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THE GENUS *AMBLYOMMA* (IXODIDAE) IN THE UNITED STATES*

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INTRODUCTION

The publication of a review of the genus *Amblyomma* in the United States has become desirable because of the increasing interest in the members of this genus as known or suspected carriers of diseases and especially because of the need for criteria for the specific differentiation of the larvae and nymphs.

This genus, which is far richer in species than any other, is geographically limited to that portion of the world which is between the 40th parallels of latitude, that is, to the warmer countries. In the United States it is essentially limited to the South-eastern and Southcentral States.

C. L. Koch (1844) was the first to publish a comprehensive account of the ticks. He described many new species and the genus *Amblyomma*. Though he laid the foundation for the systematic classification of ticks, he failed in many instances to select adequate characters. G. Neumann in 1896 began his *Révision de la Famille des Ixodes* which included *Amblyomma* and he was the first to use satisfactory morphological characters and thereby made a definite contribution to the classification of genera and species.

Dönitz (1909) urged the importance of the ornamentation as an aid in recognizing the species and his plan of giving names to the constituent spots and stripes brought order into the terminology of the ornate pattern which most species of *Amblyomma* display. However, the species of *Amblyomma* in the United States are readily separated by morphological characters, hence the ornate color patterns are not described in this paper. They are shown in the figures.

L. E. Robinson (1926) gives excellent descriptions and figures of the 86 species then known and also summarizes their geographical distribution, hosts, economic aspects, and relation to disease.

The more important later writings include Sharif (1928), Dunn (1934), Aragão (1936) and Osorno-Mesa (1941). Other contributions have been made by Warburton (1927), Schulze (1932, 1933, 1936), Kishida (1935) and Cooley and Kohls (1942).

The collection of the Rocky Mountain Laboratory now contains 65 described species of *Amblyomma* from various parts of the world. A study of these and of other available species has led to a fuller understanding of critical morphological and color characters as well as of variation. Variation occurs, particularly in the color patterns, but is less confusing than in some other genera.

A single male specimen of *Amblyomma ovale* (Koch, 1844) taken from a dog, Sept. 8, 1941, Tama Indian Reservation, west of Tama, Iowa, was sent to us for

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* Contribution from Rocky Mountain Laboratory, Division of Infectious Diseases, National Institute of Health.

identification. *A. ovale* is known from Mexico and South America. The finding of this one specimen in Iowa naturally raised the question of whether this species is indigenous in that State. Concerning this question, Mr. Eddy, the sender, has written us the following:

Relative to the establishment of *A. ovale* in Iowa, I might say that we have no further records. A special attempt was made to collect in the area where the tick was picked up and also in other near by areas. Considering the number of animals that were examined throughout the spring, summer and fall of 1941 and the fact that such animals were taken from this same area, I personally feel that the tick is not established on the Tama Iowa Indian Reservation. I realize that certain animals not checked could serve as normal hosts for this tick in North America, but I feel justified in believing otherwise.

The present paper is based largely upon miscellaneous collections made by members of the staff of the Rocky Mountain Laboratory. The authors wish to express their appreciation to these staff associates and to numerous other professional workers and various institutions in this country that have sent us materials; especially Dr. E. A. Chapin, of the U. S. National Museum; Dr. J. C. Bequaert, of Harvard University; Dr. F. C. Bishopp, of the Bureau of Entomology and Plant Quarantine; to Dr. Paul L. Piercy, of the Agricultural and Mechanical College of Texas; and to Dr. R. R. Parker, Director of the Rocky Mountain Laboratory, for advice and for reviewing this manuscript.

THE MEDICAL AND VETERINARY IMPORTANCE OF *Amblyomma* IN THE UNITED STATES

Maver (1911) reported the experimental transmission of the Rocky Mountain spotted fever rickettsia by *Amblyomma americanum* nymphs and adults which as larvae had engorged on an infected guinea pig.

Parker, Philip, and Jellison (1933) demonstrated the survival of this rickettsia from infected female ticks to the larvae of the next generation and transmission by the latter. They considered that the experimental data and the habits and host relationships of *A. americanum* strongly suggested that it was a natural vector of spotted fever. Several instances of possible transmission by this tick in Virginia, Missouri and Louisiana were cited.

In an unpublished paper presented before the American Epidemiological Society on March 20, 1942, Hassler, Sizemore and Robinson discussed seven cases of spotted fever which occurred in 1941 within a period of 32 days in an Oklahoma family in which the circumstantial evidence pointed to *A. americanum* as the vector.

Anigstein (1942) reported four Texas cases in which circumstantial evidence again pointed to *A. americanum* as the vector.

Parker, Kohls, and Steinhaus (1943) reported the recovery of the spotted fever rickettsia from nymphal *A. americanum* collected in Oklahoma. This demonstration of spontaneously infected ticks in nature, together with the accumulated circumstantial case evidence, has definitely established this tick as the third proved vector of spotted fever to man in this country.

A. americanum is certainly a potential transmitting agent of tularemia and very possibly is an actual one. However, naturally infected ticks have not been found. In unreported experiments of the Rocky Mountain Laboratory the survival of *Pasteurella tularensis* from the larval to the adult tick was shown (Parker, Philip, Davis and Cooley, 1937).

While no case of American Q fever definitely diagnosed as such has been reported following tick bite, the infectious agent, *Rickettsia diaporica*, has been recovered from several species of ticks. Parker and Kohls (1943) have recorded the recovery of ten strains from *A. americanum* collected in Liberty County, Texas, in 1937.

An apparently new clinical entity designated as Bullis fever has recently been described by Woodland, McDowell and Richards (1943) as occurring in 1942 and 1943 among troops stationed at Camp Bullis, Texas. Epidemiological data suggest that the disease is transmitted by a blood-sucking parasite and that the most likely vector is *A. americanum*.

Parker, Kohls, Cox and Davis (1939) have reported the recovery of a rickettsia pathogenic for guinea pigs from *Amblyomma maculatum* collected in Liberty County, Texas. This rickettsia belongs to the Rocky Mountain spotted fever group and is most closely related to that of boutonneuse fever. This rickettsia is apparently wide spread in the *A. maculatum* population in the South and since its initial isolation has been recovered several times from ticks collected in Texas and also from ticks collected in Georgia. The disease which it produces in guinea pigs is relatively mild. Its pathogenicity for man is unknown. If human infection is caused, it is likely of infrequent occurrence since this tick only occasionally attaches to man.

Woodland, McDowell and Richards (1943) suggested that *Amblyomma americanum* is the vector of an apparently new disease entity designated as Bullis fever, which was prevalent in 1942 and 1943 among troops stationed at Camp Bullis, Texas. Anigstein and Bader (1943a, b) have reported the recovery of a possible rickettsia, which they believe to be associated with this disease from *A. americanum* collected at this same camp.

While *A. cajennense* is a carrier of Brazilian spotted fever of Brazil and of Tobia petechial fever of Colombia, disease conditions which are presumably identical to each other and to Rocky Mountain spotted fever, it has never been found naturally infected with the spotted fever rickettsia in the United States, nor has it been suspected of being a vector. However, it is certainly a potential one. Fortunately, its distribution in this country, as at present known, is limited to the southern tip of Texas, and it appears unlikely to extend its range consequentially.

Because of their very long hypostomes, *A. cajennense* and *A. americanum*, the larvae, nymphs and adults of which all attack man freely, are particularly annoying pests in sections of the country in which they are abundant. When they are removed by pulling, the hypostome is usually left in the skin and is not pulled out as ordinarily happens with our species of *Dermacentor*. The bites of *A. americanum* have been found particularly annoying during the past two years by troops training at some of the Army camps in the South Central States, and in those where this tick has been particularly abundant morale has been noticeably affected.

The following quotation from a letter received from Mr. E. B. Palmer, of Seattle, offers first-hand evidence of the degree of annoyance that these ticks can cause. In this instance the species concerned is almost certainly *A. cajennense*.

I am going to Mexico on November 1st and expect to be there some ninety days hunting jaguar and ocelot. This will be my third trip. The first trip was down near Tampico, the next near Mazatlan and this trip will be near San Ignacio. On both previous trips I suffered the tortures of the damned with the so-called "ticks." Was unable to get its name but the Mexicans call them ticks. . . . On both my trips I was completely covered with them, particularly on my arms and legs. This little fellow is so small that you do not feel him crawl. Where he bites and

after he fills himself with blood the place where he sucked the blood forms a watery blister about the size of a pin-head, and itches so that you have to scratch it. . . . My legs and arms were raw from these bites and my scratching them. I have found that alcohol rubbed on them relieves the itching very materially. The Mexicans who accompanied me on these trips would take dry palm leaves and set them afire and singe themselves much the same as we do chickens or turkeys. They would do this once a day or more. . . . It would be a Godsend to all people hunting in Mexico if they could be relieved from the itching of these ticks.

In the United States the *Amblyomma* are not known to be important as transmitting agents of disease among domestic animals. It is likely that *A. americanum* transmits spotted fever and possibly tularemia to dogs and sheep, but in general such transmission would be of most consequence as a factor in the natural maintenance of the disease agents concerned. However, serious illnesses as a result of tularemia infections are quite possible. These ticks are most important in relation to domestic animals because of debilitation caused by massive infestations. *A. maculatum* is particularly important because "it creates conditions in ears of domestic animals which induce screwworm infestations." (Hixson, 1940.) It is likely that *A. americanum* also functions in the same manner to some extent. Hooker, Bishopp and Wood (1912) wrote:

In the sections where this tick (*A. maculatum*) occurs in any numbers it is the source of great annoyance to domestic animals, particularly to cattle. By attaching to the inside of the ears, as frequently occurs, great irritation is caused; . . . The injury in the ears furnishes opportunity for the screw-worm fly (*Chrysomya macellaria*) to deposit its eggs, which in the case of equines sometimes results in the destruction of the cartilage, thus causing the ears to droop—a condition known as "gotched" ears. The species is also of some importance on account of the fact that it sometimes attacks man.

Robinson (1926), writing of *Amblyomma* in general, stated:

Leaving out of account the question of disease transmission in the strict sense, many of the species of the genus *Amblyomma* cause severe injury to domestic stock—bovines, equines, sheep and goats—by the enormous quantities of blood which they abstract from their hosts when present in large numbers, and by the suppuration of the wounds which they inflict, and by general tick worry.

The spontaneous bacterial flora of *A. americanum* has been found by Dr. Edward A. Steinhaus, of the Rocky Mountain Laboratory, to consist of species of the genera *Bacillus*, *Micrococcus*, *Proteus*, *Alcaligenes* and *Eberthella* (unpublished data).

TERMS

Apical ventral spur.—The ventral spur at the distal end of the tarsi of adults and rarely in the nymphs of *Amblyomma*. It may be present or absent. Other more proximal ventral spurs may be present.

Basis capituli.—(Sometimes abbreviated to "basis.") The basal portion of the capitulum, spoken of as the "basal ring" by some authors. The basis capituli is movably attached to the anterior part of the scutum and lies partly within the emargination.

Capitulum.—The anterior portion of a tick which bears the mouth parts, sometimes spoken of as the "false head," "head" or "rostrum." It consists of the basis capituli, the palpi, hypostome, and chelicerae.

Cornua.—In *Amblyomma* this useful term is confusing because of the shape and contour of the basis capituli. Cornu (pl. cornua) as herein used means the more or less projecting postero-lateral corner of the basis.

Coxal spurs.—Retrograde processes on the coxae. Internal spurs are on the side toward the median line of the tick and external spurs are on the outer side toward the margin of the body.

Festoons.—Uniform, more or less rectangular areas along the posterior border of the dorsum, separated by grooves. Present in both sexes.

Files.—The longitudinal rows of the denticles or “teeth”—in this paper sometimes referred to as lateral files and median files. The lateral files indicate the outer paired rows. The median files include all except the laterals. Files number 1 are the same as the the laterals, the highest numbered files are those nearest the middle line.

Frame.—The elevated chitinous periphery of the spiracular plate. When the “thickness” of the frame is described, reference is made to the transverse thickness.

Hypostome.—The ventral mouth part with recurved teeth or denticles arranged in longitudinal rows or files. The length of the hypostome is the measurement from the base to the tip and “about” is used because there is usually no definite point or line at the base from which to measure. The denticles are expressed in a formula as 3/3 or 4/4, indicating the number of files on each half of the hypostome. The denticles may be long and sharp or short and rounded apically. The term “over hang” is sometimes used to indicate the extension beyond the base of the tooth where it is attached.

Lateral groove.—In males, the groove at the sides of the scutum which may be complete, incomplete, or absent.

Legs.—Measurements of the length of articles are made from the dorsal side rather than from the ventral side which “telescopes.”

Macula.—In adult ticks, the more heavily sclerotized spot on the spiracular plate through which the principal respiratory opening passes.

Marginal groove.—In females the groove at the sides of the postscutal area of the body; present in unfed ticks and disappearing as the female becomes distended with feeding.

Millimeters.—All measurements are in millimeters expressed in numerals without repeating the usual “mm.”

Nubs.—Small projections on the posterior edge of the ventral scute.

Ornate.—Adults and nymphs of *Amblyomma* are either ornate or inornate, which refers to the presence or absence of a pattern of colors which include dark and light units. The pattern may be in connected lines and broad areas or in separated spots or with both. Emphasis is on the pattern rather than on the color, which varies somewhat. While an extended terminology of the members of the pattern was erected by Dönitz (1909) and revised by Robinson (1926), such terminology is omitted in this paper because it is not needed in distinguishing between the United States species. The reader is referred to the particular figures in which the pattern is shown.

Salience.—A definite edge which projects more or less.

Trochantal spur.—Spur on the ventral surface of the trochanter, similar to coxal spurs.

Ventral plaques.—More or less definite sclerotized plates situated just anterior to the ventral scutes. Present in most males of *Amblyomma* but of little use in differentiating United States species.

Ventral scutes.—Chitinous thickenings of the ventral surface of the festoons which may be very distinct and protruding, faint or absent. They may also bear nubs.

GENUS *Amblyomma* C. L. KOCH 1844

1844. *Amblyomma* Koch, p. 223.
 1872. *Adenopleura* Macalister, p. 287.
 1877. *Xiphiastor* Murray, p. 201.
 1899. *Amblyomma* Koch: Neumann, p. 200.
 1908. *Amblyomma* Koch: Banks, p. 37.
 1911. *Amblyomma* Koch: Neumann, p. 53.
 1926. *Amblyomma* Koch: Robinson, p. 9.

Usually ornate with dark spots and stripes on a pale background. Eyes and festoons present. Palpus usually long with article 2 especially long. Basis capituli of variable form, often sub-quadrangular or sub-triangular. Males without the adanal shields found in *Rhipicephalus*, *Boophilus* and *Hyalomma* though they may have ventral plaques or ventral scutes which may be extended beyond the margin of the body. Spiracular plates sub-triangular or comma-shaped. Nymphs resemble adults but may differ in the shape of the spiracular plate and are seldom ornate.

Genotype: Amblyomma cajennense (Fabricius, 1787.)

