# THE TICKS OF OKLAHOMA

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By

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# PREFACE

During the fall of 1938 the writer was assigned the problem of the distribution of the ticks in Oklahoma. The thesis grew out of this problem. The correct distribution of any species depends upon accurate identification of that species. In fact, the correct determination of ticks is a basic essential, regardless of the type of work done. However, this work is not to be considered as a comprehensive paper on the taxonomy of the ticks; nor, is it thought that the species herein listed represent a complete list of the ticks present in Oklahoma.

The role that ticks play in the dissemination and transmission of diseases of man and animals is being realized today more than ever before, and it is hoped that this thesis may serve as a basis for future consideration of the group in this State.

The writer gratefully acknowledges his indebtedness to the following people who aided in the preparation of this work: the staff of the Oklahoma Agricultural and Mechanical College Entomology Department, for their valuable suggestions and criticisms, more particularly, to Dr. D. E. Howell, under whose supervision the work was carried on; to Dr. L. E. Rozeboom, under whose direction the work was started; to Professor C. E. Sanborn, from whose collection this information was largely obtained; to Dr. R. A. Cooley, Rocky Mountain Laboratory, who determined a number of doubtful, species of the genus Ixodes and to Dr. F. C. Bishopp, Bureau of Entomology and Plant Quarantine, for looking up some early records concerning the group.

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# INTRODUCTION

There is very little information relative to the ticks of Oklahoma aside from a few scattered publications. However, Professor C. E. Sanborn (1928-1937) collected a large number of specimens, and the information here set forth was gained largely from the study of this material. The writer has not only attempted to assimilate this material, but has made an effort to compile all data pertaining to ticks in this area. It has been the writers aim to collect in those areas where no specimens have been taken, rather than to duplicate other known records. Only a summary of a years collection of the rabbit tick Haemaphysalis leporis-palustris is included. It is hoped that the details may be published later.

Full reference to the literature has been made, especially on synonymy contained in the works of Salmon and Stiles (1901), Neumann (1911), Nuttall, Warburton, Cooper and Robinson (1908, '11, '15, and '26), and Cooley (1938).

The writer has met with some difficulty in determining certain species of the genus Ixodes. Some of the varieties of ticks that the writer has given specific rank is in conformity with unpublished reports by Dr. Cooley. The state of confusion that exists between species of this genus is being realized today more than in the past. There are at present no satisfactory keys for the group, but it is hoped the keys given will be at least of some practical value in determining the ticks present in this state.

## HISTORICAL

The first description of a tick that is now known to occur in the United States was that Ixodes ricinus (L.) in 1746. The same author (1758) described the lone star tick Amblyomma americanum. Other species with the type locality in some other country were described by Fabricius (1794), Leach (1815), Koch (1844), Guerin (1894), Cambridge (1876) and Duges (1883).

The first description of American ticks was by Say (1821). He described eight species. Packard (1869) described ten species, Riley (1869) one species and Fitch (1872) four species. One of the ticks, Dermacentor variabilis (Ixodes quinquestriatus = I. robertsoni) described by Fitch (1872) is of interest since he received the specimens from the Indian territory west of Arkansas. Marx (1892) made the first attempt to classify the ticks of this country. In 1896 Neumann published the first part of his revision of the Ixodoidea of the world, a summary of which appeared in 1911. The work of Salmon and Stiles (1901) on the cattle ticks of the United States represents the first great step on the classification of the group. The revision of the Ixodoidea of the United States by Banks (1908) has proved very valuable. A monograph of the Ixodoidea of the world was begun by Nuttall, Warburton, Cooper, and Robinson in 1908. The family Argasidae appeared in 1908, the genus Ixodes in 1911, the genus Haemaphysalis in 1915 and the genus Amblyomma in 1926. Their work represents the most valuable contribution to the literature of ticks. The work by Hooker, Bishopp and Wood (1912) on the biology of

some North American ticks is considered important since little has been done on this phase of the subject. Cooley (1938) gave a taxonomic account of the genera Dermacentor and Otocentor. Dr. Cooley hopes to publish a similiar account of some of the other genera in the near future.

There are numerous important publications on the taxonomy and biology of ticks scattered throughout the literature. The writer has mentioned only the more important ones appearing on the subject in this country.

# KEY TO THE FAMILIES, GENERA AND SPECIES OF OKLAHOMA TICKS

Dorsal shield absent; head sub-terminal or ventral; anus near middle of venter; pulvilli absent or rudimentary---
----------Argasidae.

Dorsal shield present; head terminal; anus near anterior end of body; pulvilli present----------Ixodidae.

## ARGASIDAE

1. Margin of body thin and acute--------*Argas persicus*.
   Margin of body rounded----------2
2. Body with short stiff bristles; tarsus I with a dorsal tubercosity or hump----------*Ornithodoros megnini*.
   Body with bristles absent; tarsus I with three humps
   ----------*O. turicata*.

## IXODIDAE

1. Anal groove surrounding the anus anteriorly--Ixodes-2
   Anal groove surrounding the anus posteriorly--------7
2. Tarsus I one and one-half times as long as the metatarsus----------*I. scapularis*.
   Tarsus I less than one and one-half as long as the metatarsus----------3
3. Shield without definite lateral carinae--*I. texanus*.
   Shield with definite lateral carinae----------4
4. Basis capituli with auriculae present, strong, forming a retrograde tooth----------*I. dentatus*.
   Basis capituli with auriculae faint or absent-------5

5. Spiracular plate about 400 by 350 microns, goblets about 125----------I. cookei.
Spiracular plate about 300 by 250 microns, goblets about 100----------6

6. Porose areas small, outline well-defined, separated by nearly their width; anal groove broadly rounded ----------I. kingi.
Porose areas large, outline ill-defined, close together; anal groove ogival----------Sculptus.

7. Eyes absent, palps short, second joint usually projecting laterally beyond the basis capituli---- ----------Haemaphysalis leporis-palustris.
Eyes present, second joint of palps not projecting beyond basis capituli----------8

8. Basis capituli hexagonal dorsally and males with adanal shields----------Rhipicephalus sanguineus.
Basis capituli not hexagonal dorsally, and males without adanal shields----------9

9. Palps long in relation to width, second article about twice as long as broad, basis capituli of variable form, coxae IV not enlarged in male---------- ----------Amblyomma americanum.
Palps short in relation to width, second article about as broad as long, basis capituli rectangular dorsally, coxae IV enlarged in male----------Dermacentor---10.

10. Spurs on coxa I divergent, internal spur shorter---- ----------D. parumapertus.

Spurs on coxa I sub-parallel, about the same length-ll

ll. Stigmal plate without dorsal prolongation, goblets few and large----------D. albipictus.

Stigmal plate with distinct dorsal prolongation, goblets numerous and small----------D. variabilis.

SUPERFAMILY IXODOIDEA BANKS, 1894

Superfamily characters: Acari of the suborder Mesostigmata with a pair of stigmal plates a little anterior or posterior of coxae IV; hypostome large, furnished beneath with numerous recurved teeth; venter with furrows; large forms, usually sanguivorous.

FAMILY ARGASIDAE CANESTRINI, 1890

Synonymy: 1844: Fam. Argasiden Koch, pp. 219-220.

1846: Fam. Argantidae Agassiz, p. 32.

1861: Fam. Argasides Furstenberg, p. 208.

1877: Subfam. Argasidae Murray, pp. 180-184.

1880: Tribe Argasides Magnin, pp. 132-136.

1886: Tribe Argasines Railliet, pp. 499-502.

1890: Fam. Argasidae Canestrini, p. 530.

1892: Subfam. Argasinae Trouessant, pp. 38, 46, 47.

1892: Tribe Argasinae Neumann, pp. 96, 104, 105.

1892: Group Catastomata Marx, pp. 233-234.

1893: Subfam. Argasines Railliet, pp. 715-718.

The above synonymy taken from Nuttall (1908).

Family characters: None-scutate ticks with leathery integument and slight sexual dimorphism; spiracles small and usually anterior to coxae IV. Coxae unarmed; pulvilli absent or rudimentary. The capitulum lies partly (larvae)

or wholly (nymphs and adults) in a hollow of the overhanging anteriorly protruding body.

This family is represented by about 40 species, and is composed of two genus, Argas and Ornithodoros. However, Nuttall (1908) states that he is not sure there is more than one genus. Bedford (1932) recognizes only one genus, Argas. The distinct differences that formerly existed between the two genera have been all but removed by the subsequent description of new species. The present classification of these two groups apparently is not a satisfactory one. There are several aberrant forms in each genera. Some of the species of the genus Argas resemble the type species of the genus Ornithodoros as much as do certain "so called species" within that genus. Whether the removal of the genus Ornithodoros by Bedford was the logical thing to do, he at least simplified matters.

## GENUS ARGAS LATREILLE, 1796

Synonymy: 1796: Argas Latreille, p. 178.
1796: Carios Latreille, p. 176.
1804: "Rhynchoprion" Hermann, p. 69.
1806: Caris Latreille, p. 161.
1834: "Rhyachoprion Hermann" of Duges, p. 14.

The above synonymy taken from Nuttall (1908).

Generic Diagnosis: Body flattened, oval or rounded, margin of body usually flattened and differing in structure from the general integument. The capitulum (in adults and

nymphs) hidden under front of body; discs numerous on both sides of body; eyes absent.

Type species: Argas reflexus (Fabricius).*

The genus Argas is represented in the United States by two species and in Oklahoma by one, A. persicus.

ARGAS PERSICUS (OKEN), 1818

Synonymy: 1818: Rhynchoprion persicum Oken, p. 1567.
1823: Argas persicus Fischer de Waldheim, p. 269.
1829: Argas mauretianus Guerin-Meneville, p. 43.
1844: Argas miniatus Koch, p. 219.
1872: Argas americanus Packard, p. 740.
1891: Argas sanchezi Alf. Duges, p. 20.
1893: Argas radiatus Railliet, p. 718.
1896: Argas miniatus firmatus Neumann, p. 12.
1903: Argas persicus (Oken) Lounsbury, p. 261.
1905: Argas persicus miniatus Neumann, p. 240.
1908: Argas persicus (Oken) Nuttall, p. 8.
1910: Argas persicus (Oken) Donitz, p. 409.
1911: Argas persicus (Oken) Neumann, p. 121.
1913: Argas persicus (Oken) Patton and Cragg, pp. 581, 583.
1913: Argas persicus (Oken) Robinson and Davidson, pp. 217-256.
1934: Argas persicus (Oken) Bedford, p. 281.

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* Nuttall (1908, p. 4) adopts A. persicus (Oken) as the type species since it has a world-wide distribution and has been better studied.

The above synonymy is similar to that of Bedford (1934).

Specific Diagnosis: Adults. Body ovate or quite oval, widest back of middle, color yellowish-brown to slate; integument with numerous oval or round discs, arranged more or less symmetrically. Genital opening between coxae I and II. Spiracles small, concentric, equal to one-half the width of the anal ring. Capitulum with four long setae directed forwards on the base, two post-hypostomal, one near the articulation of each palp. Palpi about twice as long as hypostome. Hypostome with several fine denticles on each side distally, followed by stout teeth 2:2, the teeth increasing to 3:3, 4:4, 5:5 basally, but decreasing in size, not reaching external border nor extending beyond half the length of the hypostome. Legs sub-equal and similar; coxae I and II separated, II, III and IV continuous.

The above description applies to both sexes as most authors do not distinguish the sexes. The male is generally smaller and narrower in front. The genital opening of the male is half-moon shaped and surrounded by an oval ring and narrower than the capitulum while the female orifice is a slit-like opening and broader than the capitulum.

