



The *Amblyomma* (Acari: Ixodida: Ixodidae) of Mexico: Identification Keys, Distribution and Hosts

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Abstract

Taxonomic keys, distributional data and hosts are provided for the 26 *Amblyomma* species known from Mexico. Members of this genus have been collected in 30 of Mexico's 32 states and are associated with 43 nominal vertebrate taxa, of which 40 have been identified to species and four (*Python* sp., *Myrmecophaga tridactyla*, *Tamandua tetradactyla*, *Tupinambis teguixin*) are non-native. Mammals are the principal class of vertebrates parasitized by Mexican *Amblyomma* species, followed by reptiles, birds and amphibians. Our knowledge of Mexican *Amblyomma* is still far from complete because many potential hosts have not yet been examined and vast areas of the country remain unexplored.

Key words: *Amblyomma*, Ixodidae, keys, distribution, hosts, Mexico

Introduction

Ticks of the genus *Amblyomma* (Koch) are parasites of all classes of terrestrial vertebrates: amphibians, reptiles, birds and mammals. Many members of this genus are of medical and veterinary importance, serving as vectors of microorganisms that cause diseases, such as Rocky Mountain spotted fever (Cooley & Kohls 1944; Estrada-Peña *et al.* 2004), other rickettsioses of the spotted fever group (Estrada-Peña *et al.* 2004), heartwater (Sonenshine 1991) and enzootic tularemia (Cooley & Kohls 1944), in domestic and wild animals, as well as humans.

The genus *Amblyomma* may be characterized as follows: body generally medium- to large-sized; scutum usually ornate, often with bright, multicolored iridescent patterns or dark spots and stripes on a pale ground; eyes and festoons present; palps usually long, palpal segment 2 very long; anal groove situated posterior to anus; spiracles subtriangular or comma-shaped; basis capituli variable in dorsal outline (Robinson 1926; Sonenshine 1991). *Amblyomm*ine ticks occur worldwide, chiefly in humid tropical and subtropical regions (Sonenshine 1991). The genus is the third largest in the Ixodidae and currently comprises 130 species (Guglielmone *et al.* 2010), 59 of which are found in the Neotropical Zoogeographic Region (Barros-Battesti *et al.* 2006; Nava *et al.* 2009). In Mexico, Hoffmann (1962) initially recognized 17 species: *Amblyomma americanum* (Linnaeus), *Amblyomma auricularium* (Conil), *Amblyomma cajennense* (Fabricius), *Amblyomma castañedai* Vargas and Hoffmann, *Amblyomma coelebs* Neumann, *Amblyomma dissimile* Koch, *Amblyomma imitator* Kohls, *Amblyomma inornatum* (Banks), *Amblyomma longirostre* (Koch), *Amblyomma maculatum* Koch, *Amblyomma oblongoguttatum* Koch, *Amblyomma ovale* Koch, *Amblyomma parvum* Aragão, *Amblyomma pecarium* Dunn, *Amblyomma rotundatum* Koch, *Amblyomma sabanerae* Stoll, and *Amblyomma scutatum* Neumann. However, *A. castañedai* is currently considered a junior synonym of *A. scutatum* (Camicas *et al.* 1998). Later, Hoffmann and López-Campos (2000) again recorded these species but included new locality records for some of them, and Whitaker & Morales-Malacara (2005) compiled a list of ectoparasites associated with Mexican mammals, including 12 *Amblyomma* species. Recently,

Guzmán-Cornejo *et al.* (2006b) reported 26 species of *Amblyomma* in Mexico, adding *Amblyomma calcaratum* Neumann, *Amblyomma elaphense* (Price), *Amblyomma humerale* Koch, *Amblyomma multipunctum* Neumann, *Amblyomma nodosum* Neumann, *Amblyomma pacae* Aragão, *Amblyomma tigrinum* Koch, *Amblyomma triste* Koch, *Amblyomma tuberculatum* Marx, and *Amblyomma varium* Koch. Specimens of most of the *Amblyomma* species currently known from Mexico can be found in the Colección Nacional de Ácaros (CNAC), Instituto de Biología, Universidad Nacional Autónoma de México (UNAM). To encourage further research on New World *Amblyomma*, we here present all the published information on this genus in the Mexican Republic, together with new records and taxonomic keys to all species.