Key to Females

		PAGE
1. Scutum, inornate	<i>inornatum</i>	105
Scutum, ornate	2	
2. Coxa I with external spur distinctly longer than the internal spur	3	
Coxa I with subequal spurs	5	
3. Scutum with the pale markings usually limited to a spot near the posterior end	<i>americanum</i>	87
Scutum with pale markings in an extensive pattern	4	
4. Coxa I with internal spur about half the length of the external spur	<i>cajennense</i>	83
Coxa I with the internal spur very short or insignificant	<i>maculatum</i>	94
5. Coxa IV with the external spur longer than the internal spur	<i>dissimile</i>	99
Coxa IV with the two spurs about equal	<i>tuberculatum</i>	102

Key to Males

		PAGE
1. Scutum, inornate	<i>inornatum</i>	106
Scutum, ornate	2	
2. Coxa I with the internal spur moderately long	3	
Coxa I with internal spur short or insignificant	4	
3. Scutum with the pale markings in an extensive, connected pattern	<i>cajennense</i>	84
Scutum with the few pale markings in isolated spots	<i>americanum</i>	88
4. Coxae II, III, and IV each with one spur	<i>maculatum</i>	95
Coxae II, III, and IV each with two spurs	5	
5. Coxa IV with the external spur distinctly longer than the internal spur	<i>dissimile</i>	100
Coxa IV with both spurs short	<i>tuberculatum</i>	102

Key to Nymphs

		PAGE
1. Scutum, ornate	<i>tuberculatum</i>	103
Scutum, inornate	2	
2. Basis capituli pointed at the sides	<i>maculatum</i>	95
Basis not pointed at the sides	3	
3. Hypostome with dentition 3/3	<i>dissimile</i>	102
Hypostome with dentition 2/2	4	
4. Scutum with conspicuous punctations and with surface pebbled	<i>avicolens</i>	107
Scutum with moderate punctation or with none and with surface smooth	5	
5. Scutum with punctations distinct, deep, grooves shorter and a little wider	<i>americanum</i>	88
Scutum with punctation faint, shallow, grooves longer, and a little narrower	<i>cajennense</i>	84

The nymphs are easily separated except those of *americanum* and *cajennense*. Nymphs of *inornatum* have not been seen.

Amblyomma cajennense (Fabricius, 1787)
(Figs. 1 and 2)

1787. *Acarus cajennensis* Fabricius, p. 372.
 1794. *Ixodes cajennensis* (Fabricius), p. 427.
 1805. *Ixodes cajennensis* (Fabricius), p. 354.
 1821. *Ixodes crenatus* Say, II, p. 76.
 1844. *Amblyomma cajennense* (Fabricius): Koch, p. 226.
 1844. *Amblyomma tenellum* Koch, p. 227.
 1844. *Amblyomma mixtum* Koch, p. 227.
 1887 (1884?). *Ixodes herrerae* Duges, p. 487.
 1888. *Amblyomma sculptum* Berlese, p. 192.
 1899. *Amblyomma parviscutatum* Neumann, p. 208.
 1899. *Amblyomma cajennense* (Fabricius): Neumann, p. 205.
 1907. *Amblyomma cajennense* (Fabricius): Hunter and Hooker, p. 60.
 1908. *Amblyomma versicolor* Nuttall and Warburton, p. 407.
 1912. *Amblyomma cajennense* (Fabricius): Hooker, Bishopp and Wood, p. 151.
 1926. *Amblyomma cajennense* (Fabricius): Robinson, p. 288.

Female

Body: Length of unengorged specimens from 3.12 to 3.42, width from 2.34 to 2.55. Oval, with the width over length varying considerably. Scutum extending about half the length. Marginal groove complete and continuing across the basis of the festoons. Nubs on the ventral scutes sometimes visible from above. Well engorged females may become as large as 13.50 × 11.00 and are about equally broad on both ends.

Capitulum: Length from 1.11 to 1.5; width of basis, 0.66. Basis sub-rectangular and with very mild cornua. Porose areas small, nearly circular. Surface smooth, shining, punctate. Palpi long, compressed laterally. Hairs moderate in number.

Scutum: Length 1.62 to 1.86, width 1.71 to 1.86. Triangular, usually a little broader than long, sometimes with length and breadth equal, widest in front of the middle, postero-lateral margins nearly straight. Cervical grooves short, deep in front, then continuing posteriorly as shallow valleys. Scapulae narrow. Eyes moderate in size, pale and very mildly convex. Ornate with whitish pattern variable. Punctations moderate in number, usually larger in the antero-lateral areas.

Legs: Moderate in length and size, relatively slightly longer and smaller than in the male. Distal end of tarsus I with apical and sub-apical ventral spurs absent, present on II, III and IV. Length of tarsus I, 1.05; metatarsus, 0.75. Length of tarsus IV, 0.66; metatarsus, 0.75.

Coxae: Coxa I with two distinct spurs, the external spur much longer. Coxae II, III and IV each with a single, broad, flat, rounded spur. All coxae with a few, long, fine hairs.

Spiracular plate: Frame moderately well sclerotized, surface a little concave at the macula. Length 0.51, width 0.51.

Genital aperture: Situated at about the level of the intervals between coxae II and III.

Hypostome: Spatulate, long, notched apically. Dentition 3/3. Length 0.93.

Male

Body: Length from 2.34 to 3.12, width 1.80 to 2.40. Robinson (1926) gives the length as 3.9 to 4.9 and width 2.3 to 3.0. Broad oval, wider behind.

Scutum: Smooth, shining, and with the dark-colored spots slightly elevated over the light-colored ones; scapulae pointed. Cervical grooves short and deep. Lateral grooves distinct posteriorly and across the festoons, fading out back of the eyes. Conspicuous extensions of the ventral plaques present in some specimens. Eyes small, and slightly elevated. Ornamented, with a characteristic pattern which includes spots on some of the festoons. Punctations moderate in size and number, the larger ones limited mainly to the light-colored areas.

Capitulum: Length from 0.84 to 1.05, width of basis from 0.48 to 0.66. Basis subquadrate, sides a little convex, cornua short to moderate. Surface smooth, shining, punctate. Palpi long, compressed laterally. Combined length of I and II, 0.51 to 0.54.

Hypostome: Spatulate, long, apically rounded and very faintly notched. Dentition 3/3. Length about 0.72.

Legs: Moderate in length, with their sizes progressively increasing from I to IV. Terminal and sub-terminal ventral spurs absent on tarsus I; present on II, III and IV. Length of tarsus I, 0.87; metatarsus, 0.66. Length of tarsus IV, 0.60; metatarsus, 0.78.

Coxae: Coxa I with two long spurs, the external one longer. Coxae II and III each with one short, broad, flat spur. Coxa IV with one long, internal spur.

Spiracular plate: Large, moderately well sclerotized, with the surface slightly concave. Length 0.66, width 0.36.

Genital aperture: Situated at about the level of the intervals between coxae II and III.

Nymph

Body: Broad oval. Length (unengorged) 1.38, width 1.14.

Capitulum: Length 0.42, width of basis 0.3. Basis sub-quadrate, sides convex, cornua faint or absent, posterior margin concave or nearly straight. Surface smooth, impunctate. Palpi long and with a few fine hairs. Combined length of articles 2 and 3, 0.24.

Hypostome: Spatulate, moderately long, faintly notched apically. Dentition 2/2. Length about 0.24.

Scutum: Length 0.66; width 0.84. Broadly cordiform, wider than long, broadest at about the middle, scapulae rounded. Cervical grooves deep and long, reaching to near the postero-lateral margins. Eyes large, pale, mildly convex. Punctations moderate in number, small, faint, seen best in reflected light.

Legs: Ventral spurs absent on distal ends of all tarsi. Length of tarsus I, 0.42; metatarsus, 0.24. Length of tarsus IV, 0.30; metatarsus, 0.21.

Coxae: Coxa I with two distinct spurs, the internal one shorter. Coxae II, III and IV each with a single spur. All spurs short, those on II, III and IV flat and relatively a little narrower than in *americanum*.

Spiracular plate: Large, nearly flat, but sunken at the respiratory opening. Length 0.21, width 0.14.

Larva

Scutum: Length 0.235, width 0.336. Much wider than long. Cervical grooves shallow, long, and about parallel. Surface smooth, faintly shagreened, impunctate.

Capitulum: Length 0.18, width 0.15. Basis short and broad, with rounded points at the sides. Surface smooth, shining, impunctate. Palpi long, with articles 2 and 3 about equal, hairs few and fine. Combined length of articles 2 and 3 about 0.11.

Hypostome: Short and broad distally. Dentition 2/2. Length about 0.086.

DISTRIBUTION AND HOSTS

The type locality of *A. cajennense* is Guiana. Robinson (1926, p. 51) summarized the known distribution of *A. cajennense* and included the previous data of Koch (1844), Stoll (1888–1893), Berlese (1888), Neumann (1899), Banks (1908),

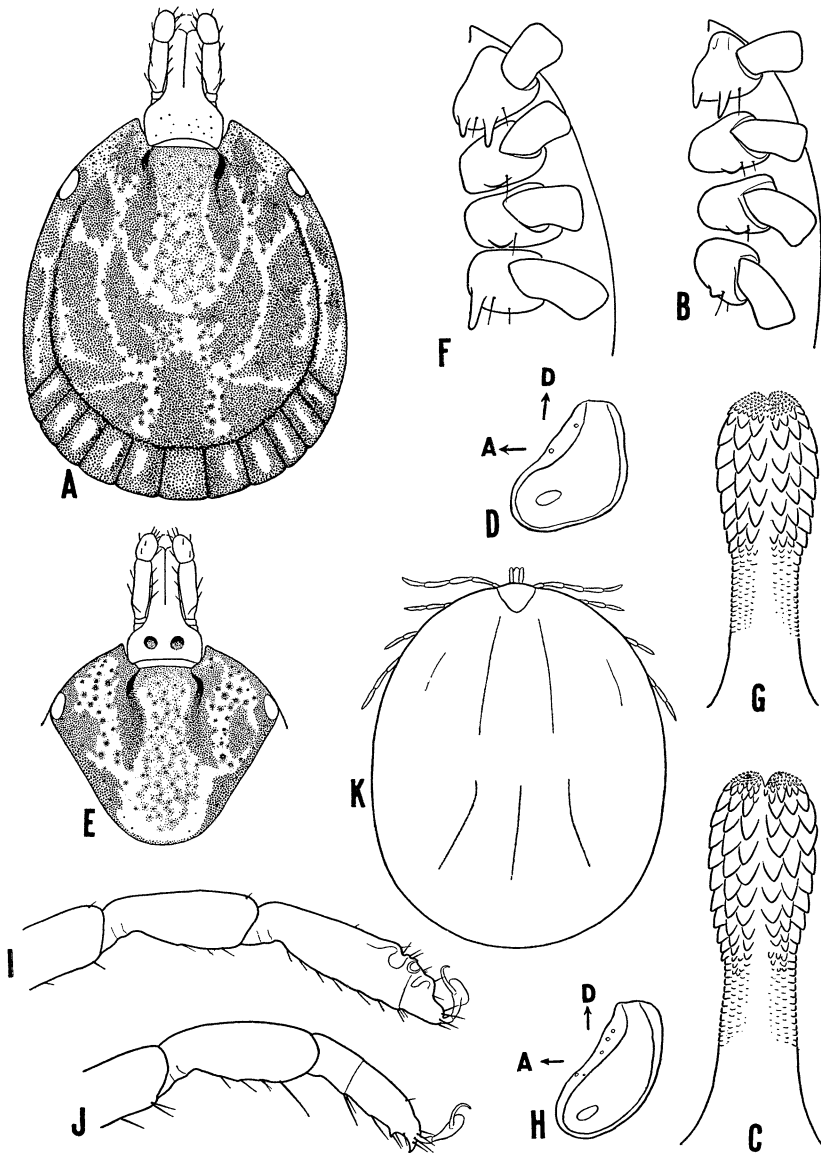


FIG. 1. *Amblyomma cajennense* (Fabricius). A. Capitulum and scutum, male. B. Coxae of female. C. Hypostome, female. D. Spiracular plate, female. E. Capitulum and scutum, female. F. Coxae of male. G. Hypostome, male. H. Spiracular plate, male. I. Leg I, female. J. Leg IV, female. K. Engorged female.

Hunter et al (1907) and Aragão (1911). He reported the species as occurring in Southern United States, Central America, West Indies and South America, particularly along the Atlantic seaboard as far south as Buenos Aires. The following countries other than the United States are definitely mentioned: Mexico, Brazil, Guatemala, Nicaragua, Costa Rica, Colombia, Guiana, Panama, Honduras, Cuba, Trinidad, Vera Cruz, Yucatan, Venezuela, Paraguay and Argentine Republic. Hunter et al (1907) include Bermuda. Banks (1908, p. 42) and Hooker et al (1912, p. 152) indicate this tick to be established in the United States only in the

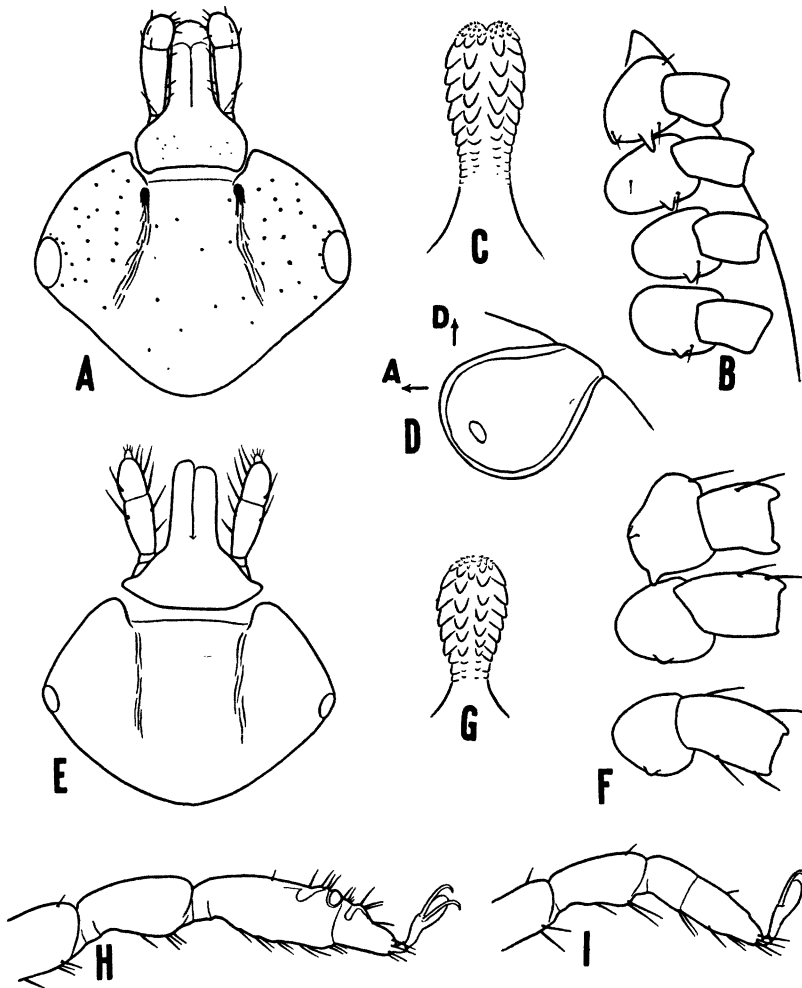


FIG. 2. *Amblyomma cajennense* (Fabricius). A. Capitulum and scutum, nymph. B. Coxae of nymph. C. Hypostome, nymph. D. Spiracular plate, nymph. E. Capitulum and scutum, larva. F. Coxae of larva. G. Hypostome, larva. H. Leg I of nymph. I. Leg IV of nymph.

southern end of Texas and southern point of Florida. References by Banks (1908), and others, and unpublished records of the Rocky Mountain Laboratory show that specimens of this tick have been found in scattered localities in several States. The Laboratory also has specimens from several of the countries listed above, as follows: From Mexico on man, opossum, *Sciurus*, and domestic animals, 17 lots; from Colombia on domestic animals, 8 lots; from Brazil on man, domestic animals, and capybara, 16 lots; from Honduras on domestic animals, 5 lots; from Nicaragua on man and domestic animals, 6 lots; from the Canal Zone, hosts not stated, 4 lots. Including the records of previous writers, some 25 different animals have been reported as hosts.