## HOSTS

A. persicus is primarily a pest of the chicken, but is known to attack a number of other fowls. Bedford (1934) states that it has been found on ducks, geese, turkeys,

pigeons, canaries and ostriches. This tick has been long known to attach man in Persia and Nuttall (1908) states it commonly attachs man in that country. Neumann (1896) reports the fowl tick from quail, and according to Salmon and Stiles (1901) Packard found it once among Boophilus annulatus which had been collected from cattle. Hunter and Mitchell (1909) report removing one larva from a meadow lark and three adults from a rabbit in Texas. Dr. Howell (University of California) recently presented the writer with specimens taken from a cliff swallow's nest on Mt. Diablo, Contra Costa County, California.

Specimens taken in Oklahoma have been removed from poultry houses.

## DISTRIBUTION

The fowl tick has practically a world-wide distribution. In this country it is apparently confined to the southwestern part, occurring in California, Oregon, Arizona, New Mexico, Texas and Florida. Hooker, Bishopp and Wood (1912) state that the Marx collection contains specimens from Iowa.

Reports indicate that A. persicus is present in many parts of this state, however, few actual records have been made. The tick is probably present in all parts of the west and southwestern Oklahoma. The writer has examined specimens from Washita, McClain, Grady and Jefferson counties.

## GENUS ORNITHODOROS KOCH, 1844

Synonymy: 1844: Ornithodoros Koch, p. 219.

1877: Argas (Ornithodoros) Murray, p. 183.

1878: Ornithodoros Karsch, p. 321.

1895: Rhynchoprium Marx, p. 199.

1896: Ornithodoros Koch: Neumann, p. 3.

1899: Ornithodoros Koch: Morgan, p. 136.

1901: Ornithodoros Koch: Salmon and Stiles, p.407.

1907: Alectorobius Pocock, p. 189.

1908: Ornithodoros Koch; Banks, p. 16.

1912: Ornithodoros Koch: Hooker, Bishopp and Wood, p. 61.

1932: Ornithodorus Matheson, p. 40.

1934: Argas Bedford, p. 59.

The above synonymy taken from Nuttall (1908) with addition to date.

Generic Diagnosis: Body flat when unfed, but usually becoming very convex on distention, anterior end more or less pointed and hood-like, margin thick and not clearly defined, similar in structure to the rest of the integument, and generally disappearing on distention. Capitulum subterminal, its anterior portions often visible dorsally in the adult. Discs present or absent, not arranged radially when present. Ventral folds and grooves present but not constant. Eyes present or absent. Type species: Ornithodoros savignyi (Audouin).

The genus is represented in the United States by seven species and in Oklahoma by two. However, Riley (1935) recovered specimens of O. talaje that might have originated in Oklahoma. The two species found in this state are O. megnini and O. turicata. The latter species has not been previously recorded in Oklahoma.

ORNITHODOROS MEGNINI (DUGES), 1883

Synonymy: 1883: Argas megnini Duges p. 196.
1893: "Argas americana" Packard: Townsend, p.50.
1895: Rhynchoprium spinosum Marx, p. 199.
1896: Ornithodoros megnini (Duges): Neumann, p. 42.
1912: Otobius megnini Banks, p. 99.

Specific Diagnosis: Adults. Body panduriform, slightly attenuated anteriorly, broadest at legs II or III, constricted behind legs IV, broadly rounded posteriorly; color brown to violet or black. Dorsum: symmetrical depressions, one arciform, longitudinal, from each side of the projecti on corresponding to the capitulum; lateral and slightly anterior to this an infundibuliform depression; posteriorly along the lateral border, a longitudinal groove of variable length, sometimes interrupted; a median groove occupying the greater length of the posterior half. Venter: Pre-anal groove absent; replaced by a first post-anal groove at a tangent to the anal frame, straight and joining the coxal groove; the true post-anal groove near posterior border; a broad

median anal groove terminating at this posterior groove. Supra-coxal and coxal folds broad, well marked. Spiracles circular, 250 u in diameter, stigmal plate semilunar. Anus: anal frame broader, than long, each valve provided with four short hairs. Eyes absent. Integument with small circular, shallow pits with short central hairs, the whole surface being finely granular like sandpaper. Capitulum very small and short. Hypostome short, broad basally, rounded distally, unarmed. Palps with articles relatively broad and short; on the dorsal surface of the articles, especially on the first and dorsally on the basis capituli, posterior to the palps, numerous pennate hairs. Two post-hypostomal hairs. Legs thinner and shorter than in nymph; coxae disposed as in the other members of the genus; tarsi with a dorsal tuberosity. Size: female length 5-6 mm.; width, 3-4mm.; male somewhat smaller. (Nuttall, in part)

HOSTS

O. megnini commonly attacks the larger animals such as cows and horses. As the common name indicates, this parasite lives in the ears of its hosts. Hooker, Bishopp and Wood (1912) lists the following hosts: cattle, horses, dogs, cats, mules, man, sheep and hogs. Cooley (1932) states that Parker (1916) collected the spinose ear tick from rabbits in Montana. Hearle (1938) states that the jack rabbit is apparently the favorite host in the northern areas.

Host records from Oklahoma include the horse, cow and elk.

## DISTRIBUTION

Guanajuato, Mexico is the type locality for this species. It is commonly found in the southwestern United States, but has been reported from a number of the more northern states. Hearle (1938) lists it in British Columbia, and Bedford (1934) states that it is well established in Africa. It is also present in Central and South America.

This tick has been known in Oklahoma for over forty years. Lewis (1899) reported the ear tick as being common for the western part of the state. The writer has seen specimens from Woodward, Dewey, and Comanche counties.

O. megnini is not a common tick in the northern states nor is it a common parasite of the smaller animals. However, there are several records of it being collected under these conditions. It was collected in Montana in 1915 from rabbits and again in 1930 from the same hosts. Unpublished reports by Dr. Cooley suggests that this tick is a different species. However, one should expect sporadic occurrences of this tick throughout the United States, since the nymphs remain attached for several weeks.

So far as is known O. megnini is of little or no economic importance from a disease transmission standpoint, but often becomes a serious pest of cattle and horses.

ORNITHODOROS TURICATA (DUGES), 1876

Synonymy: 1876: Argas turicata A. Duges.

1895: Ornithodoros americanus Marx, p. 199.

Specific Diagnosis: Adults. Body with sides almost straight and parallel, the anterior extremity narrowed to a round point, the distal portions of the capitulum more or less visible dorsally in the replete adult. Integument thick, with hemispherical, brilliant contiguous granulations, larger posteriorly. No obvious discs, but tracts where mamillae are absent, arranged as in O. savignyi. Numerous clubbed hairs between the mamillae. No eyes. Venter: coxal and supra-coxal folds well marked in unfed specimens; a pre-anal groove reaching to the supra-coxal fold; a post-anal groove parallel to it, and midway between the anus on the posterior border. Anus almost as wide as long, with numerous hairs; anal frame quadrangular. Spiracles circular with correntic perforate plate. Capitulum with integument finely honey-combed; hypostome slightly lanceolate with a crown of numerous small teeth, followed by 2:2, 11 or 12 teeth per file; two hypostomal hairs; palps long and only slightly tapering; articles one and two equal in length; numerous pennate hairs on dorsal surface of palps and basis capituli. Legs: coxae contiguous, decreasing in size from I-IV; bristling with very fine spines, reinforced by granulations, especially on the posterior border; tarsi cylindrical, slightly tapering at their tips; three dorsal humps, smaller on hind legs; similar tubercles, less salient, on the

protarsi. Males average 3.5 by 2.5 mm.; females 6 by 4 mm. (Nuttall, in part).

## HOSTS

*O. turicata* is known to attack a number of animals including cattle, hogs, dry land-turtles, gophers, man and several species of rodents. The specimens collected in Oklahoma were taken from prairie dogs.

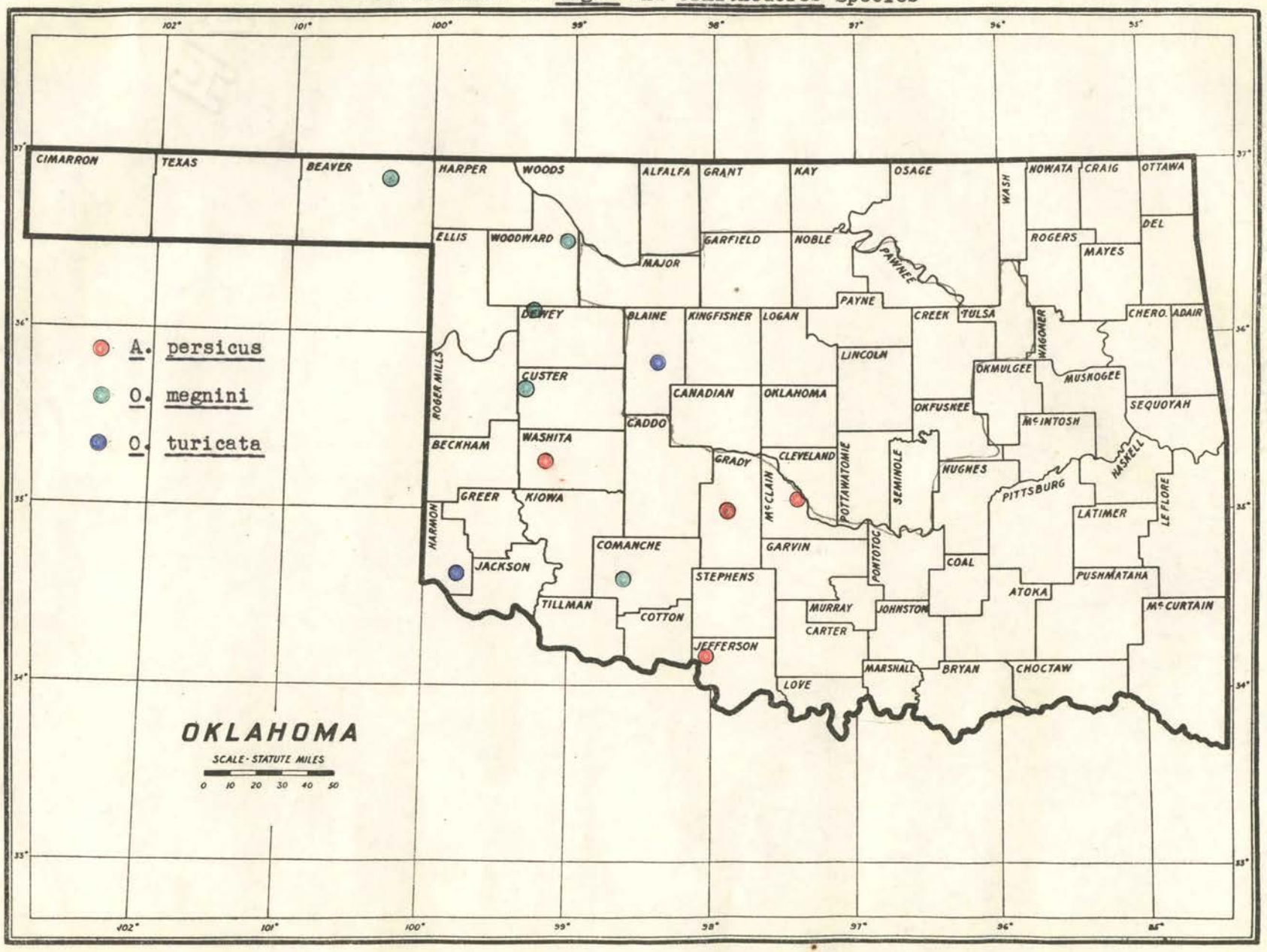
## DISTRIBUTION

This species is common in parts of South and Central America and has been reported from Florida, New Mexico, Texas, California, Arizona, Kansas and Idaho. The latter state is represented by a single collection and is north of its natural range.

Records from this state include collections from Blaine and Harmon counties.