Materials and methods

Initially, we conducted computerized bibliographic searches, using an array of public and proprietary databases (Agricola, Biological Abstracts, BioOne, Biosis, CAB Abstracts, Medline, Zoological Record), to locate published references to the species of *Amblyomma* that have been reported from Mexico. We then searched CNAC's Biota (version 1.6.1) database to locate any unpublished collection records of Mexican *Amblyomma*.

This work is divided into three sections. The first contains taxonomic keys to *Amblyomma* females and males, based largely on the keys in Robinson (1926) and Jones *et al.* (1972), with subsequent additions and emendations. The second section consists of a parasite-host list organized alphabetically by Mexican state. Within each state we separate collection records by tick species, again arranged alphabetically and with each species name in **boldface**, followed by host(s) and literature citations. Where information is unavailable, we denote this as "ND" (Not Determined). For new records, we cite the tick species, number and sex or stage(s) (F = female, M = male, N = nymph, L = larva), locality, date, host name, and CNAC accession number. The third section is a host-parasite list, following the traditional classification of vertebrates (Amphibia, Reptilia, Aves, Mammalia). Within each vertebrate group, hosts and their respective parasites are presented in alphabetical order. Host names were verified or corrected using specialized bibliographies for each group: American Ornithologists' Union (1998) for birds, Flores-Villela (1993) and Flores-Villela and Canseco-Márquez (2004) for amphibians and reptiles, and Ramírez-Pulido *et al.* (1996, 2005) and Wilson and Reeder (2005) for mammals.

Results

The present work recognizes 26 *Amblyomma* species (*A. americanum*, *A. auricularium*, *A. cajennense*, *A. calcaratum*, *A. coelebs*, *A. dissimile*, *A. elaphense*, *A. humerale*, *A. imitator*, *A. inornatum*, *A. longirostre*, *A. maculatum*, *A. multipunctum*, *A. nodosum*, *A. oblongoguttatum*, *A. ovale*, *A. pacae*, *A. parvum*, *A. pecarium*, *A. rotundatum*, *A. sabanerae*, *A. scutatum*, *A. tigrinum*, *A. triste*, *A. tuberculatum*, *A. varium*) associated with amphibians, reptiles, birds and mammals in Mexico. Hoffmann and López-Campos (2000) felt that *A. cajennense* occurs throughout Mexico. However, we have found tick records for only 30 of Mexico's 32 federal entities – no collection records appear to exist for the states of Aguascalientes and Tlaxcala. In our parasite-host list, we have appended the category "Mexico," which contains collection records that were published without mention of particular states or localities.

The presence of *A. humerale*, *A. multipunctum*, *A. tigrinum*, *A. tuberculatum* and *A. varium* in Mexico needs to be confirmed, because available records lack data on hosts, locality, and specimen deposition. On the other hand, the absence of *A. quasicyprium* Robinson is virtually certain. This species was described as a parasite of primates in Frontera, State of Tabasco, Mexico (Robinson 1926). However, Keirans (1985) determined that the Mexican specimen of *A. quasicyprium* is actually *A. cyprium* Neumann, and that the host and locality data for this specimen are incorrect. *Amblyomma cyprium* is now considered a junior synonym of *A. breviscutatum* Neumann, which is confined to the Oriental and Australian Zoogeographic Regions (Voltz & Keirans 2002). An additional supposed record of *A. quasicyprium*, from *Bos taurus* in Oaxaca, Mexico, was cited by Hoffmann (1961), but no specimens from this collection appear to have been preserved. Where authors have failed to link host and distribution records, we have listed all reported hosts.