Dr. Paul L. Piercy has kindly shown us the extensive records of his survey of ticks in Texas and it seems perfectly evident that the tick is abundant and established only in the following counties in Texas: Nueces, Jim Wells, Kleberg, Brooks, Kennedy, Starr, Hidalgo, Willacy and Cameron. From the Banks' record it is apparent that *A. cajennense* was at least formerly present in the southern point of

Florida. However, there have been no records published subsequently of the presence of this species in Florida. In a recent letter from Homer Hixson, he states:

The status of the tick *Amblyomma cajennense* in Florida is apparently not definitely known. Although I have not known of any intensive collecting in Southern Florida, the collecting I have known about indicates that this tick does not occur in Florida or if it does, it is rare.

A. cajennense commonly attacks man, horses, cattle, sheep, goats, dogs and pigs. Neumann (1909, p. 442) mentions several authentic records of its occurrence on the tongues of young calves and gives one record on *Bufo marinus*.

Records of the Rocky Mountain Laboratory for the United States are given in the accompanying table.

Accession No.	State	Locality	Date	Host animal or source	Number	Collector or authority
10021	Tex.	Brownsville, Cameron Co.	2/8/34	Goat	318 A.	L. Demieville
10048	"	"	4/14/34	?	372 A.	"
10036	"	"	Mar. 1935	.....	23 N., 76 A.	"
11062	"	"	Apr. 1935	Goat	90 A.	"
11060	"	"	4/13/35	Cow	65 A.	"
11061	"	"	"	Horse	105 A.	"
11087	"	"	May 1935	Cow	100 A.	"
11063	"	"	5/11/35	Goat	165 A., 30 N.	"
11119	"	"	June 1935	Cow	10 A.	"
14227	"	"	5/3/38	Dogs	?	R. M. L.
14229	"	"	"	Horses	110 A.	"
14232	"	"	5/4/38	"	100 A.	"
14234	"	"	5/5/38	"	100 A.	"
14235	"	"	"	Drag	125 N., 30 A.	"
20479	"	"	9/14/42	.....	2 A.	St. Bd. Health
11436	"	Kingsville, Kleberg Co.	10/16/35	Peccaries	3 N., 10 A.	R. M. L.
11442	"	"	10/18/35	Drag	20 A.	"
14183	"	"	5/25/38	Deer	3 A.	R. M. L.
14833	"	"	7/25/38	Peccaries	1 A.	J. C. Brown

Amblyomma americanum (Linnaeus, 1758)
(Figs. 3 and 4)

1758. *Acarus americanus* Linnaeus, p. 615. (Not *Acarus americanus*, *A. nigra*, from Brazil, of Treviranus, 1831, pp. 185-191. See Salmon and Stiles 1901, p. 475.)
1778. *Acarus nigra* de Geer, p. 153.
1804. *Ixodes nigra* (de Geer) : Latreille, p. 52.
1804. *Rhynchoprion americanum* (Linnaeus) : Hermann, p. 71.
1805. *Ixodes americanus* (Linnaeus) : Fabricius, p. 356.
1844. *Amblyomma americanum* (Linnaeus) : Koch, p. 229.
1869. *Ixodes unipunctata* Packard, p. 66.
1880. "*Argas americanum* de Geer" of Megnin, p. 134 (in part).
- 1886-1893. *Amblyomma foreli* Stoll, p. 21.
1899. *Amblyomma americanum* (Linnaeus) : Neumann, p. 209.
1901. *Amblyomma americanum* (Linnaeus) : Salmon and Stiles, p. 475.
1908. *Amblyomma americanum* (Linnaeus) : Banks, p. 40.
1912. *Amblyomma americanum* (Linnaeus) : Hooker, Bishopp and Wood, p. 142.
1926. *Amblyomma americanum* (Linnaeus) : Robinson, p. 45.
1929. *Amblyomma americanum* (Linnaeus) : Oudemans, p. 198.
1936. *Amblyomma americanum* (Linnaeus) : Oudemans, p. 455.

A relatively small tick, with a considerable variation in size and also with an unusual disparity between the smaller males and larger females.

Female

Body: Length, unengorged, 2.46 to 3.40, width 1.98 to 2.60. Broad oval, with the scutum reaching about half the length. Well engorged specimens may become as large as 11.0 × 9.25.

Scutum: Length 3.30, width 1.80. Sub-triangular, posterior angle broad, posterior apex

flattened, postero-lateral sides nearly straight, scapulae pointed. Posterior angle with a conspicuous whitish spot with red and green tinges; sometimes with other spots in the scapular fields. Punctations numerous, rather evenly distributed and larger in the anterior areas. Cervical grooves short and deep, convergent posteriorly. Eyes flat, large, and pale.

Capitulum: Length 0.90 to 1.14, width of basis 0.60 to 0.73. Basis sub-rectangular, dorsal surface smooth, punctate, convex, with sides more declivitous; posterior margin nearly straight, salient; postero-lateral corners rounded, mildly suggesting cornua. Porose areas oval, divergent anteriorly, and separated by about the length of the longer axis of one. Palpi long, with the surface irregular. Combined length of 2 and 3, 0.84.

Hypostome: Long, spatulate, faintly notched apically; denticles 3/3. Length about 0.75.

Legs: Long and small and with long, fine hairs. Apical and sub-apical ventral spurs absent on tarsus I, present on II, III and IV. Length of tarsus I, 0.96; metatarsus, 0.66. Length of tarsus IV, 0.75; metatarsus, 0.70.

Coxae: Coxa I with two spurs, the external one long and pointed, a single broad, plate-like spur each on II and III, a single, triangular, plate-like spur on IV. Long, fine hairs on all coxae.

Spiracular plate: Large and with its frame moderately sclerotized, surface concave. Length 0.60, width 0.54.

Genital aperture: Situated at the level of the intervals between coxae II and III.

Male

Body: Length 2.95, width 2.26. Oval, wider behind.

Scutum: Smooth and shining. Surface in general flattened, more convex in front of the festoons. Cervical grooves short, deep, and convergent anteriorly. Lateral grooves distinct near the festoons, disappearing back of the eyes. Festoons long, all limited anteriorly by a continuation of the marginal groove. Ornamentation limited to symmetrical, isolated whitish spots as shown in the figure. In some specimens the white spots are much smaller or absent. Punctations numerous and small. Eyes flat, pale.

Capitulum: Length 0.9, width of basis 0.59. Basis sub-quadrate, smooth, shining, and punctate; cornua short. Palpi long, with the surface irregular. Combined length of articles 2 and 3, 0.54.

Hypostome: Essentially as in the female. Denticles 3/3. Length about 0.48.

Legs: Legs long and small, and with long, fine hairs. Apical and sub-apical ventral spurs absent on tarsus I, present on II, III and IV. Length of tarsus I, 0.69; metatarsus, 0.48. Length of tarsus IV, 0.54; metatarsus, 0.54.

Coxae: Coxa I with two spurs, the external one longer and pointed. Coxae II and III each with a single broad, flat spur. Coxa IV with a long, pointed, internal spur. All coxae with long, fine hairs.

Genital aperture: Situated between coxae II.

Spiracular plate: Large, convex, and with the frame only moderately sclerotized. Length 0.51, width 0.28.

Nymph

Body: Broad oval. Length (unengorged) 1.32, width 1.23.

Capitulum: Length 0.42, width of basis 0.30. Basis broad and short. Posterior margin nearly straight, salient. Surface smooth, shining, and with a very few punctations. Palpi long, combined length of 2 and 3, 0.21.

Hypostome: Long, rounded apically. Dentition 2/2. Length 0.27.

Scutum: Length 0.6, width 0.75. Broadly cordiform, usually slightly broader than long, broadly rounded behind. Cervical grooves deep in front, becoming shallow behind and disappearing back of the eyes. Eyes large, pale, and a little convex. Surface smooth, shagreened. Punctations moderate in number, larger, and more easily seen than in *cajennense*.

Legs: Apical and subapical ventral spurs absent on all tarsi. Length of tarsus I, 0.33; metatarsus, 0.21. Length of tarsus IV, 0.28; metatarsus, 0.19.

Coxae: Coxa I with both external and internal spurs present, coxae II, III and IV only with the external spur present. All spurs short.

Spiracular plate: Large, mildly sclerotized. Length 0.26, width 0.18.

Larva

Capitulum: Length 0.20, width of basis 0.15. Basis short, broad, and rounded at the sides. Surface smooth, shining and impunctate. Palpi short, laterally compressed, and with relatively long hairs. Length about 0.11.

Hypostome: Small, spatulate in shape, rounded apically. Dentition 2/2. Length about 0.66.

Scutum: Shape much as in the nymph, but relatively shorter. Cervical grooves moderately deep, long, parallel. Surface smooth, shagreened, impunctate. Length 0.25, width 0.35.

Coxae: Coxa I with two small spurs; II and III with one spur.

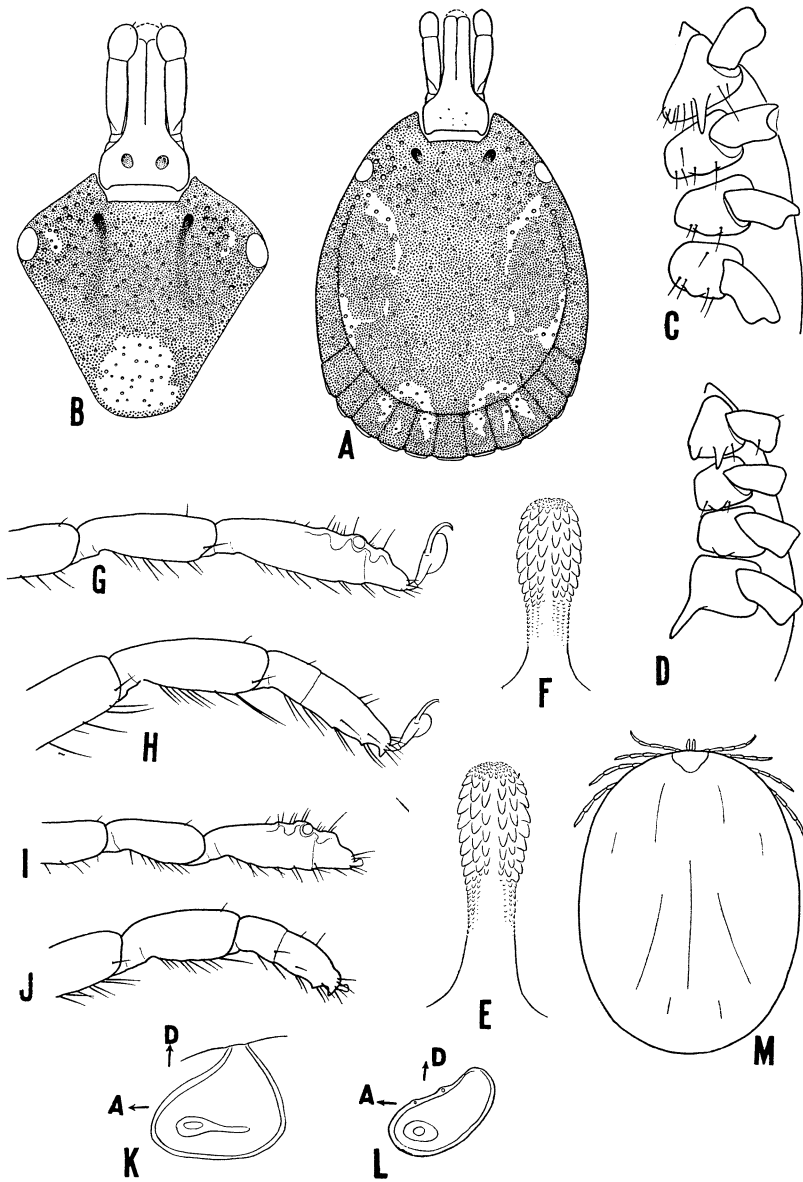


FIG. 3. *Amblyomma americanum* (Linnaeus). A. Capitulum and scutum, male. B. Capitulum and scutum, female. C. Coxae of female. D. Coxae of male. E. Hypostome, female. F. Hypostome, male. G. Leg I, female. H. Leg IV, female. I. Leg I, male. J. Leg IV, male. K. Spiracular plate, female. L. Spiracular plate, male. M. Engorged female.

DISTRIBUTION AND HOSTS

The type locality of *americanum* is Pennsylvania or New Jersey but the type host is not known.

Knowledge of the distribution of this tick in the United States is rather indefinite and we can do no better than to quote from a recent publication by Parker, Kohls and Steinhaus (1943), as follows:

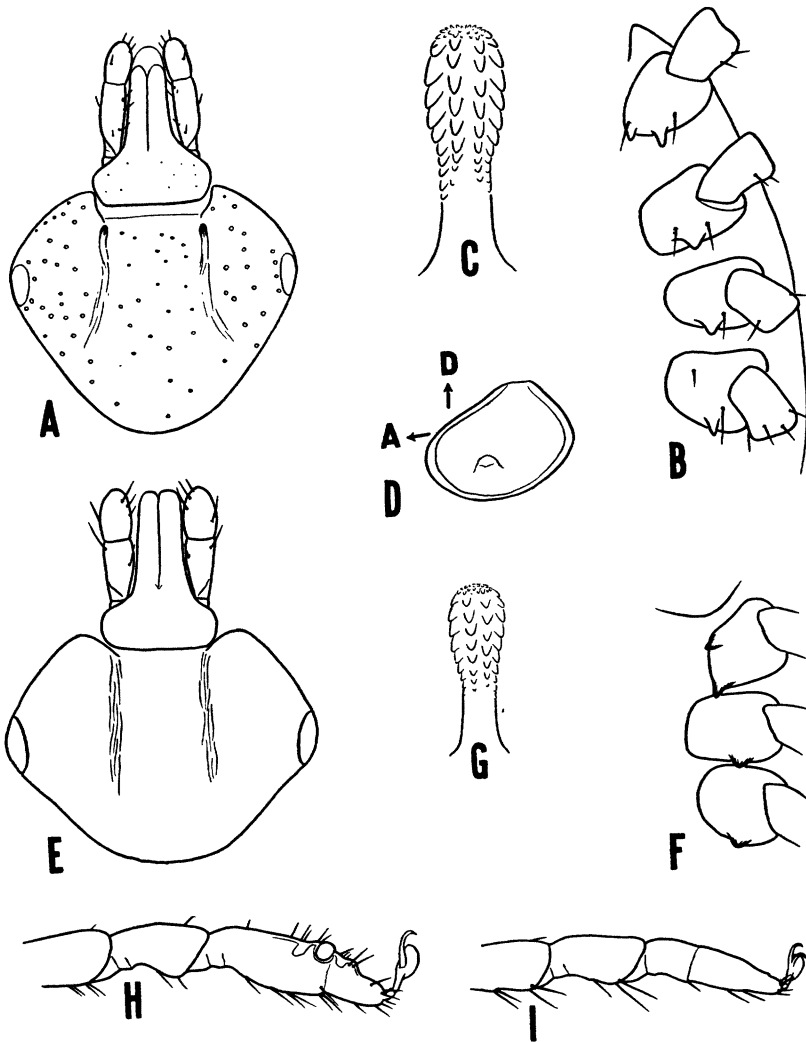


FIG. 4. *Amblyomma americanum* (Linnaeus). A. Nymph, capitulum and scutum. B. Nymph, coxae. C. Nymph, hypostome. D. Nymph, spiracular plate. E. Larva, capitulum and scutum. F. Larva, coxae. G. Larva, hypostome. H. Leg I of nymph. I. Leg IV of nymph.

