have been engorged on bovines in the laboratory. In the laboratory at Auburn, reared larvae, nymphs, and adults engorged readily on domestic rabbits and completed all stages of development. However, the nymphs and adults had a marked adverse effect upon this host, probably because of the extremely long mouthparts possessed by these stages. Bishopp and Trembley (6) list the gopher tortoise exclusively as host for the adult and nymph; the larva, however, is listed from several species of mammals and birds. Their list includes the following: cattle, dog, cottontail rabbit, fox squirrel, chicken, owl, hawk, meadowlark, and

TABLE 5. ALABAMA HOST RECORDS OF *Amblyomma americanum*, *Amblyomma maculatum*, AND *Amblyomma tuberculatum*

Host	Number examined	Number of ticks			Average/host		
		Larva	Nymph	Adult	Larva	Nymph	Adult
<i>Amblyomma americanum</i>							
<b>Mammalia</b>							
Cat.....	8	0	1	0	0.00	0.12	0.00
Dog.....	46	0	1	3	0.00	0.02	0.06
Eastern cottontail rabbit.....	145	12	2	0	0.08	0.01	0.00
Man.....	---	3	9	1	---	---	---
Raccoon.....	59	0	24	2	0.00	0.41	0.03
White-tailed deer.....	56	0	6	95	0.00	0.11	1.70
<b>Aves</b>							
Wild turkey.....	30	0	17	0	0.00	0.57	0.00
<i>Amblyomma maculatum</i>							
<b>Mammalia</b>							
Cotton rat.....	333	0	2	0	0.00	0.006	0.00
Dog.....	46	0	0	2	0.00	0.000	0.04
Man.....	---	0	0	2	---	---	---
<i>Amblyomma tuberculatum</i>							
<b>Reptilia</b>							
Gopher tortoise (Alabama).....	26	0	3	15	0.00	0.111	0.58
Gopher tortoise (Georgia).....	14	0	71	40	0.00	5.071	2.86

hermit thrush. They do not list the gopher tortoise as a host for the larva, and none were taken from this host in this survey. Clifford *et al.* (7), however, recorded the gopher tortoise as a larval host, but Auburn researchers were unsuccessful in getting larvae to engorge on this host in the laboratory. Collections made from the anticipated larval hosts in gopher tortoise habitat were all negative. Incidental collections of mammals in areas inhabited by tortoises were also negative. Additional data concerning the host are given in Table 5.

### ACKNOWLEDGMENTS

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## ALABAMA HOST-TICK INDEX

Host and Number Examined      Species of Ticks Present

## Class Mammalia

## Order Marsupialia

Virginia Opossum, *Didelphis virginiana* (73).....*Dermacentor variabilis*  
*Ixodes cookei*

## Order Insectivora

Eastern Mole, *Scalopus aquaticus* (5)..... None  
Southeastern shrew, *Sorex longirostris* (2)..... None  
Shorttail shrew, *Blarina brevicauda* (13)..... None  
Least shrew, *Cryptotis parva* (2)..... None

## Order Chiroptera

Gray myotis, *Myotis grisescens* (116)..... None  
Little brown myotis, *Myotis lucifugus* (2)..... None  
Red bat, *Lasiurus borealis* (6)..... None  
Eastern pipistrelle, *Pipistrellus subflavus* (9)..... None  
Evening bat, *Nycticeius humeralis* (10)..... None

## Order Lagomorpha

Swamp rabbit, *Sylvilagus aquaticus* (9).....*Dermacentor variabilis*  
*Haemaphysalis leporispalustris*  
*Ixodes dentatus*  
Eastern cottontail rabbit, *Sylvilagus floridanus* (145).....*Dermacentor variabilis*  
*Haemaphysalis leporispalustris*  
*Amblyomma americanum*  
*Ixodes dentatus*  
Domestic rabbit (20).....*Dermacentor variabilis*

## Order Rodentia

Eastern chipmunk, *Tamias striatus* (20)..... None  
Woodchuck, *Marmota monax* (8).....*Dermacentor variabilis*  
*Ixodes cookei*  
Gray squirrel, *Sciurus carolinensis* (280).....*Dermacentor variabilis*  
*Ixodes marxi*  
*Ixodes texanus*  
Fox squirrel, *Sciurus niger* (15).....*Haemaphysalis leporispalustris*  
Southern flying squirrel, *Glaucomyz volans* (12)..... None