The importance of the genus *Ornithodoros* as transmitters of relapsing fever in the United States was first brought to attention by Meller and Graham (1930) in central Texas. Since 1930 cases have been reported from Arizona, Nevada, California, New Mexico, Kansas, Washington and British Columbia. *O. turicata* has been incriminated in Texas and is likely the responsible vector in Kansas. The fact that this tick is a proved vector in Texas and is suspected in Kansas, attaches considerable importance to its presence in Oklahoma.

# Distribution of Argas and Ornithodoros Species



## FAMILY IXODIDAE MURRAY, 1877

Synonymy: 1834: Family Ixodei Duges, p. 15.

1834: Family Ixodiden Koch, p. 220.

1859: Family Ixodides Gervais and van Beneden, p. 460.

1877: Family Ixodidae Murray, p. 185.

1877: Family Ixodini Canestrini and Franzago, p. 110.

1880: Family Ixodidae Karsch, p. 41.

1880: Tribe Ixodides Megnin, p. 120.

1885: Subfamily Ixodidae Berlese, p. 131.

1886: Tribe Ixodines Railliet, p. 495.

1892: Subfamily Ixodinae Trouessart, p. 38.

1892: Tribe Ixodinae Neumann, p. 96.

1892: Group Antistomata Marx, p. 233.

1901: Subfamily Ixodinae Salmon and Stiles, p. 459.

1908: Family Ixodidae Murray: Banks, p. 20.

1911: Family Ixodidae Murray: Nuttall and Warburton, p. 115.

The above synonymy taken from Nuttall (1911).

Family Characters: Males with scutum entire; females with scutum confined to the anterior portion of body; sexual dimorphism marked. Capitulum terminial and spiracles a little anterior-dorsal of coxae IV. Palpi non-flexible and

porose areas present on the female capitulum (except one African species).

Type Genus: Ixodes Latreille, 1795.

The family Ixodidae is represented in the United States by about seven genera and thirty-five to forty species, depending upon the person consulted. It is represented in this state by five genera and twelve species. The rabbit tick (Haemaphysalis leporis-palustris) and the american dog tick (Dermacentor variabilis) are the two most common species in Oklahoma. However, Amblyomma americanum and Ixodes scapularis are very abundant in parts of their range.

GENUS IXODES LATREILLE, 1795

Synonymy:
1710: "Ricinus caninus" Ray, p. 10 (? I. ricinus).
1746: Acarus Linnaeus, p. 79.
1796: Ixodes Latreille, p. 179.
1804: Cynorhaestes Hermann, p. 66.
1822: Crolonus Dumeril, p. 56.
1844: Haemalastor Koch, p. 223.
1853: Pschatocephalus Frauenfeld, p. 55.
1857: Dermanyssus Kolenati, p. 20.
1857: Sarconyssus Kolenali, p. 21.
1878: Hyalomma Pickard-Cambridge, p. 222.
1902: Ceratixodes Neumann, p. 115.
1904: Euixodes Neumann, p. 444.
1911: Ixodes Latreille: Nuttall and Warburton, p. 133.

The above synonymy taken from Nuttall and Warburton, (1911).

Generic Diagnosis: Inornate ticks with eyes and festoons absent; males with a pregenital, median, anal, two adanal and two epimeral plates on the venter; marginal fold prominent. Anal groove embracing the anus anteriorly and divergent or completely closed behind; tarsi without spurs (except in I. putus).

Type Species: Ixodes ricinus (Linnaeus) Latreille, 1804.

There are about eighteen species known from North America of which six are recorded from this state. Cooley (Unpublished reports) considers both I. scapularis and I. cookei as distinct species. I. marxi as listed by Ward (1934) is not included here, since the writer has been unable to examine the specimen. I. kingi may well be open to question since only immature stages have been collected, although these were identified by Dr. F. C. Bishopp.

IXODES SCAPULARIS (SAY, 1821)

Synonmy: 1821: Ixodes scapularis Say, pp. 59-82.

1899: Ixodes affinis, Neumann, pp. 120, 121.

1908: Ixodes scapularis Say, in Banks, p. 25, 26.

1911: Ixodes r. var. scapularis (Say, 1821): Nuttall and Warburton p. 156.

1940: Ixodes scapularis Say: Cooley. Unpublished.

Specific Diagnosis: Male. Body dark red-brown to almost black. Scutum glossy with fine punctations and numerous scattered hairs. Emargination and scapulae moderate.

Genital orifice, grooves and plates similiar to type. Capitulum with trapezoid base, narrower in front and without cornua. Hypostome with six or eight, crenulated, stronger posteriorly and with two large basal teeth. Palps with article III slightly longer than II. Coxae I with internal spine overlapping II, and all coxae with small external spines. Tarsi I tapering abruptly. Spiracles elongate, narrow behind and with macula anterior.

Female. Body red-brown, engorged forms whitish; shield, dark red. Capitulum with hind angles pronounced, porose areas large, but not elongate as in the type; palpi long, second joint a little longer than three. Shield a little longer than wide, broadly rounded behind, sides not angulate and lateral carinae absent. Legs long and slender; tarsus fully one and one-half times as long as metatarsus. Coxa I with internal spine overlapping II and a short external tooth. Coxae II-IV with short external teeth, barely armed in some specimens.

## HOSTS

The type host for this species is unknown. Hooker, Bishopp and Wood (1912) state that specimens have been taken from dogs, cows, horses, sheep, deer, opossum and the immature stages from quail, blue jay and thrush. It has been collected in Oklahoma from the following animals: cow, horse, wolf, dog, bobcat, mule, goat, fox, squirrel, raccon, deer, elk and skunk.

## DISTRIBUTION

The black-legged tick is scattered through the southeastern United States. In Oklahoma, it is apparently more prevalent in the eastern part, but occurs as far west as Comanche county.

It has been shown experimentally to transmit bovine anaplasmosis, but does not appear to be an important disease vector otherwise.

## IXODES DENTATUS NEUMANN, 1899

Specific Diagnosis: Male. Capitulum: basis capituli, convex, slightly rounded medianly and broader in front; sides almost straight and converging posteriorly; cornua short and slightly pointed laterally. Palpi with article III a little longer than II. Scutum with cervical grooves convergent for about one-third of their length, then divergent, moderately deep in front and shallow behind. Lateral grooves distinct, marginal fold elevated, narrow in front and gradually broadening behind. Tarsus I tapering abruptly, II, III and IV tapering gradually, Venter: basis capituli pentagonal, greatest width at insertion of palpi, basis narrowing posteriorly. Auriculae fairly distinct, ridge rough and rounded, Hypostome: dentition, 5:5, basal 5 rows 4:4 (last one 2:2); about 14 denticles per file, outer row strong, inner files crenulated and fused, cornua absent, hypostome spatulate. Coxae: coxae bearing long hairs; coxa I with internal spur long and slender, overlapping II, and a short but acute external spur; coxa II-IV

with short, flattened and conical spurs at both posterior angles, those on II about the same size; internal spurs on coxae II-IV slightly decreasing in size. Genital and anal grooves divergent in front but curving inward at margin of body, the latter groove rounded (horse-shoe shaped) anteriorly; genital opening between coxae III. Stigmal plate with 2 rows of goblets at narrowest and 6 or 7 at widest place between macula and marginal cell, totalling about 110 goblets; macula a little antero-ventrally of center.

Female. Shield a dark red-brown, body blackish (from alcoholic specimens). Scutum a little longer than broad, rounded behind, punctations numerous behind; lateral carinae distinct, reaching the hind margin. Capitulum with porose areas far apart; cornua fairly prominent. Venter: Hypostome lanceolate, 4:4. Palpi with article 2 a little longer than 3, I spined ventrally; auriculae distinct. Coxa I with internal spur long and slender; all coxae with short external spurs. Stigmal plate circular, macula near the center.

## HOSTS

The type specimen was taken from a rabbit in Maryland. Specimens from Oklahoma were taken from the cottontail rabbit (Silvilagus floridanus alacer). Bishopp and Smith (1937) mentions collecting I. dentatus from rabbits in Massachusetts.

## DISTRIBUTION

I. dentatus has been collected in Maryland, Massachusetts, and Oklahoma. The latter collection was made at Wyandotte and contained two males and two females.

## IXODES SCULPTUS NEUMANN, 1904

1904: Neumann, p. 462.

Specific Diagnosis: Male. Scutum coarsely punctate, marginal groove deep; cervical grooves faint, strongly diverging; lateral grooves absent. Pregenital plate rounded; median about as broad as long; anal grooves slightly diverging behind; adanal plates with sides parallel. Capitulum small, basis narrowing behind; cornua faint. Palps with article III about as long as II. Hypostome rounded, teeth transversely fused. Coxa I with a strong internal spine, overlapping II; a blunt external spur on all coxae. Tarsi tapering abruptly.

Female. Scutum a little longer than broad; carinae present, curving medially, running out beyond the middle; cervical grooves superficial. Marginal groove deep. Capitulum with cornua fairly prominent, pointed; ridge rough, thinly chitinized; porose areas large, deep and ill-defined, close together; hypostome pointed, dentition 2:2; palps with article II about one and one-half times longer than III. Coxa I with a long spine; all coxae with external spurs. Legs with tarsi tapering abruptly.

### HOSTS

Small rodents appear to be the natural hosts of this tick. Host records include the following animals: prarie dog, rock squirrel, striped ground squirrel and white footed mouse. Records from this state include the prairie dog, thirteen-striped ground squirrel, pocket gopher and spotted and striped skunk.

## DISTRIBUTION

The type specimen was collected in the Santa Cruz Mountains, California. It has been taken in Texas, Montana, Wyoming, Iowa and Oregon. The tick is represented here from Cimarron, Payne and Washita counties.

A number of immature specimens have been received and collected from other counties that are probably of this species. Nothing was known of the male until Hixon (1932) worked out the biology and described the male. He found that it did not feed, but remained in the den or home of its host.

## IXODES COOKEI PACKARD, 1869

Synonymy: 1869: Ixodes cookei Packard, p. 67.

1871: Ixodes cruciarius Fitch, p. 366.

1901: Ixodes hexagonus var. longispinosus Neumann, p. 283.

1902: Ixodes hexagonus Salmon and Stiles, p. 467 (not I. hexagonus Leach fide Banks).

1908: Ixodes cookei Packard, Banks, pp. 28-29.

1911: Ixodes hexagonus var. cookei (Packard, 1869): Nuttall, p. 183.

1938: Ixodes cookei Packard, Cooley, (U. S. Publ. Rept. 53: (49) 2175).

Above synonymy taken from Nuttall (1911).

Specific Diagnosis. Male. Body nearly as broad in front as behind, marginal fold fairly prominent. Cervical grooves superficial, widely divergent. Capitulum with basis rectangular, sides almost parallel, cornua very short, ridge straight; auriculae small, forming a blade-like ridge; palps with article II about as long as III; hypostome rounded in front, with about eight transverse rows, fused. Anal plate narrowed in front; adanal plates narrowed posteriorly. Coxa I with a long internal spine: coxae II-IV with basal spurs faintly indicated; external spurs present on coxae I-IV, distinct. Stigmal plate large, rounded. Tarsi suddenly narrowed before the tip.

Female. Shield reddish; moderately punctate, evenly distributed; narrowed behind; cervical grooves shallow, widely divergent, reaching margin; carinae fairly strong, running out near posterior end of cervical grooves. Capitulum with basis rectangular, sides slightly convergent; cornua short, bluntly rounded; ridge almost straight, heavily chitinized; porose areas large, shallow, not separated by their width; palps with article II plainly longer than III; hypostome sharply pointed, dentition 4:4 or 3:3 (corona) then 2:2, teeth pointed. Venter with anal groove pointed, sides almost parallel, not far apart. Coxa I with a long internal spine, basal spurs on coxae II-IV faint or absent; all coxae with external spurs present, small; hind borders slightly trenchant. Spiracular plate about 400 by 350 microns, goblets about 125. Tarsi suddenly narrowed.