Hooker, Bishopp and Wood (1912) show *A. americanum* as occurring east and south of a line starting from a short distance west of the southernmost tip of Texas and extending northward and northeastward across the States of Oklahoma, Kansas (southeastern corner), Missouri, Illinois, and Indiana into southern Michigan, and thence almost directly eastward across New York and the southern portions of the three northern New England States. However, such evidence as we have suggests that it is extremely scarce in the northern portion of this area.* We also have recent reports of its occurrence in southern Iowa. Actually, there is very little published information concerning the distribution and abundance of this tick in any of the 18 States concerned. Apparently it is most abundant in parts of Texas, Louisiana, Oklahoma, Arkansas, and Missouri. Doubtless it is abundant, at least sporadically, in other southern States eastward to the Atlantic Coast.

* The State Entomologists of Ohio, Indiana, and Illinois (J. S. Houser, J. J. Davis, and W. P. Flint, respectively), and R. E. Rebrassier, of the College of Veterinary Medicine of Ohio State University, have recently informed us that they know of no records of *A. americanum* in their respective States.

The Marx collection contained one specimen from Labrador. Neumann (1911) extended the range of the species to Guatemala, Brazil and Guiana and our records suggest it is common in Mexico.

A. americanum shows a very wide range of hosts, including birds. All three stages commonly bite man. Neumann (1911) records it on man, cow and *Felis pardalis*. Hooker et al record it on man, dog, cattle, horse, deer, goat, peccary, hog, mule, skunk, sheep, wolf, fox, squirrel, badger, domestic cat, wild turkey and chaparral cock. The records on dog, cattle, man and horse are most frequent and in that order. Our records add the cotton rat, wild hog (Mexico) and "Tinamou" (Mexico).

Rocky Mountain Laboratory records of this tick in the United States are in the accompanying table.

Accession No.	State	Locality	Date	Host animal or source	Number	Collector or authority
14191	Ark.	Harrison, Boone Co.	6/6/38	Dogs	104 A.	R. M. L.
14192	"	"	"	Cows	134 A., 1 N.	"
14196	"	"	6/7/38	7 dogs	2 A.	"
14813	"	Alpine, Boone Co.	6/8/38	2 horses, cow	12 A.	"
15506	"	Boone Co.	3/14/39	Dog	1 ♀	S. J. Carpenter
16653	"	Lead Hill, Boone Co.	7/5/39	Dog, cattle, horse	75 ♀, 14 ♂	"
16654	"	Boone Co.	7/7/39	Dog	82 ♀, 26 ♂	"
15520	"	Calhoun Co.	4/4/39	Cow	8 ♀	"
16655	"	Denver, Carroll Co.	7/6/39	Dog	2 N., 7 ♂, 30 ♀	"
15517	"	Sparkman, Dallas Co.	4/3/39	"	14 ♂, 14 ♀	"
15516	"	Sparkman, Dallas Co.	4/3/39	Cow	4 ♀, 2 ♂	"
19047	"	Hot Springs, Garland Co.	.....	....	36 N., 22 L.	Bur. An. Ind.
20293	"	Onachita Co.	July '43	....	1 N., 2 A.	W. J. Baerg
20292	"	Union Co.	"	....	1 A.	"
20274	"	Washington Co.	6/20/43	....	1 A.	"
20291	"	"	7/10-14 1943	Man	1 A.	"
19646	Ga.	Broxton, Coffee Co.	6/4/42	Dog	2 N., 3 A.	Dr. Geo. Brigham
20233	"	Blackbeard Isl. (off coast of Georgia)	7/13/42	Soil	1 A.	Herbert H. Ross
18885	Ia.	Osceola, Clarke Co.	6/28/41	Cow	1 ♀	G. S. Cantonwine
19772	La.	Kisatchie Nat. For., Grant Parish	June 1941	....	2 ♀	Jones & Archer
7661	Miss.	Phoenix, Yazoo Co.	7/22/31	....	36 ♀, 21 ♂	.....
13425	"	Vicksburg, Warren Co.	2/26/37	Dog	1 ♂	R. M. L.
20496	"	Harrison Co.	8/20/43	Man	1 N.	F. N. Young, Jr.
14817	Mo.	Golden, Barry Co.	Oct. 1937	Man	1 N.	H. H. Echwalt
14826	"	Cassville, Barry Co.	6/8/38	3 cottontail rabbits	47 N.	R. M. L.
14827	"	Golden, Barry Co.	6/8/38	Timber wolf	5 ♀	"
14822	"	Cassville, Barry Co.	6/9/38	12 dogs	29 A., 16 N.	"
14823	"	"	"	1 dog	14 A.	"
14828	"	"	"	12 dogs	70 N., 11 A.	"
14829	"	"	"	"	40 N., 14 A.	"
14830	"	"	"	5 dogs	47 N., 30 A.	"
14831	"	"	"	"	24 N., 40 A.	"
14824	"	Eagle Rock, Barry Co.	"	"	35 N., 36 A.	"
14825	"	"	"	"	13 N., 32 A.	"
14824	"	Golden, Barry Co.	"	Timber wolf	35 N., 56 A.	.....
14821	"	Viola, Barry Co.	6/10/38	8 cottontail rabbits	41 N.	R. M. L.

Accession No.	State	Locality	Date	Host animal or source	Number	Collector or authority
16654	"	Bergman, Boone Co.	7/7/39	Dogs	100 A.	"
20276	"	Jefferson City, Cole Co.	6/26/43	Dog	2 A.	Dr. John W. Williams, Jr., St. Bd. Health
19048	"	Hot Springs, Garland Co.	.....	....	2 N.	Dr. H. H. Little
16653	"	Lead Hill, Marion Co.	7/5/39	Dogs	8 A.	R. M. L.
14370	Okla.	Atoka, Atoka Co.	6/6/35	Dog	4 A.	"
19233	"	Durant, Bryan Co.	9/6/41	Dogs and grass	7 N.	Dr. F. R. Hassler
19929	"	Armstrong, Bryan Co.	9/4/42	Drag	180 N.	R. M. L.
19931	"	Wilson, Carter Co.	9/9/42	Cow and dog	18 N.	"
19932	"	"	"	Drag	490 N.	"
20488	"	Cache, Comanche Co.	3/4/42	Coyote	1 A.	Frank B. McMurry
8127	"	Broken Bow, McCurtain Co.	2/20/32	Cow	1 ♀	Mr. Sanborn
20249	"	Camp Gruber, Muskogee Co.	6/1/43	Drag	3 N., 13 A.	Herbert H. Ross
20295	"	"	5/15-6/11/43	Man	14 N., 16 A.	Michael Ballin
20294	"	"	6/11 & 7/1/43	"	11 N., 8 A.	"
19933	"	Weathers, Pittsburg Co.	9/11/42	6 dogs	3 A.	R. M. L.
19934	"	"	"	Drag	110 N.	"
20287	Tenn.	Baird's Mills, Wilson Co.	7/12/43	....	86 A.	War Dept., Nashville
20300	"	"	8/1/43	....	12 N., 6 A.	"
20453	"	"	8/8/43	....	35 A.	"
20451	"	"	8/9/43	....	250 N., 1 A.	"
20457	"	"	8/10-14/43	Ground	354 N.	"
20454	"	"	8/12/43	....	460 N.	"
20460	"	Nashville, Davidson Co.	8/24/43	....	387 N.	"
20462	"	"	8/25/43	....	101 N.	"
20463	"	"	8/27/43	....	225 N.	"
20244	Tex.	Camp Hood, Bell Co.	5/30/43	....	1 N., 4 A.	Dr. David Lackman
20290	"	"	4/26/43	Man	3 A.	"
19881	"	West Columbia, Brazoria Co.	?	....	3 ♀	T. McGregor
19951	"	"	6/23/42	Man	1 N.	Dr. W. Gingrich
19952	"	"	"	"	1 N.	"
19919	"	"	8/22/42	Drag	2500 N.	R. M. L.
19920	"	"	8/24/42	Cow	1 ♀, 1 N.	"
19922	"	"	"	Drag	900 N.	"
19921	"	"	"	Dog	?	"
19923	"	"	8/25/42	Drag	2000 N., 1 ♂	"
20467	"	Brazos Co.	4/19/43	....	4 N.	State Bd. Hlth.
20472	"	Brown Co.	10/10/42	Dog	1 N.	"
17312	"	Colorado Co.	5/30/40	Deer	1 N., 4 A.	T. T. Waddel
20458	"	Dallas Co.	8/5/43	....	19 N.	Southwest Biological Sup. Co.
20464	"	Cuero, DeWitt Co.	5/21/43	....	5 A.	State Bd. Hlth.
13922	"	Tartleton Prairie, Erath Co.	7/29/37	Cows	22 N.	R. M. L.
13924	"	"	"	"	4 A.	"
13935	"	"	8/3/37	Cow	3 A.	"
13936	"	"	"	Horse	2 N.	"
13931	"	"	8/5/37	Cows	8 N., 12 A.	"
13932	"	"	"	Dogs	20 N.	"
19924	"	Galveston, Galveston Co.	8/27/42	Dogs	1 ♀	"
20459	"	Hardin Co.	.....	....	14 N.	Southwest Biological Sup. Co.
20465	"	Jefferson Co.	5/19/43	Dog	5 A.	State Bd. Hlth.
14188	"	Kingsville, Kleberg Co.	5/27/38	Coftontail	1 ♂	J. C. Brown
14955	"	"	12/18/38	Deer	1 ♀	"
13709	"	Plum Grove, Liberty Co.	July 1937	....	6 A.	State Bd. Hlth.
13705	"	"	7/2/37	Grass	100 A.	"
13698	"	"	7/3/37	Cows and wooded area	5 A.	"
13692	"	"	7/4/37	Dogs	8 A.	R. M. L.
13702	"	"	7/5/37	Goats	41 A.	St. Bd. Hlth.

Accession No.	State	Locality	Date	Host animal or source	Number	Collector or authority
13703	"	"	7/6/37	Bushes	5 A.	"
13693	"	"	7/7/37	Goats	23 A.	R. M. L.
13695	"	"	"	Cows	11 A.	"
13696	"	"	"	Squirrel	5 A.	St. Bd. Hlth.
13701	"	"	"	Cows	7 A.	"
13489	"	"	7/9/37	Dog	5 A.	R. M. L.
13491	"	"	"	Man	4 A.	"
13492	"	"	"	Horse	28 A.	"
13490	"	"	7/10/37	Cows	41 A.	"
13716	"	"	7/12/37	Dog	5 A.	"
13715	"	"	7/14/37	Horse	9 A.	"
13719	"	"	7/14/37	Dog	6 A.	"
13712	"	"	"	Cow	39 A.	St. Bd. Hlth.
13713	"	"	"	Dogs	20 L., 4 N., 2 A.	"
13718	"	"	7/15/37	Goat	22 A.	R. M. L.
13495	"	"	7/16/37	....	3 A.	"
13342	"	"	7/19/37	....	8 A.	"
13826	"	"	7/19/37	Cow	6 A.	"
13827	"	"	"	Dog	15 A.	"
13828	"	"	7/20/37	Goats	16 A.	"
13835	"	"	7/22/37	Dog	8 A.	"
13836	"	"	"	Goat	23 N.	"
13837	"	"	7/23/37	Cow	27 N.	"
13915	Tex.	Plum Grove, Liberty Co.	7/26/37	Cows	21 N., 10 A.	R. M. L.
13916	"	"	"	Dog	19 A.	"
13919	"	"	7/28/37	"	4 A.	"
13920	"	"	"	"	21 A.	"
13921	"	"	"	Cows	27 N.	"
13923	"	"	7/30/37	"	28 A.	"
13926	"	"	"	"	10 A.	"
13929	"	"	8/4/37	"	10 N., 19 A.	"
13933	"	"	"	....	6 N., 11 A.	"
13840	"	"	8/8/37	Cow	6 N., 20 A.	"
13844	"	"	"	Drag	Many N., 1 A.	"
13841	"	Parker Place, Liberty Co.	"	"	200 A.	"
13842	"	"	"	Dog	12 N., 10 A.	"
13843	"	"	"	2 horses	20 N., 15 A.	"
13846	"	Plum Grove, Liberty Co.	8/9/37	Drag	200 N., 1 A.	"
13847	"	"	"	8 cows	2 N., 3 A.	"
13848	"	"	"	Dog	2 N.	"
13849	"	Parker Place, Liberty Co.	"	Drag	450 N., 2 A.	"
13850	"	Howard Ranch, Liberty Co.	"	12 cows	2 N., 54 A.	"
13851	"	Plum Grove, Liberty Co.	8/10/37	Goats	14 N., 2 A.	"
13852	"	"	"	Cows	95 N., 27 A.	"
13853	"	Hughes Kennels, Liberty Co.	"	Dog	27 N., 8 A.	"
13854	"	Ford Place, Liberty Co.	"	"	30 L., 2 N., 3 A.	"
13855	"	Hightower Ranch, Liberty Co.	"	"	21 L., 17 N., 3 A.	"
13857	"	Cleveland, Liberty Co.	"	2 horses	6 N., 4 A.	"
13858	"	"	"	5 dogs	100 N.	"
13859	"	Parker Place, Liberty Co.	8/11/37	Drag	100 N.	"
13861	"	"	"	"	100 N.	"
13862	"	Cleveland, Liberty Co.	"	Horse	5 N., 1 A.	"
13863	"	Parker Place, Liberty Co.	8/12/37	Drag	300 N.	"
13864	"	"	"	2 horses	15 N., 5 A.	"
13866	"	Plum Grove, Liberty Co.	"	Cows	11 N., 3 A.	"
13867	"	"	"	8 dogs	5 N., 5 A.	"
13868	"	Parker Place, Liberty Co.	"	Drag	300 N.	"
13869	"	"	"	Cow	4 N., 5 A.	"
13870	"	"	8/13/37	Drag	675 N.	"
13871	"	"	8/14/37	"	1550 N.	"
13873	"	"	"	Rabbit	Many L., 230 N., 100 A.	"
13872	"	Cleveland, Liberty Co.	"	Dogs	32 N., 7 A.	"
14247	"	"	5/11/38	6 horses	1 N., 68 A.	"
14248	"	"	.....	12 dogs	65 A.	"