Pocket gopher, <i>Geomys pinetis</i> (7).....	None
Beaver, <i>Castor canadensis</i> (81).....	None
Marsh rice rat, <i>Oryzomys palustris</i> (77).....	<i>Dermacentor variabilis</i>
Eastern harvest mouse, <i>Reithrodontomys humulis</i> (3).....	None
Oldfield mouse, <i>Peromyscus polionotus</i> (48).....	<i>Dermacentor variabilis</i>
<i>Peromyscus</i> sp. (24).....	None
Cotton mouse, <i>Peromyscus gossypinus</i> (177).....	<i>Dermacentor variabilis</i> <i>Haemaphysalis leporispalustris</i>
Golden mouse, <i>Peromyscus nuttali</i> (19).....	<i>Dermacentor variabilis</i>
Cotton rat, <i>Sigmodon hispidus</i> (333).....	<i>Dermacentor variabilis</i> <i>Haemaphysalis leporispalustris</i> <i>Amblyomma maculatum</i>
Eastern woodrat, <i>Neotoma floridana magister</i> (17).....	<i>Dermacentor variabilis</i> <i>Ixodes woodi</i>
Eastern woodrat, <i>Neotoma floridana illinoensis</i> (6).....	None
Pine vole, <i>Microtus pinetorium</i> (9).....	<i>Dermacentor variabilis</i>
Muskrat, <i>Ondatra zibethica</i> (37).....	None
Black rat, <i>Rattus rattus</i> (8).....	None
Norway rat, <i>Rattus norvegicus</i> (26).....	None
House mouse, <i>Mus musculus</i> (104).....	None
Nutria, <i>Myocastor coypus</i> (5).....	None
<b>Order Carnivora</b>	
Dog, <i>Canis familiaris</i> (46).....	<i>Dermacentor variabilis</i> <i>Haemaphysalis leporispalustris</i> <i>Rhipicephalus sanguineus</i> <i>Amblyomma americanum</i> <i>Amblyomma maculatum</i> <i>Ixodes cookei</i> <i>Ixodes scapularis</i>
Cat, <i>Felis domestica</i> (8).....	<i>Dermacentor variabilis</i> <i>Ixodes cookei</i> <i>Ixodes scapularis</i>
Spotted skunk, <i>Spilogale putorius</i> (6).....	<i>Ixodes cookei</i>
Striped skunk, <i>Mephitis mephitis</i> (11).....	<i>Ixodes cookei</i>
Bobcat, <i>Lynx rufus</i> (8).....	<i>Haemaphysalis leporispalustris</i> <i>Ixodes scapularis</i> <i>Dermacentor variabilis</i>
Red fox, <i>Vulpes fulva</i> (9).....	<i>Ixodes cookei</i>
Gray fox, <i>Urocyon cinereoargenteus</i> (17).....	<i>Dermacentor variabilis</i> <i>Ixodes cookei</i>



Raccoon, <i>Procyon lotor</i> (59).....	<i>Dermacentor variabilis</i> <i>Amblyomma americanum</i> <i>Ixodes cookei</i> <i>Ixodes dentatus</i> <i>Ixodes scapularis</i> <i>Ixodes texanus</i>
Mink, <i>Mustela vison</i> (46).....	<i>Ixodes cookei</i>
Longtail weasel, <i>Mustela</i> <i>frenata</i> (2).....	None
River otter, <i>Lutra canadensis</i> (4).....	<i>Ixodes cookei</i>
<b>Order Artiodactyla</b>	
White-tailed deer, <i>Odocoileus</i> <i>virginianus</i> (56).....	<i>Dermacentor variabilis</i> <i>Amblyomma americanum</i> <i>Ixodes scapularis</i>
Cow (43).....	None
Swine (23).....	None
<b>Order Perissodactyla</b>	
Horse (3).....	None