## HOSTS

I. cookei is apparently a parasite of the smaller animals. Banks (1908) lists the following animals: fox, mink, weasel, gopher, porcupine, woodchuck, raccoon, dog, cat and robin. I. cruciaris (I. cookei) by Fitch (1871) was taken from man. Hearle (1938) states that it is a common tick of the ground-hog.

Records from Oklahoma include the cow, praire dog, skunk, badger and coyote.

## DISTRIBUTION

Present records indicate this species is more prevalent in the Eastern states. Banks (1908) mentions specimens from Maine, Massachusetts, New York, New Jersey, Maryland, Washington, D. C., Michigan, Iowa, Minnesota, Colorado, Kansas, Texas and Canada. Chamberlin (1937) reports it from Oregon and Hearle (1938) states that it is common in British Columbia.

In Oklahoma, it has been collected in Payne, Cimarron, Comanche, and Washita counties.

## IXODES TEXANUS BANKS, 1909

1909: Ixodes texanus Banks, p. 172.

Specific Diagnosis: Male. Unknown.

Female. Scutum about as long as broad (specimens at hand with scutum distinctly longer than broad), widest before the middle; cervical grooves shallow, slightly divergent posteriorly and almost reaching margin; punctations

fairly deep, evenly distributed; carinae absent. Capitulum small, basis very rugged; porose areas wide apart, ill-defined and cornua short; hypostome with dentition 2:2; auriculae faint. Venter: Vulva between coxae III, anal grooves pointed or slightly rounded in front and divergent behind; coxae I with internal spur very short, blunt or distinctly pointed, external spur absent; coxae II-IV unarmed. Tarsi humped and tapering abruptly.

## HOSTS

The type specimen was taken from a raccoon in Live Oak county, Texas (Mitchell and Bishopp). It has also been collected from the weasel and chipmunk. It is represented in Oklahoma by a single collection, from a squirrel.

## DISTRIBUTION

I. texanus has been collected in Texas, California, Oregon, Montana, and British Columbia. A single collection was made in Oklahoma, at Ardmore.

This tick is apparently more common in British Columbia than in the United States. Hearle (1938) mentions removing nearly 250 specimens from the neck of a weasel. Only a single collection was made in Oregon. Cooley (1938) states that the tick is rare in Montana.

## IXODES KINGI BISHOPP, 1911

1911: Ixodes kingi Bishopp, p. 172.

Specific Diagnosis: Male. Basis capituli dark brown; greatest width at base of palpi, slightly narrowed from this point to the posterior angles; angles prominent; on the ventral side of the basis capituli is a nearly semi-circular ridge curving backward from near the base of each palpus where it is very prominent; palpi very short and broad, second segment nearly as broad as long, third broader than long. Scutum brownish yellow, darker in front over an area corresponding to the shield in the female, sides nearly parallel, broadly rounded behind; surface shiny with a very few short hairs, closely covered with large deep punctures at anterior end; lateral carinae strong, running from angles of capitular emarginaton to edge of scutum one-fifth of its length back; cervical grooves indistinct. Legs with tarsi I and II tapering rather abruptly, III and IV gradually. Coxae I with a short spine, all with a distinct apical tooth. Stigmal plate oval, 90 goblets per plate, five rows at widest and two at narrowest point between macula and marginal cells; macula a little ventor-anteriorly from center. Body with anal groove straight (transverse) in front of anus, straight but strongly divergent behind.

Female. Basis capituli dark reddish brown, of medium size; postero-lateral angles prominent; porose areas small, slightly broader than long, separated by nearly their width;

outline defined, pits large and deep; palpi very short and broad. The greatest width occuring at the second segment, this segment is only slightly narrowed back to its basal articulation where it is abruptly constricted; ventrally the basis capituli is smooth and somewhat narrowed posteriorly. Scutum reddish brown, darkest anteriorly, greatest width at about one-third of the distance from anterior angles, distinctly narrowed behind, the posterior-lateral margin being slightly concave; lateral carinae strong, running nearly to margin, slightly behind middle of scutum; scutum distinctly depressed for the entire length of the lateral carinae immediately mediad of those carinae; surface of scutum densely and rather evenly covered with coarse punctures. Legs short and rather slender; tarsi abruptly narrowed near apex; all coxae with a distinct apical tooth; coxa I with a moderately long, stout basal spine. Stigmal plate small, transversely oval, about 96 irregularly arranged goblets per plate; five rows of goblets at widest and two at narrowest point between macula and marginal cells. Body pale yellow, punctuate, rather densely covered with moderately yellow hairs; genital aperture between coxae III; anal groove broadly rounded in front of anus and divergent behind it. (Bishopp, original desc.)

HOSTS

The badger (Taxidea taxus) is the type host of this species. I. kingi has been taken from the following animals according to Hooker, Bishopp and Wood (1912); gopher, marmot,

skunk, dog, pine squirrel, pika, chipmunk, ground squirrel, prairie dog, mink, wolf, and kangaroo rat. Chamberlin (1937) lists the pocket mouse. The specimens collected in this state were taken from a dog and a wood rat.

## DISTRIBUTION

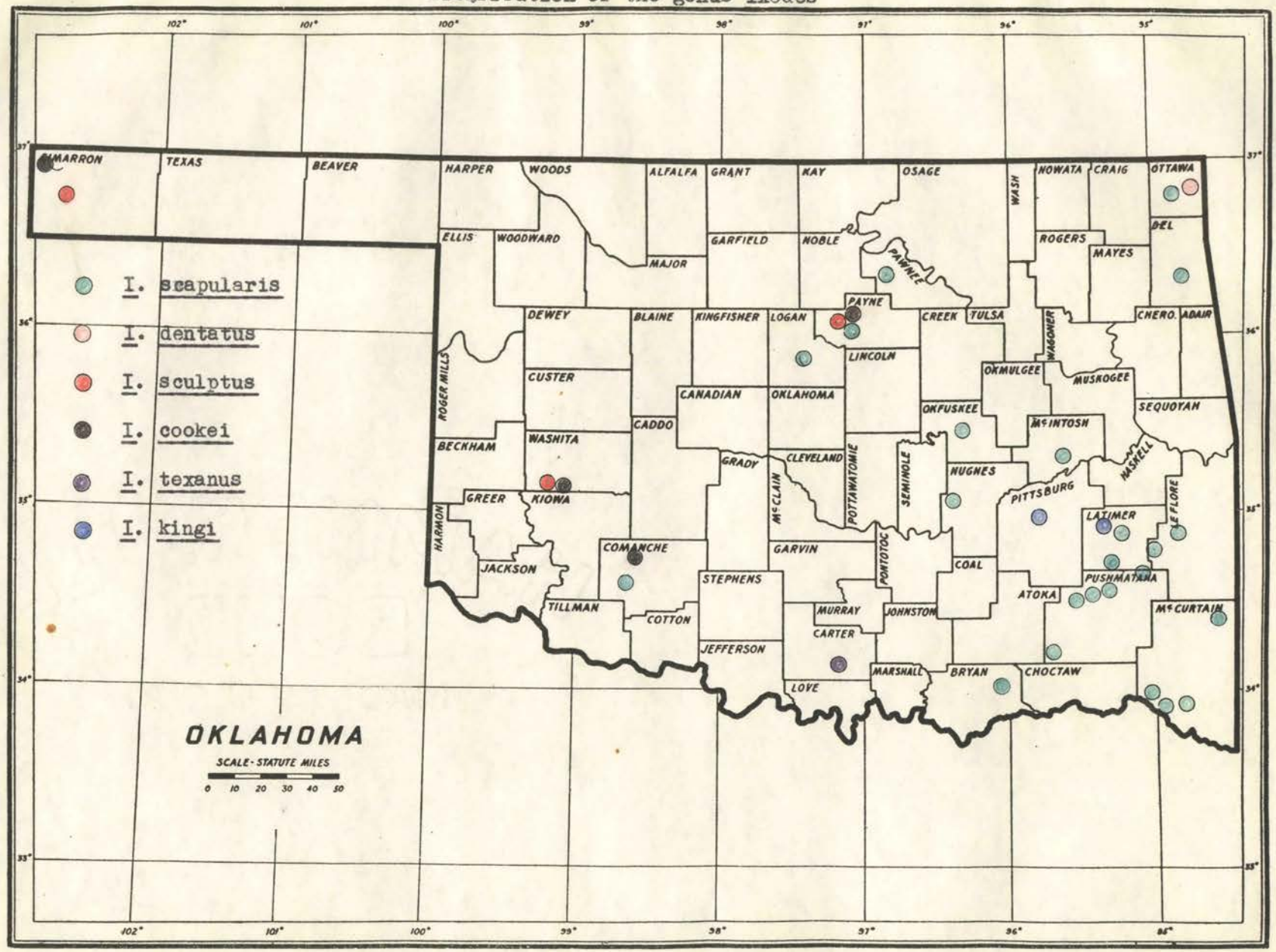
The type locality of this species is Meeteetse, Wyoming. Hooker, Bishopp and Wood (1912) collected specimens in Texas, New Mexico, California, Utah, Idaho and Montana. Chamberlin (1937) records it from Oregon. Hearle (1938) states it has been collected in Alberta. Two collections have been made in Oklahoma, Pittsburg, and Latimer counties. It must be mentioned that these records are indicated by immature stages, however, they were identified by Dr. F. C. Bishopp.

## GENUS RHIPICEPHALUS KOCH, 1844

Synonymy: 1844: Rhipicephalus Koch, pp. 238-239.
1889: Phauloixodes Berlese, fasc. LV, Nos. 7-8.
1889: "Phaulixodes" Berlese, 1889, fasc. LV, No. 8.
1892: "Phautioxodes Berlese" of Marx, p. 236.
1899: "Rhicephalus" in Fuller, p. 392.
The above synonymy taken from Salmon and Stiles (1901).

Generic Diagnosis: Usually inornate, with eyes and festoons, with short palps and basis capituli usually hexagonal dorsally. Coxa I bifid, hind coxae not enlarged in male. The male possesses a pair of adanal shields and

Distribution of the genus Ixodes



usually a pair of accessory adanal shields; some females when replete, show a caudal protrusion. Spiracles bluntly or elongate comma shaped.

Type species: Rhipicephalus sanguineus (Latreille).

This group contains about 30 species, the more important species occuring in Africa. The genus is represented in the United States by a single species, R. sanguineus.

Specific Diagnosis: Male. Capitulum with basis rectangular dorsally; cornua moderate; palpi very short, first segment prolonged internally; cervical grooves short and deep. Ventrally the basis capituli is narrowed and rounded behind; hypostome about the same length as the palpi, dentition 3:3. Adanal plates triangular, accessory plates comparatively small, spiniform. Coxa I bifid, similar to the genus Dermacentor; external spurs on II-IV small, internal spurs very short, flat and conical on II and III, spur on IV small, faint or absent. Stigmal plate longer than broad, prolongation prominent.

Female. Capitulum similar to that male; cornua short; porose areas small, circular; cervical grooves widely divergent, running out just in front of the distinct lateral carinae; shield longer than broad, angulate. Scapulae bluntly rounded. Legs slender, tarsi tapering gradually. Other characters similar to those found in the male.

## HOSTS

Although commonly a parasite of the dog, Hooker, Bishopp and Wood (1912) lists the following hosts: fox, cat, ox, horse, hare, camel, sheep, goat, birds, and also one or two species of reptiles. Stoddard (1936) reports taking a number of immature stages of Rhipicephalus spp. from the bobwhite quail. In parts of the Old World, man is a frequent host. The specimens taken in Oklahoma were removed from a dog. However, the record from Okmulgee county was a "house infestion."