Accession No.	State	Locality	Date	Host animal or source	Number	Collector or authority
14252	"	"	5/12/38	15 dogs	20 A.	"
14256	"	"	"	Fox squirrel	9 N.	"
14926	"	Dayton, Liberty Co.	9/9/38	13 dogs	8 A.	"
14927	"	"	"	12 cows	1 ♀	"
19954	"	Dayton, Liberty Co.	8/15/42	.....	19 N.	"
19953	"	Liberty, Liberty Co.	8/16/42	.....	66 N.	"
14264	"	Cleveland, Liberty Co.	5/16/43	10 goats	73 N.	"
13494	"	Montgomery Co.	7/16/37	.....	11 A.	St. Bd. Hlth.
20169	"	Newton Co.	4/4/43	Drag	30 A.	Melvin Kyle
13704	"	San Jacinto Co.	7/4/37	Horses	21 A.	St. Bd. Hlth.
13496	"	"	7/11/37	Cows	12 A.	"
13498	"	"	"	Horses	20 A.	"
13499	"	"	"	Dogs	6 A.	"
13714	"	"	7/14/37	Parker home	6 N., 5 A.	"
13720	"	"	7/15/37	Horse	12 A.	"
13721	"	"	"	Dog	14 A.	"
13722	"	"	"	Flag	19 N., 8 A.	"
13830	Tex.	San Jacinto Co.	7/16/37	Goat	4 A.	St. Bd. Hlth.
13831	"	"	"	Flag	4 A.	"
13832	"	"	"	Horse	15 A.	"
13833	"	"	"	Dog	12 N., 14 A.	"
13829	"	"	7/16-17-30/37	Cows	35 A.	"
13834	"	"	7/21/37	Goats	20 A.	"
13838	"	"	"	.....	5 A.	"
13839	"	"	"	Cow	25 A.	"
13917	"	"	7/23/37	Dogs	6 A.	"
13918	"	"	7/27/37	Cows	16 N.	"
13938	"	"	8/2/37	Cow and dog	9 A.	"
13934	"	"	8/3/37	Dog	16 N., 9 A.	"
14223	"	Manor, Travis Co.	5/1/38	Mule	25 A.	"
14224	"	"	"	Horse	10 A.	"
14225	"	"	"	3 calves	21 N., 9 A.	"

Amblyomma maculatum Koch, 1844

(Figs. 5 and 6)

1844. *Amblyomma maculatum* Koch, p. 227.
 1844. *Amblyomma tigrinum* Koch, p. 227.
 1844. *Amblyomma rubripes* Koch, p. 227.
 1844. *Amblyomma ovatum* Koch, p. 228.
 1844. *Amblyomma triste* Koch, p. 229.
 1888. *Amblyomma complanatum* Berlese, p. 191.
 1908. *Amblyomma maculatum* Koch: Banks, p. 39.
 1911. *Amblyomma maculatum* Koch: Neumann, p. 70.
 1912. *Amblyomma maculatum* Koch: Hooker, Bishopp and Wood, p. 135.
 1926. *Amblyomma maculatum* Koch: Robinson, p. 40.
 1936. *Amblyomma maculatum* Koch: Oudemans, p. 504.

Female

Body: Length, unengorged, from 3.70 to 4.40, width from 2.40 to 2.85. Engorged examples may become as long as 18.00 and as wide as 13.00. Oval, a little narrower in front. Scutum less than half the body length. Marginal groove complete and continuous across all the festoons. Festoons often with a small, terminal nub visible from above.

Scutum: Length 1.8 to 2.20, width 1.60 to 2.00. Sub-triangular, narrowed posteriorly, rounded terminally; antero-lateral border very convex. Scapulae long, pointed. Eyes a little convex. Cervical grooves moderately deep anteriorly, shallow, and disappearing posteriorly. Ornate, with the light and dark color pattern contrasting sharply. Punctations numerous, large and small ones intermingled, the former more numerous in anterior areas.

Capitulum: Length from 1.00 to 1.25, width of basis 0.73. Basis sub-rectangular in shape, postero-lateral corners a little protruding, salient. Porose areas large, convex, a little divergent anteriorly. Surface smooth, shining, punctate. Palpi long, wider at article 3; hairs few and short.

Hypostome: Long, mildly notched apically. Dentition 3/3, though examination of numerous

specimens shows a tendency for a 4/4 pattern. One female examined was definitely 4/4 but the teeth of the fourth row (median) were small. Length 0.78.

Legs: Long and large, I longer but smaller than the others. Apical spurs absent on tarsus I, present on II, III and IV. Metatarsi II, III and IV with long, paired terminal spurs, directed distad. Length of tarsus I, 1.11; metatarsus, 0.99. Length of tarsus IV, 0.78; metatarsus, 1.20.

Coxae: Coxa I with a very short internal and a long, pointed external spur. Coxa II with a broad, short, flat spur; III and IV with similar spurs, but progressively smaller. All coxae with a few long, fine hairs.

Spiracular plate: Large, concave, with the frame well sclerotized. Length 0.87, width 0.66.

Genital aperture: Situated at the level of the intervals between coxae II and III.

Male

Body: Length from 3.40 to 5.00, width from 2.40 to 3.00. A medium-sized tick, oval, wider behind.

Scutum: Often with the surface mildly concave between the eyes. Lateral grooves deep, complete, starting near the eyes and with their continuation limiting the long, well-defined festoons. Ventral scutes extending over the margin and visible from above. Cervical grooves deep in front, shallow behind and disappearing back of the eyes. Scapulae long with the interval between them deep. Punctations numerous and deep in the area within the marginal groove, sparse on the festoons. Eyes a little convex. Ornate with numerous, mostly connected lineal spots of golden white (see the figure).

Capitulum: Length 0.80 to 1.20, width of basis about 0.63. Basis sub-rectangular, longer than in many species; dorsal surface convex, a little irregular, punctate; postero-lateral corners a little protruding, salient, forming short cornua. Palpi long, widest on article 3. Hairs moderate in number, short and fine. Length 0.66.

Hypostome: Spatulate, long, notched terminally. Dentition 3/3; rarely there is a fourth pair more or less complete. Length from 0.66 to 0.78.

Legs: Long and large. Leg I smaller. Apical spurs present on II, III and IV, absent on I. Long, paired, terminal spurs present on metatarsi II, III, IV, absent on I. Hairs long and fine. Length of tarsus I, 0.84; metatarsus, 0.84. Length of tarsus IV, 0.60; metatarsus, 1.02.

Coxae: Coxa I with long, pointed external spur; internal spur short, almost negligible. Coxae II and III with short, broad, flat spurs. Coxa IV with a long, pointed internal spur. All coxae with a few long, fine hairs.

Spiracular plate: Large, a little convex, with the frame well sclerotized. Length 0.69, width 0.51.

Genital aperture: Situated between coxae II.

Nymph

Body: Unengorged body pyriform, narrow; with the scutum reaching about one-third the length. Length 1.44, width 0.93.

Scutum: Length 0.57, width 0.63. Slightly wider than long, broadly rounded behind; widest back of the middle. Scapulae rounded and covered by the sides of the basis capituli. Cervical grooves moderately deep anteriorly, then continued as shallow valleys to near the postero-lateral margins. Eyes pale, nearly flat. Surface faintly shagreened. Punctations sparse. Hairs absent.

Capitulum: Length 0.36, width of basis 0.315. Basis triangular, with the lateral points protruding outside of the scapulae. Ventral surface of basis with two distinct retrograde spurs. Posterior margin convex. Surface nearly flat (dorsally), smooth, shining, impunctate. Palpus long, narrow at the base, broadest at about the suture between 2 and 3. Combined length of 2 and 3, 0.20. Hairs few and moderately long.

Hypostome: Spatulate, rounded terminally. Dentition 2/2. Length about 0.17.

Legs: Relatively a little shorter and smaller than in the adults. All tarsi with apical ventral spurs absent. Paired terminal spurs absent on all metatarsi. Length of tarsus I, 0.35; metatarsus, 0.18. Length of tarsus IV, 0.24; metatarsus, 0.21.

Coxae: Coxa I with only moderate internal spur. Coxa II with one very short, broad, flat spur. Coxae III and IV without spurs. All coxae smooth and shining and with a few fine hairs.

Spiracular plate: Large, flat, and with frame little sclerotized. Length 0.23, width 0.15.

Larva

Capitulum: Length 0.17, width of basis 0.16. Basis sub-triangular, wide, with the lateral points extending outside over the scapulae; posterior margin rounded. Surface smooth, shining, faintly shagreened, impunctate. Palpi short, smooth, and with a few fine hairs. Length 0.086.

Hypostome: Spatulate, rounded terminally. Dentition 2/2. Length about 0.11.

Scutum: Length 0.24, width 0.36. Very broadly rounded behind. Widest a little back of the middle. Cervical grooves shallow, nearly parallel. Surface smooth, shining, shagreened, impunctate.

Coxae: Spurs faintly visible. Each coxa with a single short, triangular spur, that on I largest, those on II and III progressively smaller. Hairs absent.

DISTRIBUTION AND HOSTS

The type was from "Carolina"; the type host is unknown.

In the United States the species is apparently established only in the areas bordering the Gulf of Mexico, and along the Atlantic Coast. Bishopp and Hixson (1936) state that this tick is seldom found in numbers more than 100 miles inland and that its distribution suggests "that rather high rainfall, humidity and temperature are necessary to its existence." Early records of *A. maculatum* from outside the present known normal limits of distribution are as follows: from Virginia (Niles, 1898, as *Dermacentor occidentalis*); from Memphis, Tenn. (Hunter and Hooker, 1907); from Tulare County, Calif. (Banks, 1908); from Dallas, Texas (Hooker et al, 1912). We have two recent records in the same category, i.e., a female from unknown host, Willcox, Arizona, Sept. 22, 1942 (L. P. Wehrle) and an engorged female from a dog, Weathers, Okla., Sept. 11, 1942 (Glen M. Kohls). Numerous records kindly supplied by Dr. Paul L. Piercy, Animal Parasitologist, Texas Agricultural Experiment Station, are entirely in keeping with those of this Laboratory and the map of Hooker et al (1912, p. 143). Neumann (1899, p. 252) records *A. maculatum* from Peru and Paraguay, and Neumann again (1911, p. 70) from Mexico, Ecuador, Chile and Patagonia. Robinson (1926, p. 44) records it from Brazil and Uruguay. Lahille (1905, pp. 152-153) reports that the species is common in Argentina. Newstead (1909, p. 445) reports males and females from Jamaica. Robinson (1926, p. 44) adds Colombia because of specimens donated by Dr. H. Gadow, and the Rocky Mountain Laboratory has several lots from Colombia sent by Dr. Luis Patiño-Camargo.

The adults attack a variety of the larger animals, both wild and domestic. Man is attacked occasionally. Larvae and nymphs attack birds principally but are found also on the smaller wild mammals. Hooker et al (1912) list as hosts of the adult ticks, cattle, sheep, horse, goat, dog, wolf and man, and of nymphs, meadow lark, red-winged blackbird, fox and jackrabbit. Bishopp (1912) listed collections of nymphs in southern Texas from meadow lark, *Sturnella magna*; red-winged blackbird, *Agelaius phoeniceus*; Brewer's blackbird, *Euphagus cyanocephalus*; and jack rabbit, *Lepus californicus merriami*. Hixson (Bishopp and Hixson, 1936, and Hixson, 1940), reporting from the vicinity of Valdosta, Ga., found the meadow lark to be the most important host of the immature forms during the fall and winter months. Larval hosts listed were meadow lark, *Sturnella magna*; bobwhite, *Colinus virginianus*; southern fox squirrel, *Sciurus niger niger*; eastern cotton rat, *Sigmodon hispidus hispidus*; towhee, *Pipilo erythrophthalmus*; field sparrow, *Spizella pusilla pusilla*; southern gray squirrel, *Sciurus carolinensis carolinensis*; house wren, *Troglodytes aedon*; brown thrasher, *Toxostoma rufum*; kid; lamb; mocking bird, *Mimus polyglottos*; blue jay, *Cyanocitta cristata*; loggerhead shrike, *Lanius ludovicianus ludovicianus*; and roof rat, *Rattus rattus alexandrinus*. Listed as host of the nymph were meadow lark, bobwhite, eastern cotton rat, southern fox squirrel, sheep, calf, towhee, house wren, American robin, *Turdus migratorius*; and the white-throated sparrow, *Zonotrichia albicollis*. Meadow larks and bobwhites were regarded as the most im-

portant hosts. Peters (1936) recorded the Carolina wren, *Thryothorus ludovicianus*, and the Red-eyed Towhee, *Pipilo erythrophthalmus*, as hosts in South Carolina without mention of stage or stages found.

For hosts outside of the United States see Robinson (1926).

Following are the records for the United States of the Rocky Mountain Laboratory:

Accession No.	State	Locality	Date	Host animal or source	Number	Collector or authority
16004	Ala.	Auburn, Lee Co.	7/26/39	Cow	3 ♀	Dr. E. W. Price
19377	Fla.	Bombay, Holmes Co.	9/6/41	Ears of cattle	2 ♀	L. E. Swanson
17153	Ga.	Nashville, Berrien Co.	7/29/40	Sheep	192 A.	Mr. Van Wheless
17040	"	"	8/9/40	"	75 A.	"
19650	"	Savannah, Chatham Co.	.....	.....	5 A.	R. M. L.
16008	"	Albany, Dougherty Co.	8/14/39	Dogs	6 A.	Geo. G. Brigham
16658	"	Ludowid, Long Co.	7/12/39	Sheep	4 A.	Dr. E. W. Price
14172	"	"	.....	.....	100 A.	B. A. I.
20495	Miss.	Keesler Field, Harrison Co.	8/29/43	Man	1 ♂	F. N. Young, Jr.
14171	"	Jackson, Hinds Co.	.....	.....	50 A.	B. A. I.
14078	"	"	.....	Cattle?	Many	Dr. E. W. Price
19933	Okla.	Weathers, Pittsburg Co.	9/11/42	6 dogs	1 ♀	R. M. L.
13935	Tex.	Tarleton Prairie, Erath Co.	8/3/37	Cow	3 A.	"
19924	"	Galveston, Galveston Co.	8/27/42	Dogs	7 A.	Kohls and McGregor
20459	"	Saratoga, Hardin Co.	.....	.....	1 ♂	Southwest Biological Sup. Co.
17235	"	Beaumont, Jefferson Co.	9/3/40	Mule	1 A.	R. M. L.
17239	"	"	9/5/40	Horses, mules, cattle	200 A.	"
17241	"	"	9/6/40	Horses and cattle	85 A.	"
11437	Tex.	Kingsville, Kleberg Co.	10/17/35	Horse	7 A.	R. M. L.
11144	"	Riviera, Kleberg Co.	10/19/35	Dog	6 A.	"
11443	"	"	"	Horse	2 A.	"
14832	"	Kingsville, Kleberg Co.	7/18/38	Coyote	1 A.	J. C. Brown
13826	"	Liberty Co.	7/19/37	Cow	1 A.	St. Bd. Hlth.
13917	"	Cleveland, Liberty Co.	7/23/37	Dogs	2 A.	"
13930	"	"	8/4/37	Dog	2 ♀	R. M. L.
13850	"	"	8/9/37	12 cows	23 A.	"
13857	"	"	8/10/37	2 horses	1 ♀	"
13866	"	"	8/12/37	Cows	1 A.	"
14926	"	Dayton, Liberty Co.	8/9/38	13 dogs	23 A.	"
14927	"	"	"	12 cows	86 A.	"
14928	"	"	"	Horse	7 A.	"
14930	"	Cleveland, Liberty Co.	8/12/38	20 horses	40 A.	"
14929	"	Dayton, Liberty Co.	"	Drag	46 A.	"
14931	"	"	8/13/38	Drag	60 A.	"
14932	"	Cleveland, Liberty Co.	"	45 horses	62 A.	"
17228	"	Dayton, Liberty Co.	8/31/40	Drag	62 A.	"
17231	"	Dayton, Liberty Co.	9/2/40	Cattle and dogs	18 A.	R. M. L.
17234	"	"	"	Drag	48 A.	"
19891	"	"	7/24/42	Cattle	100 A.	T. McGregor
19954	"	"	8/15/42	.....	192 A.	"
19953	"	Liberty, Liberty Co.	8/16/42	.....	214 A.	"
17242	"	Inez, Victoria Co.	9/9/40	.....	75 A.	R. M. L.
17245	"	Victoria, Victoria Co.	"	Cattle	85 A.	R. M. L.
17247	"	"	"	"	66 A.	"