### Class Aves

#### Order Columbiformes

Mourning dove, <i>Zenaidura</i> <i>macroura</i> (28).....	None
Pigeon (5).....	None

#### Order Anseriformes

Ducks (10).....	None
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#### Order Falconiformes

Sparrow hawk, <i>Falco sparverius</i> (1).....	None
Red-shouldered hawk, <i>Buteo</i> <i>lineatus</i> (2).....	None
Marsh hawk, <i>Circus</i> <i>cyaneus hudsonius</i> (1).....	None

#### Order Galliformes

Wild turkey, <i>Meleagris</i> <i>gallopavo</i> (30).....	<i>Amblyomma americanum</i>
Bob-white quail, <i>Colinus</i> <i>virginiana</i> (40).....	<i>Dermacentor variabilis</i> <i>Haemaphysalis leporispalustris</i>

#### Order Caprimulgiformes

Nighthawk, <i>Chordeiles minor</i> (2).....	None
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#### Order Passeriformes

Blue jay, <i>Cyanocitta cristata</i> (2).....	<i>Ixodes brunneus</i>
Palm warbler, <i>Dendroica</i>	

<i>palmarum</i> (1).....	<i>Ixodes brunneus</i>
Eastern meadow lark, <i>Sturnella magna</i> (4).....	None
Crow, <i>Corvus brachyrhynchus</i> (5).....	<i>Haemaphysalis leporispalustris</i>
Starling, <i>Sturnus vulgaris</i> <i>vulgaris</i> (1).....	None
House sparrow, <i>Passer</i> <i>domesticus domesticus</i> (2).....	None
Swamp sparrow, <i>Melospiza</i> <i>georgiana</i> (1).....	None
Other miscellaneous.....	None
<b>Order Ciconiiformes</b>	
Little blue heron, <i>Florida</i> <i>caerulea caerulea</i> (13).....	None
<b>Order Piciformes</b>	
Yellow-shafted flicker, <i>Colaptes auratus</i> (2).....	None
Downy woodpecker, <i>Dendrocopus pubescens</i> (1).....	None

### Class Reptilia

#### Order Chelonia

Gopher tortoise, <i>Gopherus polyphemus</i> (32).....	<i>Amblyomma tuberculatum</i>
Eastern box turtle, <i>Terrapene</i> <i>carolina</i> (6).....	None
Snapping turtle, <i>Chelydra</i> <i>serpentina</i> (4).....	None
Eastern mud turtle, <i>Kinosternon</i> <i>subrubrum</i> (8).....	None
Eastern painted turtle, <i>Chrysemys picta</i> (7).....	None

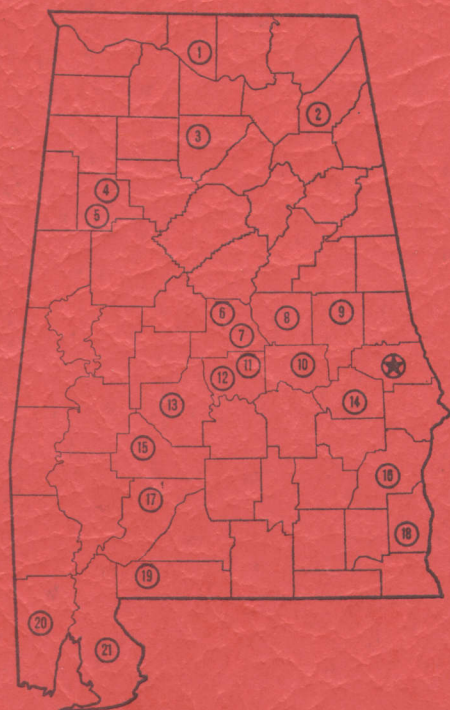
#### Order Squamata

Southeastern 5-lined skink, <i>Eumeces inexpectatus</i> (1).....	<i>Ixodes scapularis</i>
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## AGRICULTURAL EXPERIMENT STATION SYSTEM OF ALABAMA'S LAND-GRANT UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, live-stock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



### Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Tuskegee Experiment Field, Tuskegee.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Ornamental Horticulture Field Station, Spring Hill.
21. Gulf Coast Substation, Fairhope.