## DISTRIBUTION

R. sanguineus has a rather wide distribution, occurring in Europe, Asia, Africa and Central and South America. In the United States the tick was formerly confined to the southwestern part, but now is apparently established in Texas, Florida and Louisiana. It has been reported from a number of the more northern states. Collections in Oklahoma have been in Canadian, Payne, Okmulgee and Oklahoma counties.

R. sanguineus has been reported sporadically over the United States as far north as Minnesota. The author has examined a number of specimens received from Dr. Stiles, Denver, Colorado. Numerous reports of this tick infesting homes have been made, especially in the north. Hall, Price and Wright (1934) state, "the tick appears to have taken up the habit of living indoors over the winter as an adaption to cold winters." It may well become established over most of the country, since it is widely disseminated every year.

R. sanguineus has been shown experimentally in this country to transmit tularaemia, spotted fever and bovine anaplasmosis. It is an important vector of canine piroplasmosis and is known to transmit boutonneuse fever in other parts of the world. However, it is unlikely that this tick will ever play more than a minor role in human disease transmission in North America, since it so seldom attacks man.

GENUS AMBLYOMMA KOCH, 1844

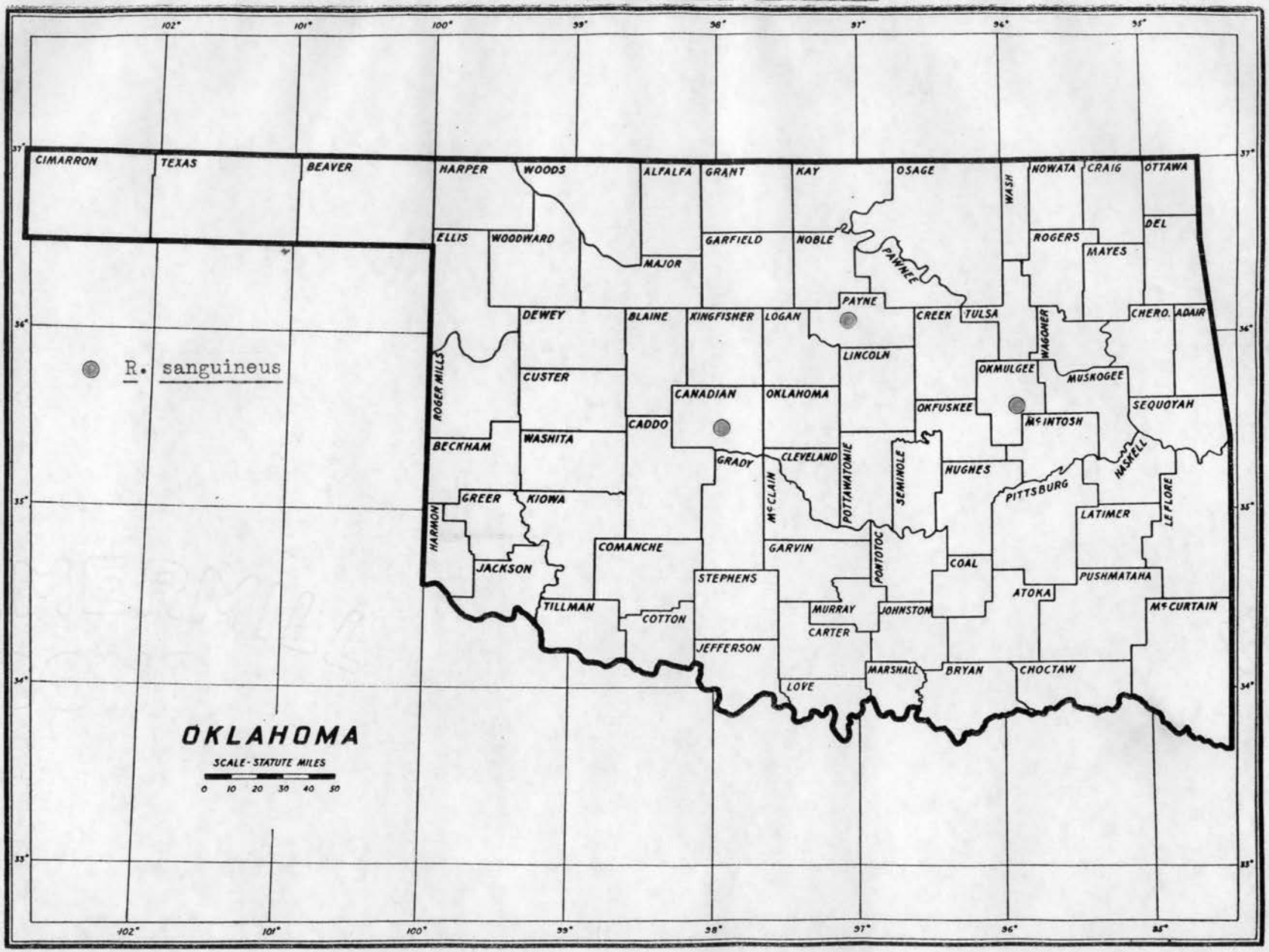
Synonymy: 1758: Acarus Linnaeus, pp. 615-618.
1804: Cynorhaestes Hermann, pp. 63, 67, 68.
1804: Rhynchoprion Hermann, pp. 69, 71.
1805: Ixodes Fabricius, pp. 361-365.
1844: Amblyomma Koch, pp. 225-231.
1872: Adenopleura Macalister, p. 287.
1877: Aphiaster Murray, p. 201.

Generic Characters: Metastriata, ticks with anal grooves embracing the anus posteriorly. Generally ornate with dark spots and stripes on a pale ground. Eyes and festoons present. Palps usually long, with article two especially long. Basis capituli of variable form. The male without adanal shields, but often with ventral plaques. Spiracles sub-triangular or comma-shaped.

Type species: Amblyomma cajennense (Fabricius)

The genus Amblyomma is by far the largest group, containing at least eighty-five valid species. Of the six known

Distribution of Rhipicephalus sanguineus



species in North America, only one species, A. americanum is recorded from Oklahoma. There are no proved vectors of any disease in the United States. However, A. americanum and A. cajennense are potential transmitters of spotted fever and tularaemia. A. maculatum also is known to experimentally transmit spotted fever, but does not attach man, at least to be of importance. A. cajennense is a presumed carrier of Sao Paulo exanthematic typus in Brazil, a disease very similar to spotted fever.

AMBLYOMMA AMERICANUM (LINNAEUS 1758)

Synonymy: 1758: Acarus americanus Linnaeus, p. 615.
1778: Acarus nigua de Geer, p. 154.
1804: Ixodes nigua (de Geer) pp. 52-53.
1804: Rhynchoprion americanum Hermann, p. 71.
1805: Ixodes americanus Fabricius, pp. 355-356.
1844: Amblyomma americanum Koch, p. 229.
1869: Ixodes unipunctata Packard, pp. 66-67.
1886: Amblyomma foreli Stoll, p. 21.

Specific Diagnosis: Male. A very small tick with a shining reddish-brown scutum marked with two pale symmetrical spots near the hinder margin of the body; usually a pale stripe at each side and a short oblique pale stripe within and behind the eyes; marginal groove present, commencing some distance behind the eyes, continous; punctations numerous, moderately small. Coxa I with two stout spurs, external one

the longer; coxae II and III with a short broad plate-like spurs, IV with a long pointed internal spur. Stigmal plate with a marked prolongation.

Female. Scutum triangular, posterior angle broad; punctations numerous, small, a little coarser and more crowded in the scapular angles, evenly distributed elsewhere; cervical grooves in form of oblique oval pits, from which yellow depressions extend backwards to the posterior third of the scutum; a large plae spot on the posterior part of the scutum. Legs with long fine hairs; coxae 1 with external spur long and pointed, internal one shorter; coxae II and III similar to that of male, IV with a short conical spur.

## HOSTS

The type host for this species is unknown. It has been taken from a number of different animals, showing very little host specificity. Oklahoma hosts include the following animals: cow, dog, wolf, horse, goat, sheep, hog, deer, mule, man, jack rabbit, hours cat, bob cat and skunk.

## DISTRIBUTION

The lone star tick is reported to occur as far north as Labrador and Manitoba, and as far south as Argentina. It is widely distributed in the south-central and southeastern states. In this state it is confined to the wooded sections of the eastern and southern parts.

A. americanum has been shown experimentally to transmit spotted fever and tularaemia. Attempts by Rees (1930) to transmit bovine anaplasmosis were negative. This tick is the most annoying pest of man in this area. It is one of the few ticks that will attack man in both the immature and adult stages.

GENUS DERMACENTOR KOCH, 1844

Synonymy: 1844: Dermacentor Koch, original description, p. 235.

1901: Dermacentor Koch: Salmon and Stiles, p. 447.

1908: Dermacentor Koch: Banks, p. 42.

1911: Dermacentor Koch: Neumann, p. 98.

1929: Cynorhaestes Hermann, 1804: Schulze, p. 735-754.

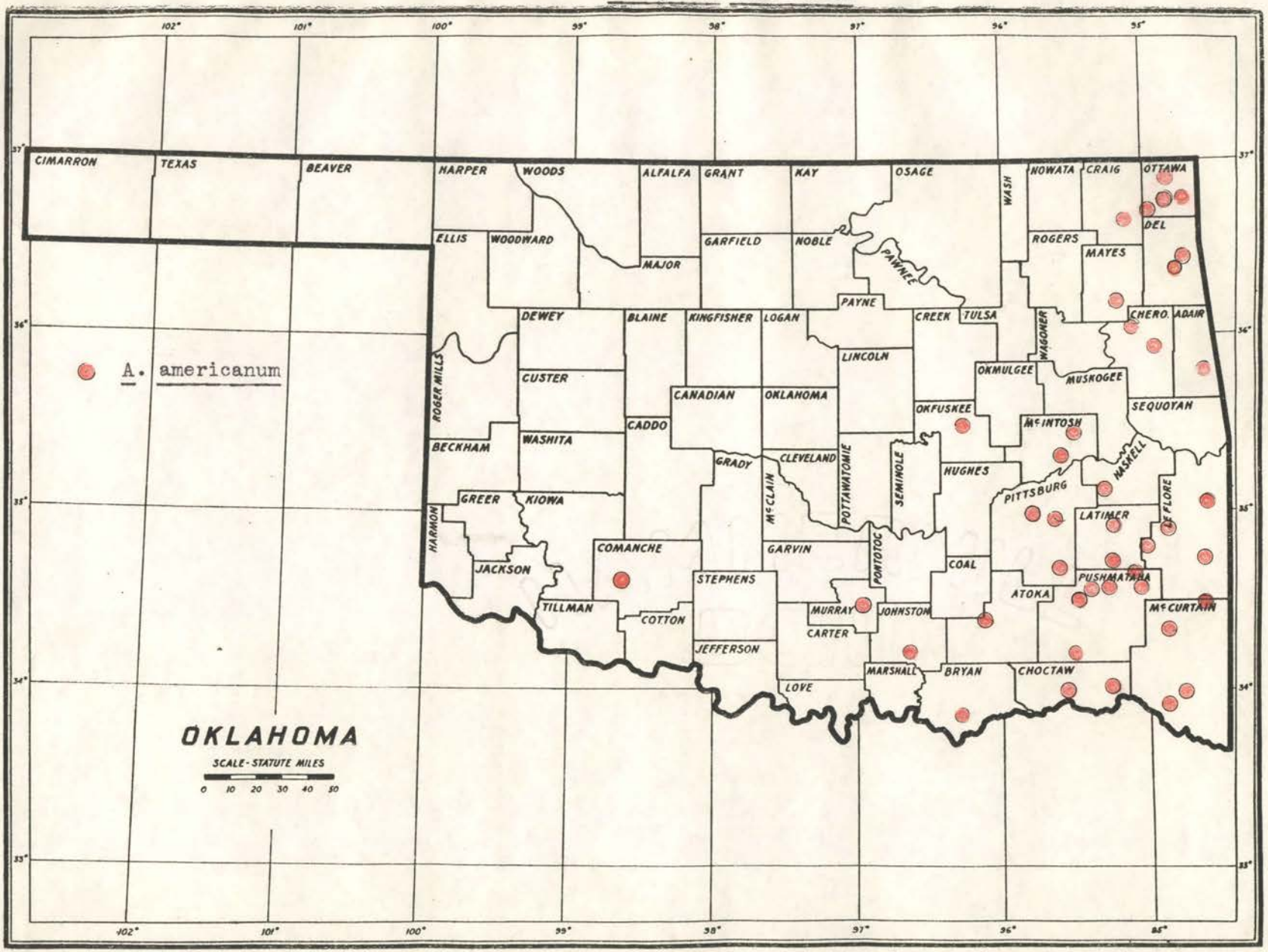
1931: Dermacentor Koch: Schulze recommends that the genus name be retained, p. 52.