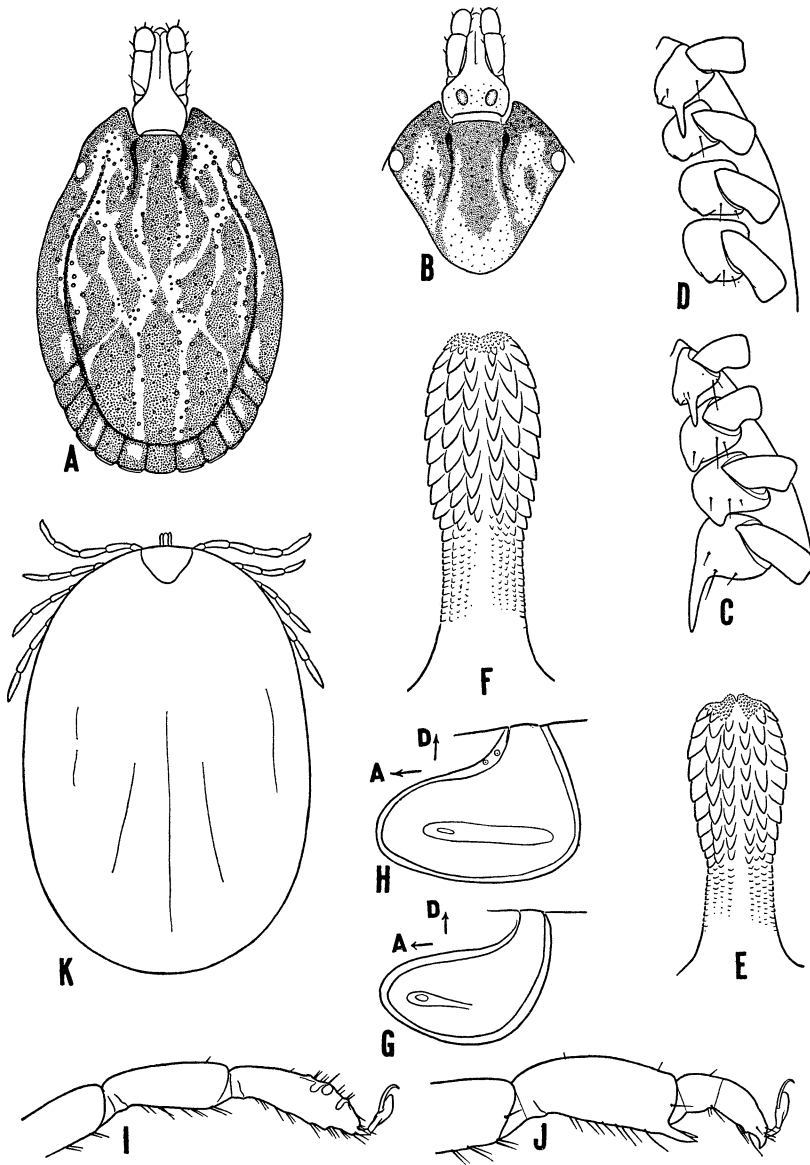


FIG. 5. *Amblyomma maculatum* Koch. A. Capitulum and scutum, male. B. Capitulum and scutum, female. C. Coxae of male. D. Coxae of female. E. Hypostome of male. F. Hypostome of female. G. Spiracular plate of male. H. Spiracular plate of female. I. Leg I of male. J. Leg IV of male. K. Engorged female.

Amblyomma dissimile Koch 1844

(Figs. 7 and 8)

1844. *Amblyomma dissimile* Koch, p. 225.
 1844. *Amblyomma irroratum* Koch, p. 225.
 1844. *Amblyomma adpersum* Koch, p. 226.
 1844. *Amblyomma infumatum* Koch, p. 228.
 1844. *Ixodes flavidus* Koch, p. 233.
 1844. *Ixodes humanus* Koch, p. 233.

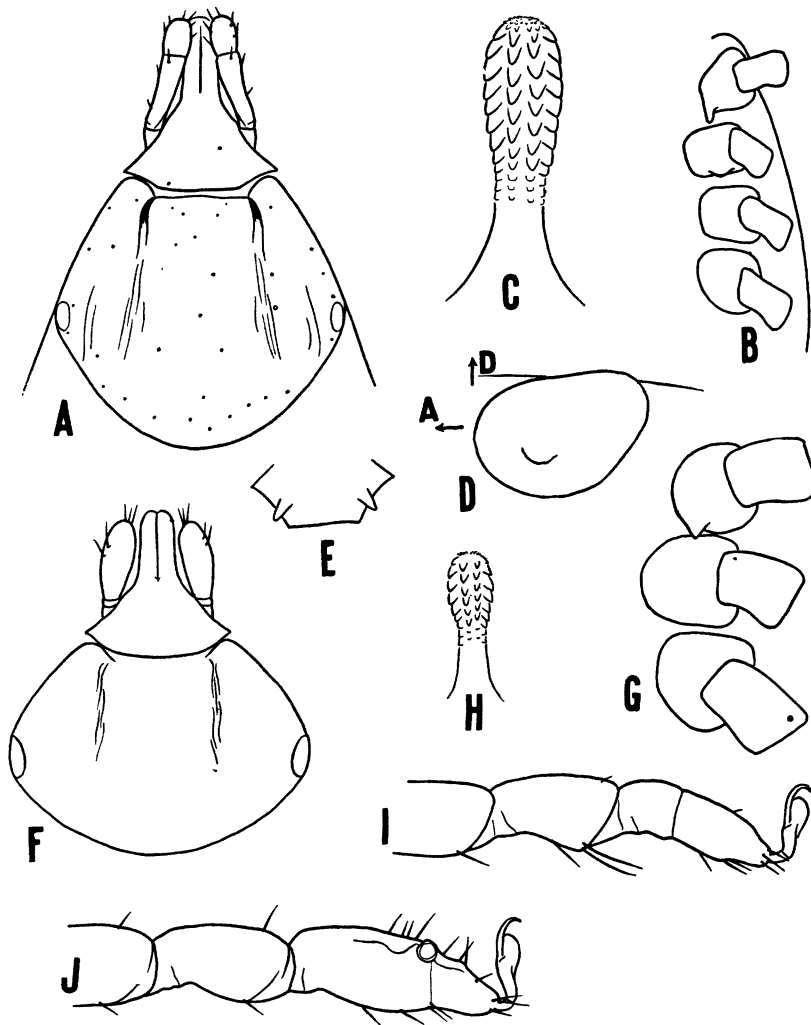


FIG. 6. *Amblyomma maculatum* Koch. A. Capitulum and scutum of nymph. B. Coxae of nymph. C. Hypostome of nymph. D. Spiracular plate of nymph. E. Spurs on venter of nymphal basis capituli. F. Capitulum and scutum of larva. G. Coxae of larva. H. Hypostome of larva. I. Leg IV of nymph. J. Leg I of larva.

1846. *Ixodes pulchellus* Lucas, p. 61.

1886-1893. *Ixodes boarum* Stoll, p. 18.

1911. *Amblyomma dissimile* Koch: Neumann, p. 72.

1912. *Amblyomma dissimile* Koch: Hooker, Bishopp and Wood, p. 130.

1926. *Amblyomma dissimile* Koch: Robinson, p. 163.

1936. *Amblyomma dissimile* Koch: Oudemans, p. 471.

Female

Body: Unengorged body about 3.6 long by 3.0 wide; moderately well sclerotized. Much engorged body, 15.00 long by 9.00 wide; wider posteriorly.

Scutum: Length from 1.74 to 2.28; width from 2.10 to 2.58. Robinson (1926) gives size as 2.45×2.85 . Sub-triangular, a little wider than long, postero-lateral sides nearly straight. Cervical grooves sigmoid-shaped, deep anteriorly, fading out behind. Punctations few, large and small ones intermingled. Ornate, with irregular spots in antero-lateral areas, and a large, pale spot in the median posterior area. Eyes large, flat, pale.

Capitulum: Length 1.14 to 1.41, width of basis 0.75 to 0.87. Robinson (1926) gives length as 1.6. Sub-rectangular, lateral margins convex. Surface sparingly punctate. Porose areas large,

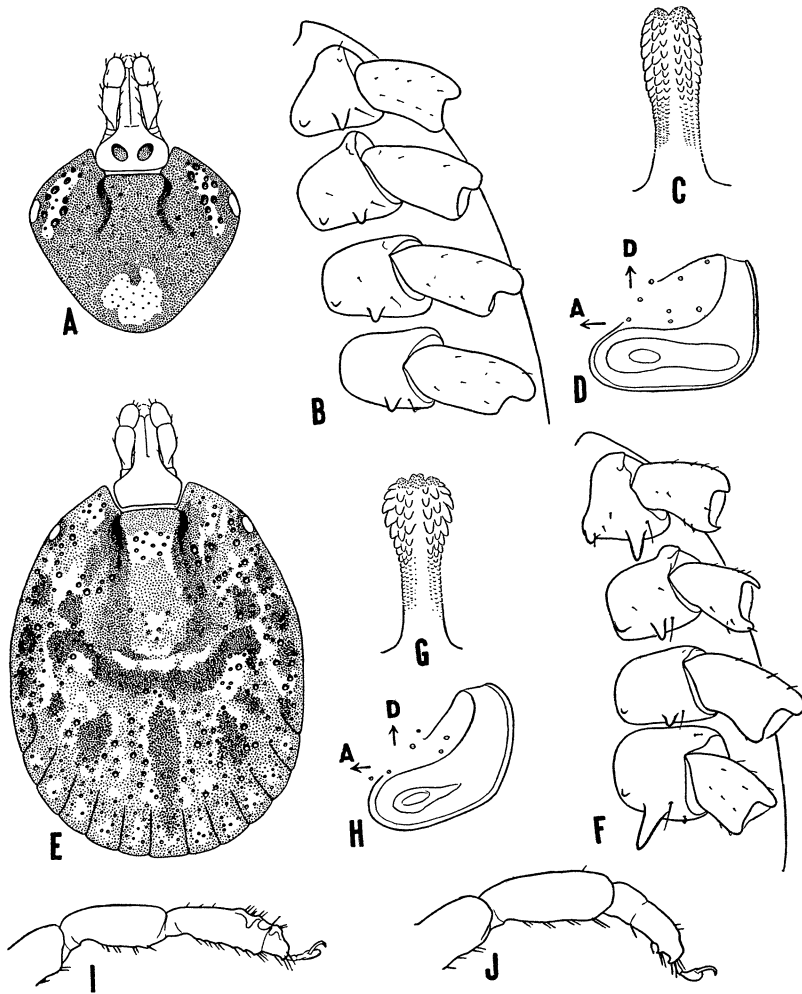


FIG. 7. *Amblyomma dissimile* Koch. A. Scutum and capitulum of female. B. Coxae of female. C. Hypostome of female. D. Spiracular plate of female. E. Capitulum and scutum of male. F. Coxae of male. G. Hypostome of male. H. Spiracular plate of male. I. Leg I of male. J. Leg IV of male.

oval, divergent anteriorly, and separated by about the shorter axis of one. Palpi long, clavate, laterally compressed; combined length of 2 and 3, 0.78 to 0.96.

Hypostome: Long, spatulate, notched apically. Dentition 3/3. Length about 0.69.

Legs: Of medium length, slender, smooth. Apical ventral spur faint on tarsus I, distinct on II, III and IV. Sub-apical ventral spur absent on I; small on II, III and IV. Length of tarsus I, 0.93; metatarsus, 0.72. Length of tarsus IV, 0.75; metatarsus, 0.75.

Coxae: In unfed specimens, coxae situated distant from the lateral margins of the body. A short, external spur present on all coxae. Coxae I, II and III with very short internal spurs; absent on IV. Robinson (1926) describes and figures the internal spur as present on IV.

Spiracular plate: Large, heavily chitinized, surface depressed. Greatest length 0.78, greatest width 0.60.

Genital aperture: Situated between coxae II.

Male

Body: Length from 2.75 to 4.50, width from 2.35 to 3.75. Broad oval, a little wider behind. Disparity in sizes is notable and small specimens have the color pattern less distinct.

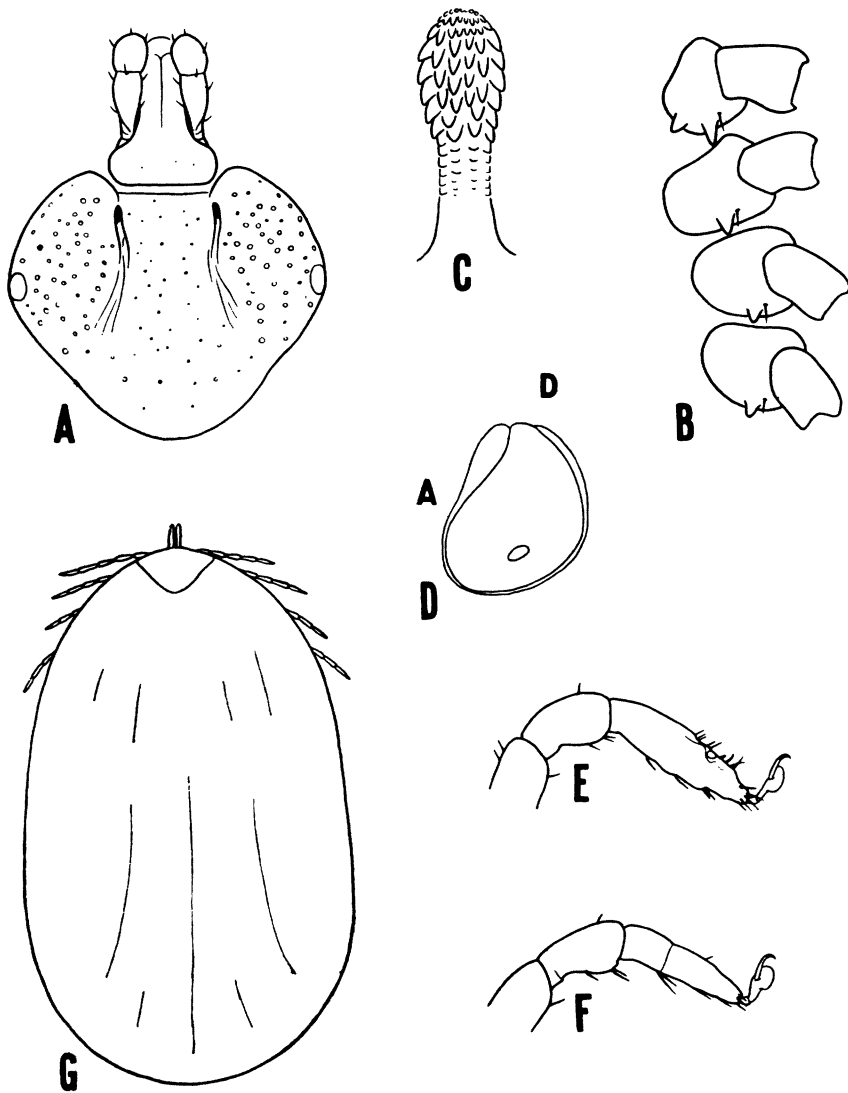


FIG. 8. *Amblyomma dissimile* Koch. A. Capitulum and scutum of nymph. B. Coxae of nymph. C. Hypostome of nymph. D. Spiracular plate of nymph. E. Leg I of nymph. F. Leg IV of nymph. G. Engorged female.