1933: Dermacentor (Koch) s. l. Indocentor n.g. Schulze, p. 424.

The above taken from Cooley (1938).

Generic Diagnosis: Usually ornate (except A. inornatum), with eyes and festoons; with short, broad or moderate palps and basis capituli retangular dorsally. Coxa I bifid in both sexes, IV enlarged in male. Spiracles sub-oval or comma-shaped. Ventral plates and shield absent in the male.

Distribution of Amblyomma americanum



Type species: Dermacentor reticulatus (Fabricius).

The genus Dermacentor is relatively small one containing seven species in the United States. This genus is represented by some of the most important disease transmitters. Species of this group occur in Europe, Asia, Oceania, Africa and Central America.
D. variabilis, D. albipictus and D. parumapertus represent the genus in this state.

DERMACENTOR VARIABILIS (SAY), 1821

Synonymy: 1821: Ixodes variabilis Say, original description, p. 77.

1844: Dermacentor electus Koch, p. 235.

1847: Dermacentor electus Koch, p. 109.

1901: Dermacentor electus (Koch 1844): Salmon and Stiles, p. 455.

1908: Dermacentor variabilis (Say 1821): Banks, p. 49.

1911: Ixodes albipictus (Packard 1869): Neumann, p. 101.

1911: Ixodes quinquestriatus = Ixodes robertsoni (Fitch 1872): Neumann, p. 101.

1911: Dermacentor americanus (Linnaeus): Neumann, p. 101.

1912: Dermacentor variabilis (Say 1821): Hooker, Bishopp and Wood, pp. 190-197.

1938: Dermacentor variabilis (Say 1821): Cooley, p. 23.

Specific Diagnosis: Male. Red-brown, dorsum with irregular white markings; legs red-brown, the tips of the joints white. Capitulum about twice as broad as long, its posterior angles slightly produced; palps nearly as long as the capitulum. Coxae as in genus; stigmal plate with a distinct dorsal prolongation, surface covered with minute granules. Length, about 4 mm.

Female. Color, similar to male; porose areas oval, of moderate size; palpi short and broad. Shield longer than broad, broadest at middle, and angulate posteriorly; punctures large and few in number. Cervical grooves deep, converging behind; stigmal plate similar to male, prolongation not so marked as in male.

## HOSTS

The dog serves as a common host for the adult stage. However, the adults have been taken from a rather long list of wild and domestic animals. Records from Oklahoma include the following animals; dog, cow, wolf, horse, cat, man, spotted skunk, squirrel, sheep, mule and elk. The writer has taken the larval stage from the cotton tail rabbit (Silvilagus floridanus alacer) and nymphs from the jack rabbit (Lepus californicus).

This tick has been known for more than a century, but has gained very little attention until recent years. It is now a proved vector of spotted fever, tularaemia and bovine

anaplasmosis. In the case of tularaemia, both stage to stage and generation to generation survival of the organism was shown in D. andersoni by Parker and Spencer (1926), and in D. variabilis by Philip and Jellison (1934). This is the first known instance of the survival of a bacterium in an arthropod vector. Most of the cases of spotted fever occurring in the eastern states have been attributed to this tick. D. variabilis does not rank with D. andersoni as a pest of man in the United States, but does so in Saskatchewan and Manitoba, according to Hearle (1938).

## DISTRIBUTION

D. variabilis is generally distributed from the Atlantic coast to the Rocky Mountains and along the west coast. It is present as far north as Manitoba. This tick covers most of the State of Oklahoma, but apparently is more numerous in the eastern half.

## DERMACENTOR PARUMAPERTUS NEUMANN, 1901

Synonymy:

1901: Dermacentor parumapertus Neumann, original description, pp. 267-268.

1905: Dermacentor electus parumapertus Neumann, in error, p. 236.

1908: Dermacentor parumapertus marginatus Neumann, Banks, in original description of marginatus as variety of paruuapertus, p. 45.

1910: Dermacentor parumapertus Neumann, and D. parumapertus marginatus Banks: Stiles, p.46-48.

1911: Dermacentor variabilis parumapertus Neumann: Neumann, as variety of variabilis Say, in error, p. 101.

1912: Dermacentor parumapertus marginatus Banks: Hooker, Bishopp Wood, p. 159.

1938: Dermacentor parumapertus (Neuman, 1901): Cooley, p. 49.

Specific Diagnosis: Male. Color, dark red-brown, with variable pattern. Capitulum moderately broad, hind angles distinctly produced. Coxae spined as usual; spurs on coxa I divergent, external spur distinctly longer. Stigmal plate with dorsal prolongation marked.

Female. Capitulum about twice as long as wide; cornua short and rounded; porose areas circular and deep. Shield longer than broad and with deep punctures; cervical grooves deep for most of their length, longer than in other species of the genus. Scutum elevated in the median longitudinal area and in the areas away from the grooves. Coxae as in male.

## HOSTS

The type specimens were taken "On a man and in a chicken house" in Lakeside, California. Hooker, Bishopp and Wood (1912) lists the cottontail and jack rabbits as the only known hosts. Cooley (1938) gives records from the coyote and deer. Specimens collected in this state were taken from jack rabbits and cotton-tails.

## DISTRIBUTION

This tick is apparently confined to the more arid sections of the southwestern part of the United States. It has been collected in Cimarron, Texas, Harper and Ellis counties of Oklahoma. This state represents the eastern range.

D. parumapertus is one of the less important ticks in the genus. Little is known of the immature stages. According to Parker (1937), it is difficult to rear. Stage to stage survival of spotted fever and transmission with infected adults of tularaemia has been shown under laboratory conditions. Whether it acts as an agent in the maintenance of these two diseases in nature is not known.

The species, D. parumapertus marginatus is not recognized by Cooley (1938).

## DERMACENTOR ALBIPICTUS (PACKARD), 1869

Synonymy: 1869: Ixodes albipictus Packard, original description, p. 65-66.

1869: Ixodes nigrolineatus Packard, original description, p. 66.

1897: Dermacentor variegatus Marx and Neumann, in Neumann, p. 367-370.

1901: Dermacentor variegatus Marx and Neumann, Salmon and Stiles, p. 452-454.

1901: Dermacentor reticulatus Fabricius: Salmon and Stiles, p. 448-452.

1908: Dermacentor albipictus Packard: Banks, p. 44-45.

1908: Dermacentor nigrolineatus Packard: Banks, 48-49.

1910: Dermacentor nigrolineatus Packard: Stiles, p. 51-55.

1910: Dermacentor albipictus Packard: Stiles, p. 61-63.

1910: Dermacentor salmoni Stiles, original description, p. 55-60.

1913: Dermacentor albipictus Packard: Bishopp and Wood, p. 161-174.

1913: Dermacentor nigrolineatus Packard: Bishopp and Wood, p. 180-186.

The above synonymy taken from Cooley (1938).

Specific Diagnosis: Male. Color, brown, pattern color distinct or faint. Capitulum wider than long, area between cornua depressed, hind angles produced. Cervical grooves short and shallow; lateral grooves faint or absent. Spurs on coxae I contiguous at their bases, parallel or slightly divergent, about the same length. External spurs on II, III, and IV about twice as long as the width at the base, internal spurs on II and III shorter, the one on IV absent. Dorsal

spur on trochanter I long and sub-acute. Spiracular plate with dorsal prolongation faint, sometimes absent.

Female. Basis capituli almost twice as broad as long; cornua shorter than in male; porose areas large and rather close together. Cervical grooves shallow, convergent for about two-fifths their length, then divergent. Scutum punctate larger punctations more numerous in the lateral areas. Marginal grooves distinct, reaching second festoon. Other characters similar to those in male.

## HOSTS

Packard (1869) described D. albipictus from specimens on moose shipped from Nova Scotia. Hosts records of this species indicate it is a parasite of the larger animals. Records this state include the following animals: elk, cow, horse, mule, deer, antelope, mt. sheep, buffalo and coyote. It is seldom collected from the latter animal. D. albipictus and Ornithodoros megnini are the only one-host ticks represented in Oklahoma.

## DISTRIBUTION

There are scattered records of this tick over most of the United States, but it appears more numerous in the north and northwestern parts. It is represented in Oklahoma by collections from Comanche, Pawnee, Delaware, Pittsburg, Latimer, Le Flore, Pushmataha, and McCurtain counties.

The winter tick is an important parasite of the larger game animals. Astounding numbers may be found on a single animal. The term "down with ticks", probably originated from this species. It has been noted that heavy infestations occur on animals in a poor condition. This would appear to be due to the parasite, to the fact that animals are more susceptible during the colder periods and to the fact that in many instances the food supply of such animals is low at this time.

D. albipictus is not known to attack men and so is of little importance as a direct transmitter of human disease. Ricketts (1907) experimentally transmitted spotted fever with this tick, but at the time, did not know he was dealing with albipictus. A bacterial disease of the moose (Klebsiella paralytica) discovered by Thomas and Cahn (1932) is carried by this tick. It was incriminated as a vector of bovine anaplasmosis by Boynton et al (1936). In Oklahoma it is becoming a serious pest of elk and other game animals at the Wichita National Refuge.

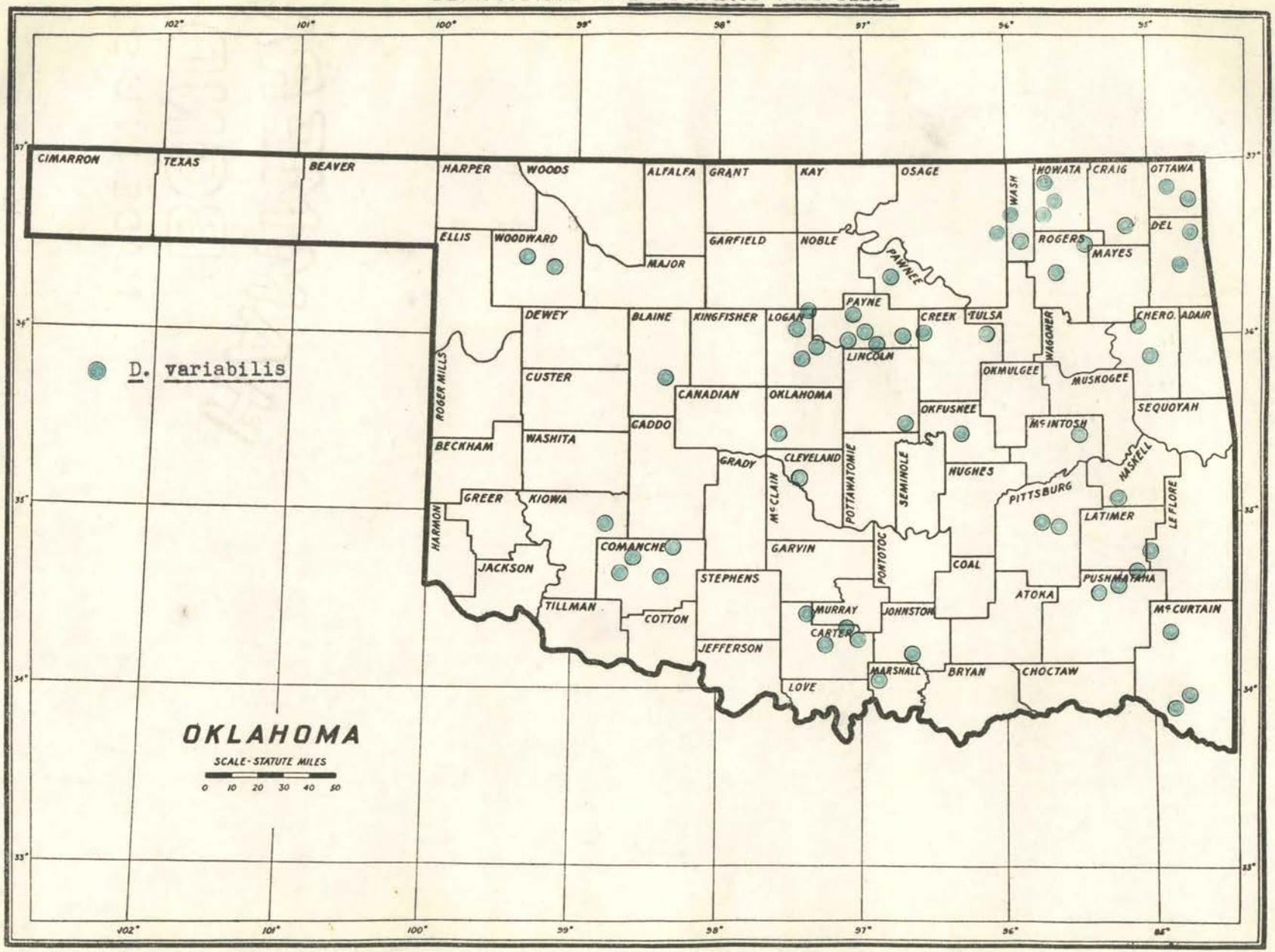
Cooley (1938) places the species Dermacentor nigrolineatus (Packard), 1869, as a synonym of the D. albipictus.

## GENUS HAEMAPHYSALIS KOCH, 1844

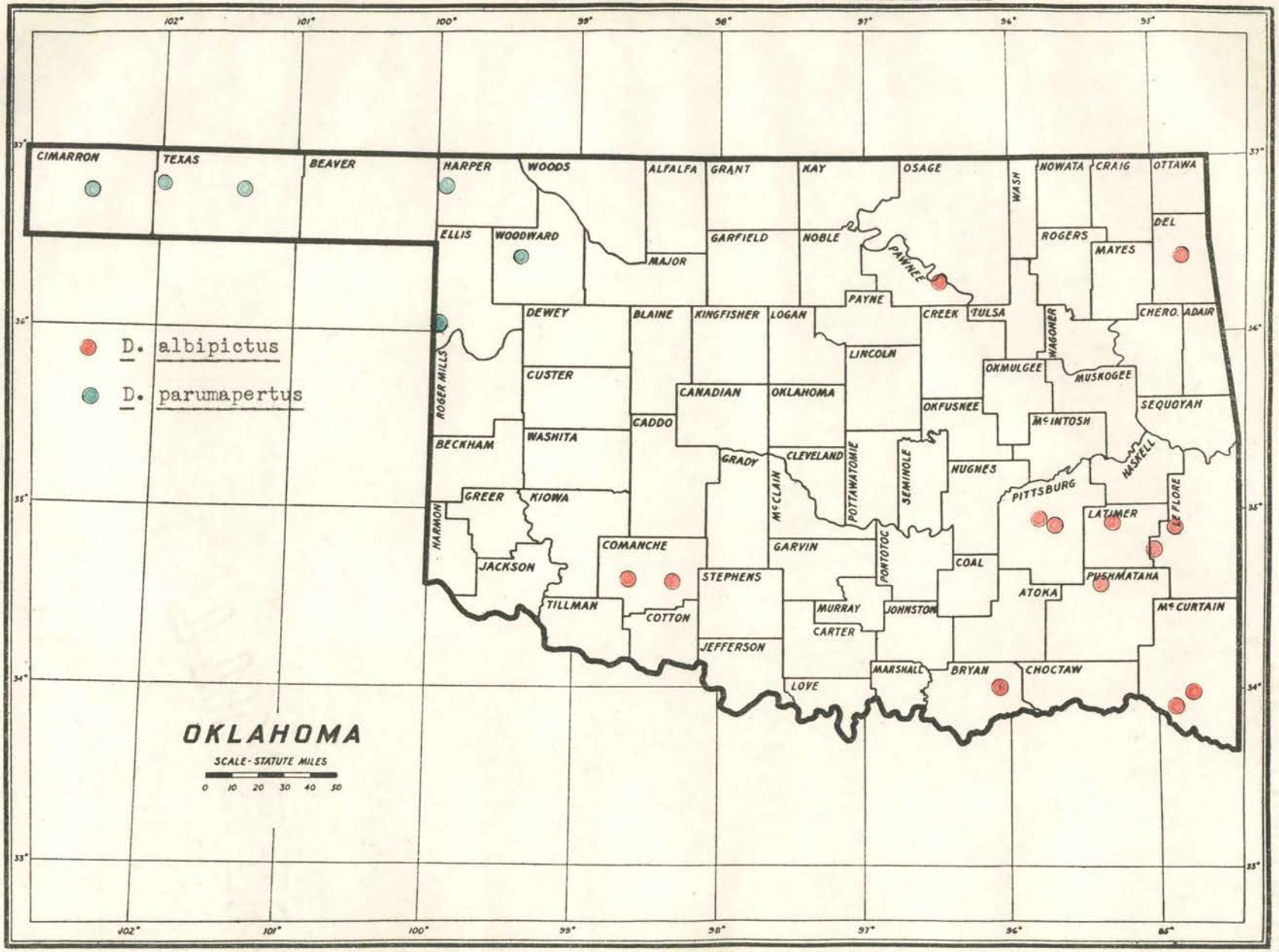
Synonymy: 1827: Ixodes Audouin, p. 428.

1844: Haemaphysalis Koch, p. 237.

Distribution of Dermacentor variabilis



Distribution of Dermacentor albipictus and D. parumapertus



1844: Rhipistoma Koch, p. 239.

1847: Rhipicephalus Koch, p. 135.

1888: Gonixodes Neumann, p. 129.

1890: Herpetobia Canestrini, pp. 486, 493, 527.

1897: Opisthodon Canestrini, p. 469.

1897: Prosopodon Canestrini, p. 417.

Above synonymy taken from Nuttall and Warburton (1915).

Generic Characters: Scutum inornate and without eyes, and in the female, without lateral grooves. Capitulum with base sub-rectangular, and with palps short and conical, broadest near the posterior end of article II, which (except in H. inermis and warburtoni) projects laterally beyond the base. Male with no ventral plates or shields. Coxae not bifid; trochanter I with a dorsal process.

Type species: Haemaphysalis concinna Koch.

This genus is one of the largest of the family, containing about fifty species and varieties. Two of this number are found in the New World, H. leporis-palustris and H. cinnabarina.

According to Nuttall and Warburton (1915) species belonging to the genus Haemaphysalis are less readily identified than Ixodes by means of a dichotomic key, because there are few salient features which serve to differentiate them. There are a number of aberrant forms in this genus, both morphologically and biologically. For instance, the larvae and nymphs

of H. inermis feed from one to two hours. However, the adult requires about a week for repletion.

HAEMAPHYSALIS LEPORIS-PALUSTRIS (PACKARD 1869)

Synonymy: 1869: Ixodes leporis-palustris Packard, p. 67.

1888: Gonixodes rostralis Duges, p. 129, not Ixodes chordeilis as stated by Neumann, p. 343.

1896: Rhipistoma leporis Osborn, p. 261.

1897: Haemaphysalis leporis (Packard)in Neumann, p. 343.

1907: Haemaphysalis leporis-palustris Packard in Hunter and Hooker, pp. 53-54.

1909: Haemaphysalis leporis Packard in Rohr, pp. 144-146.

1909: Haemaphysalis proxima Aragao, in Rohr, pp. 100-110, 146-201.

1911: Haemaphysalis leporis var. proxima Aragao, p. 167.

1912: Haemaphysalis leporis-palustris (Packard) pp. 97, 98, in Hadwen.

Haemaphysalis leporis-palustris (Packard) by numerous other workers.

The above synonymy from Nuttall and Warburton (1915).

Specific Diagnosis: Male. Scutum widest at the posterior third, punctations coarse and confluent but not deep; a pseudo-scutum generally indicated; cervical grooves rather long, convergent and deep throughout their length; lateral grooves commencing behind the pseudo-scutum, well marked to the spiracle and faintly continued to include two or three festoons; festoons rather broad. Capitulum: Base broadest in front, the sides nearly straight and converging posteriorly; cornua slight, ventral cornua present, marked in some cases; palps longer than broad, sub-cylindrical, article II very salient beyond the base, but the lateral contours of articles II and III form normally a straight line, recurved at the base of article II, no dorsal spurs, but a slight point under article III; hypostome 3:3. Venter: Anal grooves slightly ogival; spiracle large, with slight dorsal process. Legs: two short spurs, internal and external, on coxa I; a slight spur on coxae II-IV; very slight trochantal spurs; tarsus IV long stout, tapering rapidly.

Female: Scutum plainly longer than broad, with many large punctures above; cervical grooves long and deep. Capitulum not twice as broad as long, hind angles slightly prominent; porose areas oval, converging anteriorly, separated by more than their width; cornua slight, ventral cornua well marked; palps with all the characters of the male but rela-

tively longer. Venter: Spiracle sub-circular, with slight dorsal process. Legs as in the male.

## HOSTS

Rabbits and hares are the principal hosts of H. leporis-palustris. Peters (1936) gives a list of 46 species of birds that have served as hosts for this tick. Some of the uncommon hosts are the horse, cat, dasyure, pine squirrel and skunk. The latter record was made by the writer, and contained two nymphs. It is also reported to attack man in Argentina but does not do so in North America.

H. leporis-palustris has been found naturally infected with spotted fever and tularaemia. Indirectly the rabbit tick is a factor in human infections and plays an important role in the maintenance of the two diseases in nature.

## DISTRIBUTION

The type locality of this species is Fort Macon, North Carolina. The rabbit tick is one of our more wide spread species, occurring in probably every state. It is found in Mexico, Central and South America, Canada and Alaska. Nearle (1938) states that it is the most abundant species in Canada.

In Oklahoma, this tick likely occurs in every county, but is more numerous in the eastern half.

## SEASONAL HISTORY

The rabbits killed in obtaining the seasonal history were taken in Payne county. Periodical collections were

made from January 1, 1939 to January 1, 1940. Each month at least five and no more than thirty-two rabbits were collected, totalling 197. The animals were shot, bagged in the field and taken to the laboratory for examination.

It has been known for some time that the rabbit tick was active during the summer or warmer seasons of the year. Hooker, Bishopp and Wood (1912) state that the three stages of the tick may be collected during all seasons of the year. According to Cooley (1932) it is not a winter feeding species in Montana and it probably hibernates between active seasons. He also states that no records of adults have been taken in March, which would appear necessary unless the larvae hibernate over winter. Green, Bell and Evans (1938) report the rabbit tick emerges from hibernation in Minnesota during the first part of April. The latter author (1940) states that the tick may be found during mid-winter, but this is an unusual occurrence. Hixon (1940) says all stages may be collected during the winter months in Florida, but there is a marked decrease in numbers.