Scutum: Smooth, mildly convex, declivitous at sides and posteriorly. Lateral grooves absent. Cervical grooves deep and short. Ornate, with reddish-brown stripes on a pale yellow pattern tinged with rose-red. Pattern shown in the figure. Punctations large and small, intermingled, numerous in both light and dark spots. Festoons long.

Capitulum: Length from 0.84 to 1.32; width of basis from 0.60 to 0.87. Essentially as in the female. Combined length of palpal articles 2 and 3 from 0.57 to 0.84.

Hypostome: Long, spatulate, faintly notched and sinuous apically. Dentition 3/3. Length about 0.63.

Legs: Essentially as in the female. Length of tarsus I, 0.84; metatarsus, 0.72. Length of tarsus IV, 0.75; metatarsus, 0.9.

Coxae: All coxae with two spurs, with external spurs larger. External spurs I and IV about equal, II and III equal but smaller. Internal spurs progressively smaller from I to IV, that on IV very small.

Spiracular plate: Large and heavily sclerotized. Greatest length 0.84; greatest width 0.45.

Genital aperture: Situated between coxae II.

Nymph

Well engorged specimens are 3.9 long and 2.94 wide. No unfed specimens are available.

Capitulum: Length 0.42, width of basis 0.3. Basis convex on top with the lateral profile margins curved. Posterior margin a little convex; postero-lateral corners faint. Palpi moderate in length; surface irregular. Length 0.3.

Scutum: Length 0.66, width 0.96. Much wider than long. Cervical grooves sigmoid, about half the length of the scutum; deep anteriorly. Surface faintly irregular. Punctations moderate in number, larger and deeper in the antero-lateral areas.

Hypostome: Spatulate, rounded apically. Dentition 3/3. Length about 0.87.

Legs: Ventral spurs on tarsi absent. Length of tarsus I, 0.39; metatarsus, 0.21. Length of tarsus IV, 0.33; metatarsus, 0.24.

Coxae: Coxa I with two small spurs; II, III and IV with one small spur.

Spiracular plate: Much less sclerotized than in the adults. Greatest length 0.24; width, 0.18.

DISTRIBUTION AND HOSTS

The only United States records of the species are those of Bequaert (1932) from southern Florida, i.e., from gopher snake, *Spilotes corais couperi* (Holbrook), Sebastian, Indian River Co., February, 1909, and from pigmy or ground rattler, *Sistrurus miliaris* (Linnaeus), Boca Ratone, Palm Beach Co. (1931).

The species has an extended southern range which, according to Bequaert, includes Mexico, Guatemala, British Honduras, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Trinidad, Grenada, Tobago, British Guiana, Peru and Brazil.

Known hosts include 20 different kinds of Reptilia and Amphibia. In addition to these, Robinson (1926) includes a record from cow and from sheep, and Neumann (1911) mentions the capybara, "*Hydrochoerus hydrochoeris* (L.) (*H. capybara* Erxl.)."

Amblyomma tuberculatum Marx, 1894

(Figs. 9 and 10)

1894. *Amblyomma tuberculatum* Marx, p. 314.

1908. *Amblyomma tuberculatum* Marx: Banks, p. 38.

1911. *Amblyomma tuberculatum* Marx: Neumann, p. 74.

1912. *Amblyomma tuberculatum* Marx: Hooker, Bishopp and Wood, p. 123.

1926. *Amblyomma tuberculatum* Marx: Robinson, p. 174.

1932. *Amblyomma tuberculatum* Marx: Bequaert, p. 778.

Female

Body: The largest known species of the genus in the United States. Length 7.0 to 7.5, width 5.5 to 6.00. Broad oval, heavily sclerotized. Scutum reaching about two-fifths the length of body.

Scutum: Length 3.6, width 4.2. Shape broadly cordiform. Cervical grooves deep and curved. Ornate with dark-brown markings on a yellow-white ground. Pattern shown in the figure. Fine punctations very numerous and with a few large ones in the antero-lateral areas. Eyes small, flat, pale.

Capitulum: Length 2.3 to 2.60, width of basis 1.56. Basis sub-rectangular, posterior margin straight. Porose areas small, oval, divergent anteriorly, widely separated. Palpi long, relatively longer than those in the male. Combined length of 2 and 3, 1.59.

Hypostome: Spatulate, long, with the denticles 4/4, occupying two-fifths the total length. Length about 1.08.

Legs: Apical ventral spurs present on all the tarsi. Sub-apical ventral spurs present on tarsi II, III and IV. Length of tarsus I, 1.14; metatarsus, 1.10. Length of tarsus IV, 1.20; metatarsus, 1.53.

Coxae: Coxae I to IV each with two short, broad, flat spurs; internal spur on IV smaller.

Spiracular plate: Large, heavily chitinized, with the surface much depressed.

Genital aperture: Opposite the posterior borders of coxae II.

Male

Body: Length 6.2, width 5.5. Broad oval, wider behind, sides evenly rounded.

Scutum: Smooth, convex, all margins declivitous. Cervical grooves long, curved, deep in their anterior ends. Marginal grooves absent. Ornate, with dark-brown spots, mainly separated, on a dull, yellow-white ground. Pattern shown in the figure. Punctations very numerous and fine, and with a few large ones intermingled. Festoons short; ventral scutes protruding farther than the festoons, leaving narrow shelves visible from above.

Capitulum: Length 1.8, width of basis 1.23. Essentially as in the female but with the palpi relatively shorter. Combined length of palpal articles 2 and 3, 1.05.

Hypostome: Spatulate, faintly notched apically. Denticles 4/4. Length about 1.20.

Legs: Apical ventral and sub-apical spurs present on all tarsi. Length of tarsus I, 0.93; metatarsus, 0.93. Length of tarsus IV, 0.84; metatarsus, 1.50.

Coxae: Coxae I to IV each with two short, broad, flat spurs. Internal spur on IV smaller and situated on the median edge of the coxa.

Genital aperture: Situated between coxae II.

Nymph

Capitulum: Length 0.93, width of basis 0.66. Basis sub-quadrate, convex, with sides not marginated but merging into the lateral walls. Posterior margin nearly straight. Palpi long, widest on article 3.

Scutum: Length 1.44, width 1.74. Broadly cordiform with the postero-lateral margins a little flattened. Cervical grooves curved and deep. Ornate, with dark brown markings on dark yellowish-white ground. Pattern shown in the figure. Surface very finely pebbled. Large, deep punctations numerous in the lateral areas, small punctations in the median areas.

Hypostome: Shape as in the adults. Dentition 3/3. Length about 0.36.

Legs: All tarsi with the apical, ventral spur present as in adults, but small. Length of tarsus I, 0.60; metatarsus, 0.45. Length of tarsus IV, 0.60; metatarsus, 0.63.

Coxae: Coxae I and II each with two broad, short, flat spurs; internal spurs smaller. Coxae III and IV each with one external spur; internal spurs lacking.

Spiracular plate: Large and heavily sclerotized. Surface much depressed. Length and width about equal—0.33.

Larva

From cast skins of fully fed larvae we are able to describe the larva in part.

Scutum: Length 0.45, width 0.57. Cervical grooves long, extending about three-fourths the length of the scutum, deeper anteriorly. Surface impunctate.

Capitulum: Sub-triangular with rounded points at the sides. Length 0.312, width of basis 0.221. Combined length of articles 2 and 3, 0.18.

Hypostome: Dentition 2/2. Length 0.192.

Coxae: Coxa I with two small spurs; II and III each with one small spur.

DISTRIBUTION AND HOSTS

This species is known in this country only from Alabama, Georgia and Florida. Bequaert (1932) stated:

A. tuberculatum is, in the adult and nymphal stages, a common and specific parasite of the gopher turtle, *Gopherus polyphemus* (Daudin). Most probably its range coincides with that of the host, which occurs throughout the coastal plain of the Southeastern United States. L. Stejneger and T. Barbour (1923, A Check List of North American Amphibians and Reptiles, 2d ed., p. 137) give the distribution of this gopher turtle as "Coast from southern South Carolina to Florida and the Mississippi River north into southern Arkansas." Dr. Barbour tells me that it does not occur in the extreme southern part of Florida and that it certainly was never indigenous in Cuba. Neumann (1899) recorded a male of *A. tuberculatum*, at the Paris Museum, collected by Gundlach in Cuba; but this specimen must have been taken off a gopher turtle brought from the mainland and kept in captivity.

Previous, definite locality records of *A. tuberculatum* are as follows: Crescent City, Putnam Co., Florida (type locality; Marx and Hubbard, 1894). Enterprise, Volusia Co., Florida (Banks, 1904). Hawthorn, Alachua Co., Florida (Hooker, Bishopp and Wood, 1912). Southern Alabama (Hooker, 1909; Robinson, 1926).

I have seen five different lots of this tick, all taken off *Gopherus polyphemus*, from the following localities: Lakeland, Polk Co., Florida (Am. M. N. H. and W. T. Davis Coll.). La Grange, Brevard Co., Florida (W. T. Davis Coll.). Mt. Pleasant, Gadsden Co., Florida (W. T. Davis Coll.). South Carolina, without more definite locality (off a turtle brought to the Bronx Zoölogical Park.—W. T. Davis Coll.).

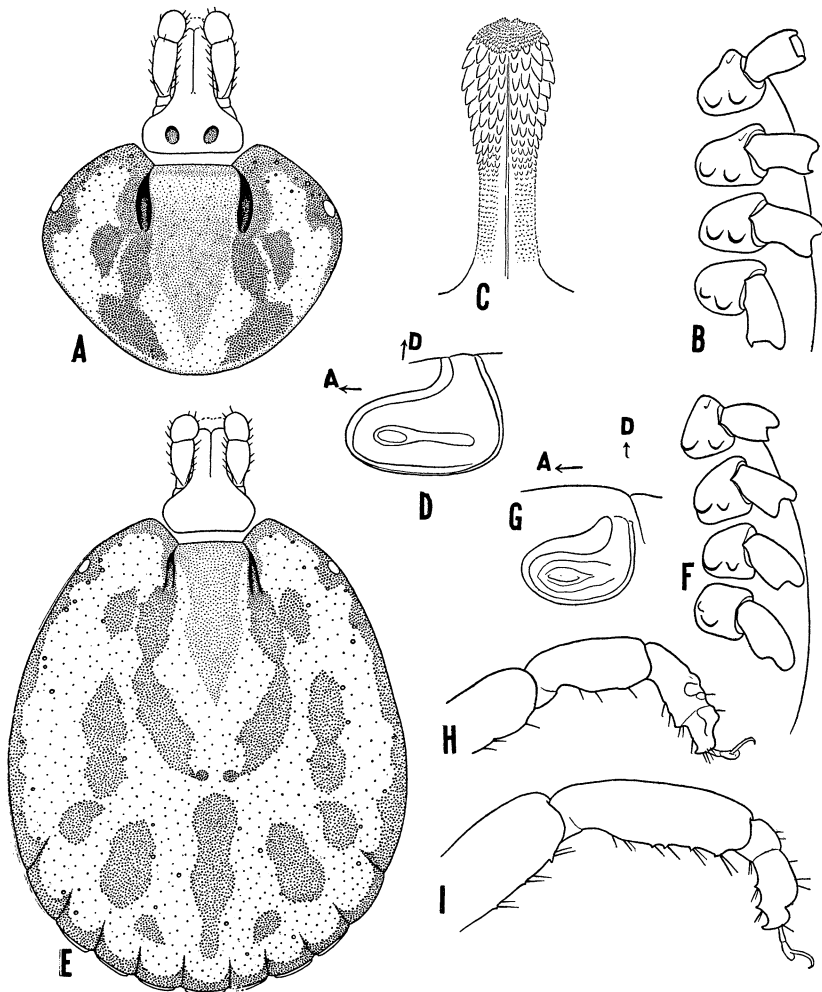


FIG. 9. *Amblyomma tuberculatum* Marx. A. Capitulum and scutum of female. B. Coxae of female. C. Hypostome of female. D. Spiracular plate of female. E. Capitulum and scutum of male. F. Coxae of male. G. Spiracular plate of male. H. Leg I of male. I. Leg IV of female.

The southern meadowlark, *Sturnella magna argutula*, has been recorded as a host in Florida, without mention of the stage of the tick.

Hooker, Bishopp and Wood (1912) stated, "engorged larvae have been collected in large numbers from dogs and rabbits and in smaller numbers from cattle and two birds of prey, namely, the owl and the hawk."

Young and Goff (1939) give the following records, all from *Gopherus polyphemus* in Florida: Miami, May 20, 1933; Leesburg, May 4, 1938, and Gainesville, November 28, 1936.