It can be seen from the data sheet or graph that both larvae and nymphs are active during all months of the year. No males were collected in December and no females were taken in November or December. Although the females were present during January and February, no replete specimens were taken until the latter part of March. The larvae appeared in great-

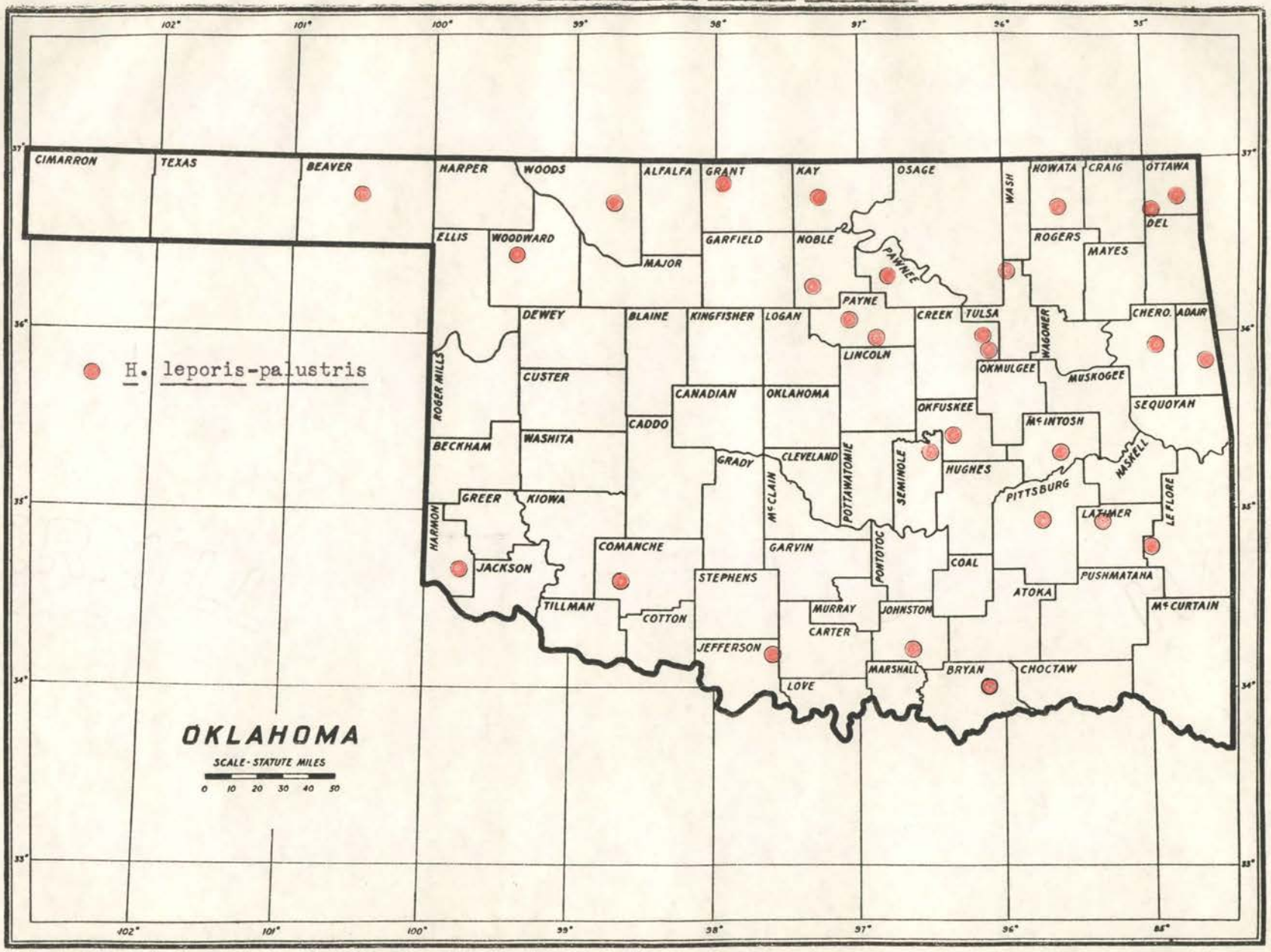
est numbers in July and the nymphs, males and females were more prevalent in June. The sudden increase of the larvae in May is probably the result of the first ovipositing females.

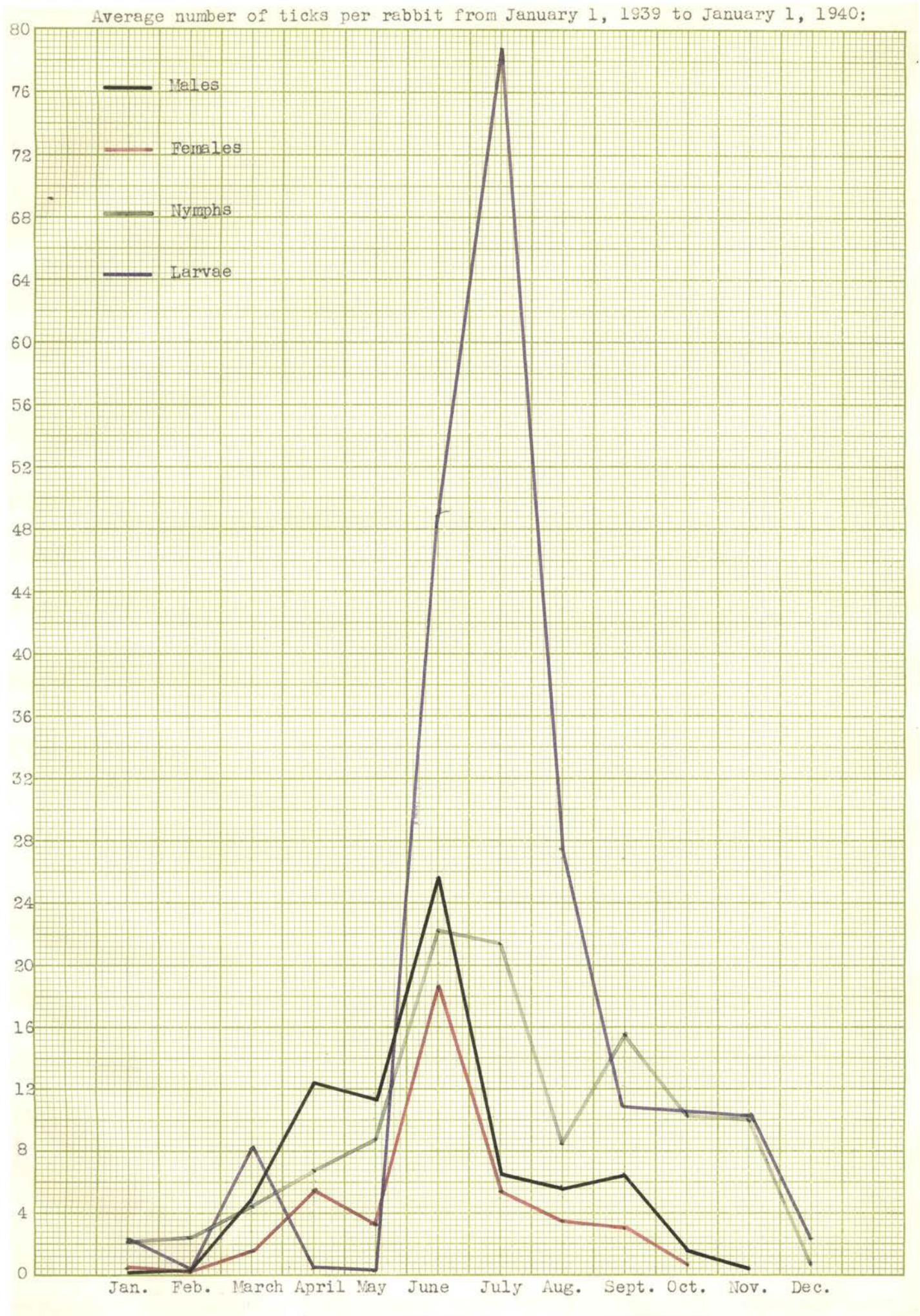
There is a marked decrease in the actual number of ticks during the fall and winter months. There appeared to be no correlation between the rainfall, relative humidity or temperature and the number of ticks present. Temperature appears a more important factor than humidity, since the ticks are fairly inactive at low temperatures, regardless of the humidity.

A YEAR'S COLLECTION OF THE RABBIT TICK HAEMAPHYSALIS LEPORIS-PALUSTRIS FROM THE COTTON TAIL RABBIT SILVILAGUS FLORIDANUS ALACER, FROM JANUARY 1, 1939 to JANUARY 1,1940

| DATE | NO. OF ANIMALS EXAMINED | AVERAGE NO. OF TICKS PER RABBIT EACH MONTH. | | | | |
|---|---|---|---|---|---|---|
| | | Males | Females | Nymphs | Larvae | Total |
| January | 26 | .15 | .23 | 2.11 | 2.15 | 4.64 |
| February | 5 | .40 | .20 | 2.20 | .40 | 3.20 |
| March | 6 | 4.66 | 1.66 | 4.33 | 8.16 | 18.83 |
| April | 32 | 12.03 | 5.87 | 6.81 | .68 | 25.40 |
| May | 13 | 11.23 | 3.30 | 8.92 | .53 | 24.00 |
| June | 19 | 25.72 | 18.84 | 22.05 | 48.94 | 115.55 |
| July | 17 | 6.88 | 5.41 | 21.35 | 78.70 | 112.34 |
| August | 11 | 5.90 | 3.80 | 8.27 | 27.45 | 45.42 |
| September | 15 | 6.66 | 3.33 | 15.33 | 10.86 | 36.18 |
| October | 17 | 1.47 | .64 | 10.41 | 10.76 | 23.28 |
| November | 20 | .40 | .0 | 10.00 | 10.30 | 20.70 |
| December | 16 | .0 | .0 | .62 | 2.18 | 2.80 |

Distribution of Haemaphysalis leporis-palustris




Average number of ticks per rabbit from January 1, 1939 to January 1, 1940:
Males
Females
Nymphs
Larvae
80
76
72
68
64
60
56
52
48
44
40
36
32
28
24
20
16
12
8
4
0
Jan.
Feb.
March
April
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.

## SUMMARY

The ticks in Oklahoma are represented by two families, seven genera and fifteen species. The family Argasidae is composed of two genera, Argas and Ornithodoros. The former is represented by the fowl tick, A. persicus. This species is probably present in most of the southwestern counties, but there are few actual records. The genus Ornithodoros is represented by O. megnini and turicata. O. megnini may be indigenous in this area, since it has been known for over forty years. O. turicata, previously unknown in Oklahoma, was collected in Harmon and Blaine counties.

The family Ixodidae contains five genera and twelve species. The genus Ixodes is represented by six species, scapularis, sculptus, cookei, texanus, kingi and dentatus. I. scapularis is the most prevalent species of Ixodes, being a common tick found on deer. I. cookei and sculptus are fairly common, but kingi, texanus and dentatus are rare. The last species had not previously been reported from this state. The genus Haemaphysalis is represented by leporis-palustris. This tick is found throughout the state, and is one of the two most common ticks present in Oklahoma. The immature stages have been collected during all months of the year, males in all but December and no specimens of females were taken in November or December. The lone star tick, Amblyomma americanum, is the only species of the genus found in this

state. This tick is by far the most important pest of man and an important parasite of cattle. It is very prevalent in the eastern half of the state. The brown dog tick, Rhipicephalus sanguineus, is an uncommon species, being collected in only four counties. The genus Dermacentor contains three species that are found here, variabilis, albipictus, and parumapertus. The dog tick, D. variabilis occurs over most of the state, but apparently is more prevalent in the eastern half. D. albipictus is confined more to the eastern and southern parts, while parumapertus is present only in the northwestern counties. It may also occur in the southwestern part of the state.

The author does not think the species mentioned above comprise a complete list of the ticks found in Oklahoma, nor, is it thought that their range of distribution is confined to those areas shown.

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