The Rocky Mountain Laboratory collection contains specimens as follows: 18545, *Gopherus polyphemus*, Florida, April 23, 1939, 4 ♂ (Amer. Mus. Nat. History); 19833, *Sceloporus undulatus undulatus*, Silver Springs, Marion Co., Florida, February 28, 1942, 5 nymphs (J. Frenkel); 16266, *Geomys floridanus*, Newman's Lake, Alachua Co., Florida, December 9, 1939, several larvae (B. A. Barrington) and

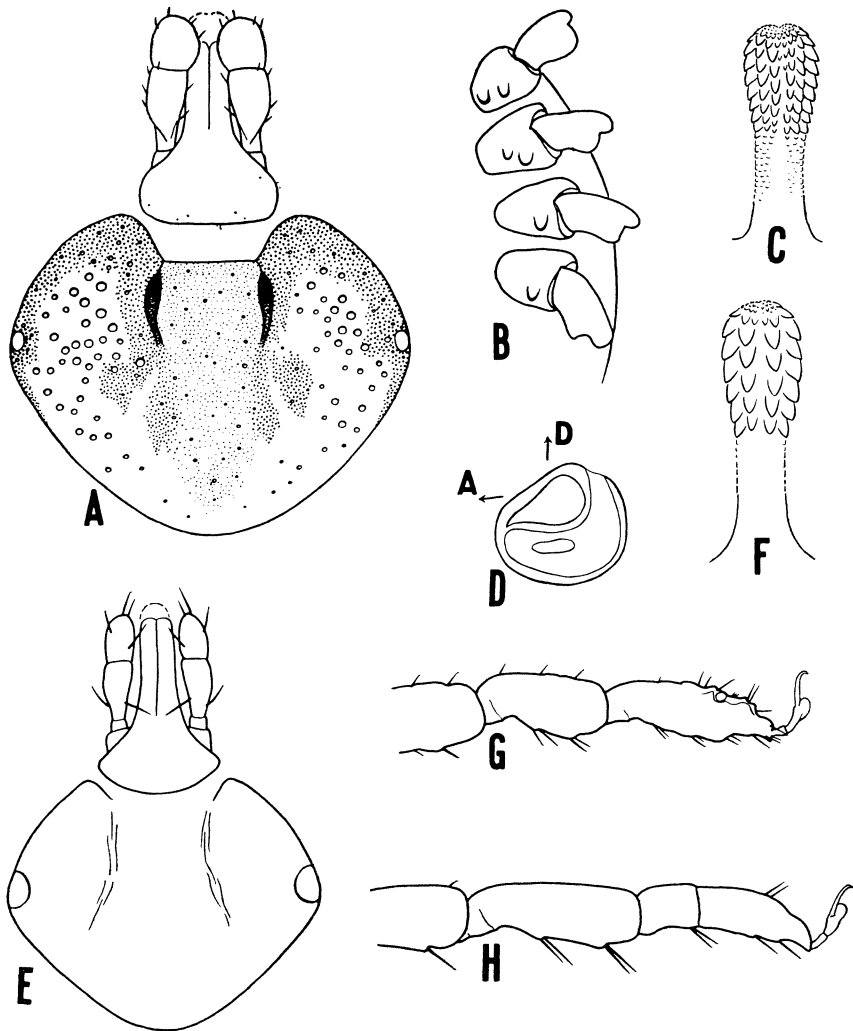


FIG. 10. *Amblyomma tuberculatum* Marx. A. Capitulum and scutum of ornate nymph. B. Coxae of nymph. C. Hypostome of nymph. D. Spiracular plate of nymph. E. Capitulum and scutum of larva. F. Hypostome of larva. G. Leg I of nymph. H. Leg IV of nymph.

19651, Broxton, Coffee Co., Georgia, host and date unknown, 1 ♂, 1 ♀ (Dr. G. Brigham).

Amblyomma inornatum (Banks, 1909)

(Fig. 11)

1909. *Aponomma inornata* Banks, p. 171.

1939. *Amblyomma philipi* Cooley and Kohls, p. 44.

Female

Body: Banks (1909) in describing the species gives the length as 8 mm. We have neither unengorged nor fully engorged specimens. One slightly fed specimen is oval, narrower in front.

Scutum: Length 1.36 to 1.62, width 1.44 to 1.56. Inornate. About as long as wide, widest a little in front of the middle. Broadly rounded behind, with the postero-lateral margins a little convex. Cervical grooves deep in front, then continuing as valleys and disappearing without reaching the postero-lateral margins. Punctations numerous, moderate in size. Some specimens have smooth elevations without punctations near the eyes which suggest lateral carinae. Eyes large, pale, slightly convex and margined by small punctations.

Capitulum: Length 0.90 to 1.02, width of basis 0.57 to 0.66. Basis sub-triangular, with the posterior margin straight, postero-lateral edges salient. Porose areas large, oval, divergent anteriorly and well separated. Surface smooth, shining, punctate. Palpi long, narrow proximally. Postero-dorsal ridge moderate. Hairs moderate in number.

Hypostome: Long, spatulate, faintly notched apically. Dentition 3/3. Length about 0.54.

Legs: Moderate in length and size. Apical ventral spur absent on tarsus I, present on II, III and IV. Sub-apical ventral spurs absent. Length of tarsus I, 0.54; metatarsus, 0.36. Length of tarsus IV, 0.48; metatarsus, 0.42.

Coxae: Coxa I with a short internal and a moderately long external spur. Coxae II, III and IV each with one broad, triangular, external spur. Faint trochantal spurs present on legs I and II. All coxae with a few hairs.

Spiracular plate: Moderate in size, flat, well sclerotized. Length 0.45, width 0.36.

Genital aperture: Situated between coxae II.

Male

Body: Length 1.86 to 2.04, width 1.32 to 1.44. Shape almost pyriform.

Scutum: Inornate. Smooth and shining. Lateral grooves distinct, starting back of the eyes and limiting the long festoons. Cervical grooves deep and short. Eyes small, pale and only slightly convex. Posterior median surface in front of the festoons more elevated than the festoons. Punctations numerous, large and present also on the festoons. Hairs absent.

Capitulum: Length 0.54 to 0.60, width of basis 0.37 to 0.39. Basis sub-triangular, cornua a little pointed, posterior margin between the cornua nearly straight, salient. Surface smooth, shining, punctate. Hairs absent. Palpi moderate in length, much broader distally, smooth, shining, impunctate, and with a few short hairs.

Hypostome: Spatulate, broad distally, very faintly notched apically. Dentition 3/3. Length about 0.3.

Legs: Terminal ventral spur absent on tarsus I, present on II, III and IV. Sub-apical ventral spurs absent. Length of tarsus I, 0.48; metatarsus, 0.30. Length of tarsus IV, 0.42; metatarsus, 0.375.

Coxae: All coxae as in the female. Faint trochantal spurs present on I and II in some specimens.

Spiracular plate: Large, flat, moderately sclerotized. Length 0.48, width 0.195.

Genital aperture: Situated between coxae II.

A. inornatum rather closely resembles *A. parvum* Aragão, 1908. *A. inornatum* is smaller, lacks the retrograde spur on the venter of the male palpal article 1, which in the female is poorly developed, and has the much larger punctations on the scuta of both sexes. In the males the most notable differences are in the palpi in dorsal view. In *parvum* the palpus is short and broad, and on article 2 has the postero-dorsal ridge prominent and sometimes overhanging.

HOSTS AND DISTRIBUTION

Amblyomma inornatum was described from dog at Corpus Christi, Texas, and from the rabbit, Victoria, Texas. No type specimens were so labelled but Dr. Bishopp has shown the senior author specimens believed to be the ones which Banks had before him when the species was described. The above descriptions are based on specimens in the collections of the Rocky Mountain Laboratory taken at Kingsville, Texas.

All other known records are tabulated below.

Accession No.	State	Locality	Date	Host animal or source	Number	Collector or authority
14069	Texas	Kingsville	6-10-38	Rabbit	1 ♀	J. C. Brown
14190	"	"	3-24-38	Rabbit	1 ♂	"
14295	"	"	5-24-38	Jackrabbit	1 ♂	R. M. L.
14329	"	"	5-25-38	<i>Canis</i> sp. (coyote)	4 ♂, 1 ♀	R. M. L.
14330	"	"				
14331	"	"				
14332	"	"				
17247	"	27 mi. N.E. of Victoria	9-9-40	Cow	2 ♀	"

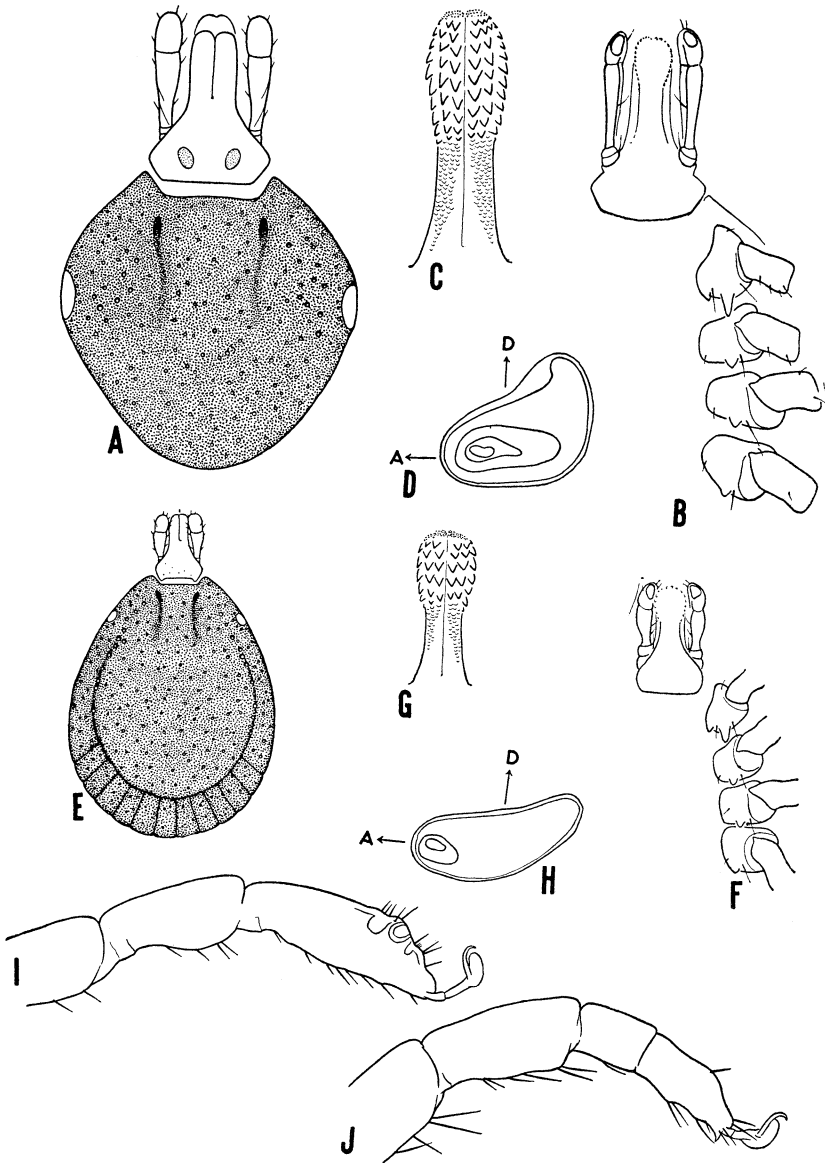


FIG. 11. *Amblyomma inornatum* (Banks). A. Capitulum and scutum of female. B. Capitulum (venter) and coxae of female. C. Hypostome of female. D. Spiracular plate of female. E. Capitulum and scutum of male. F. Capitulum (venter) and coxae of male. G. Hypostome of male. H. Spiracular plate of male. I. Leg I of female. J. Leg IV of female.

Amblyomma avecolens n. sp.

(Fig. 12)

Male and female unknown.

Nymph

Body: No unengorged specimens are available. Well-engorged specimens are very large, long-oval, slightly wider in front, measuring 6.5 long by 4.0.

Scutum: Length 1.02 to 1.14, width 1.08 to 1.11. Widest at the middle, scapulae pointed. Cervical grooves divergent backward, deep in front, and become valleys. Punctations conspicuous, deep, evenly distributed and contrasting strongly with the finely pebbled surface. Eyes small and flat.

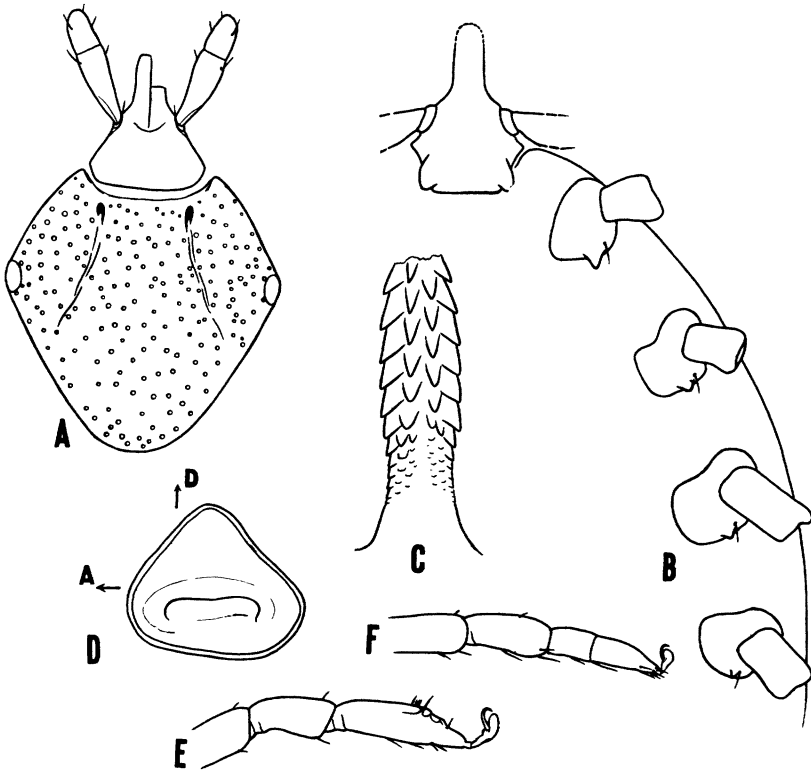


FIG. 12. *Amblyomma avicolens* n. sp. A. Capitulum and scutum of nymph. B. Capitulum (venter) and coxae of nymph. C. Hypostome of nymph. D. Spiracular plate of nymph. E. Leg I of nymph. F. Leg IV of nymph.

Capitulum: width of basis 0.45 to 0.48. (All capituli are mutilated and the length cannot be determined.) Sub-triangular, broadly rounded behind. Surface of basis and palpi finely pebbled, similar to the scutum. In ventral view basis is broad, with low lateral retrograde projections at the sides. Palpi long with a few fine hairs.

Hypostome: Long, with sides about parallel (the tip broken off). Dentition 2/2 and with files extending to near the base. Length (incomplete) 0.36.

Legs: Surface not smooth, suggesting the surface of the palpi. Tarsi long and tapering gradually; apical-ventral and sub-apical ventral spurs absent on all tarsi. Hairs few and short. Length of tarsus I, 0.54; metatarsus, 0.36. Length of tarsus IV, 0.45; metatarsus, 0.36.

Coxae: Small and with small, external spurs progressively smaller from I to IV, those on III and IV seen only with difficulty.

Spiracular plate: Sub-triangular, with the surface smooth, except at the macula, which is much depressed. Size 0.27 by 0.27.

Through the kindness of Dr. E. A. Chapin, Curator, Division of Insects, of the United States National Museum, we have had the opportunity to study three lots of nymphal ticks from birds, as listed below. The scutum is very characteristic and the bird host labels are of interest. These specimens are not easily referred to genus, but it appears reasonably certain that they are of a species of *Amblyomma*. The early stages of *Amblyomma* are not well known. Robinson (1926) omits them. Some of the specimens here described are very large and could not be of any known species in the United States, and the species of *Amblyomma* in Mexico are very little known.

Holotype: Nymph, 18707,* 1 from neck of *Vireo griseus*, Aug. 5, 1929, 6 miles east of Sorita, Kennedy Co., Texas, deposited in the collections of the Rocky Mountain Laboratory.

* Numerals refer to records of the Rocky Mountain Laboratory.

Paratypes: 18709, 1 from *Glyphorhynchus curvata*, May 3, 1926, Duck Run, British Honduras; 18702, 2 from *Xiphorhynchus* sp., Mar. 24, 1912, Panama Canal, deposited in the United States National Museum.

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