Key to Females

1. Eyes absent *A. elaphense*
- Eyes present 2
2. Hypostomal dentition 4/4 or 5/5 3
- Hypostomal dentition 3/3 7
3. Hypostome 5/5; coxa I with two large subequal spurs, the external curved mesially *A. multipunctum*
- Hypostome 4/4; external spur of coxa I not curved mesially 4
4. Coxae II–IV with one spur *A. varium*
- Coxae II–IV with two spurs 5
5. Large species (body unengorged at least 7 mm long); scutal punctations numerous but very small, except in scapular areas *A. tuberculatum*
- Smaller species (body unengorged about 5 mm long); scutal punctations numerous but larger, sometimes confluent 6
6. Internal spurs of coxae I–IV all about equal in size; scutum cordiform *A. humerale*
- Internal spurs of coxae I–IV successively decreasing in size; scutum triangular *A. sabanerae* (plates 1o, 2o)
7. Coxae II–III with two distinct spurs 8
- Coxae II–III with one spur or one spur and an indication of a second spur 9
8. Scutal punctations large and small but chiefly confined to the anterolateral fields; external spurs longer, their apices blunt to sharp *A. dissimile* (plates 1f, 2f)
- Scutal punctations mostly medium sized and not confined to the anterolateral fields; external spurs short, stout, rounded *A. rotundatum* (plates 1ñ, 2ñ)
9. Trochanters with spurs 10
- Trochanters without spurs 11
10. Scutum pale yellowish brown; punctations minute, indistinct *A. auricularium* (plates 1b, 2b)
- Scutum brown; punctations distinct and moderately deep *A. parvum* (plates 1m, 2m)
11. Tibiae of legs II–IV with either one or two spurs 12
- Tibiae of legs II–IV without spurs 14
12. Two spurs on tibiae II–IV *A. maculatum* (plates 1j, 2j)
- One spur on tibiae II–IV 13
13. Fестоons ventrally with a small tubercle at posterointernal angle *A. triste* (plates 1q, 2q)
- Fестоons lacking tubercles *A. tigrinum*
14. Scutum inornate, punctations numerous, moderate in size; coxa I with short internal spur and moderately long, slender external spur *A. inornatum* (plates 1h, 2h)
- Scutum ornate 15
15. Hypostome very long and sharply pointed; scutum indistinctly ornate; legs, especially IV, very long *A. longirostre* (plates 1i, 2i)
- Lacking this combination of characters 16
16. Coxae II–III with broad, flat, ridge-like spurs, much wider than long 17
- Coxae II–III with spurs as wide as long, or only slightly wider than long 19
17. Tubercles absent at posterointernal angles of festoons *A. imitator* (plates 1g, 2g)
- Tubercles present at posterointernal angles of festoons 18
18. Palpal segment 2 about 2.5 times as long as segment 3; festoons ventrally somewhat rugose and poorly defined, each, except median, with a well-developed tubercle at posterointernal angle; internal spur of coxa I broad and blunt *A. pecarium* (plates 1n, 2n)
- Palpal segment 2 about twice as long as segment 3; festoons ventrally smooth and clearly defined, each, except median, with a much smaller tubercle at posterointernal angle; internal spur of coxa I narrower and more sharply pointed *A. cajennense* (plates 1c, 2c)
19. Scutal ornamentation largely confined to a single spot at the posterior angle 20
- Scutal ornamentation more widespread 21
20. Ornate spot at posterior angle of scutum larger; spurs of coxa I unequal, external spur long and pointed *A. americanum* (plates 1a, 2a)
- Ornate spot at posterior angle of scutum small and irregular in outline; spurs of coxa I subequal, long and stout *A. calcaratum* (plates 1d, 2d)
21. Spurs of coxa I short *A. scutatum* (plates 1p, 2p)
- Spurs of coxa I moderately to very long 22
22. Scutum with a Y-shaped patch of ornamentation in each lateral field *A. nodosum*
- Scutal ornamentation otherwise 23
23. External spur of coxa I curved slightly outward at tip *A. ovale* (plates 1k, 2k)
- External spur of coxa I not curved apically 24
24. Coxa I with slender spurs; scutal punctations scant posteriorly *A. oblongoguttatum*
- Coxa I with stout spurs; punctations not limited to anterior portion of scutum 25
25. Scutum extensively ornate, punctations numerous and deep, cervical grooves S-shaped anteriorly; spur on coxa IV longer than wide *A. coelebs* (plates 1e, 2e)
- Scutum indistinctly ornate, punctations numerous but small and shallow, cervical grooves pyriform anteriorly; spur on coxa IV wider than long *A. pacae* (plates 1l, 2l)

Key to males

1. Eyes absent *A. elaphense* 2
- Eyes present 2
2. Marginal groove incomplete or absent 3
- Marginal groove complete, limiting all festoons 14
3. Hypostomal dentition 4/4 4
- Hypostomal dentition 3/3 7
4. Coxa IV with one long spur *A. multipunctum*
- Coxa IV with two short spurs 5
5. Scutal ornamentation extensive; punctations minute, inapparent *A. tuberculatum*
- Scutal ornamentation confined to scapulae; punctations obvious 6
6. Scutum smooth; cervical grooves short, comma-shaped *A. humerale*
- Scutum rough due to presence of punctation-free elevated areas; cervical grooves convergent... *A. sabanerae* (plates 3n, 4m)
7. Coxae II–III with two spurs 8
- Coxae II–III with one spur 9
8. External coxal spurs much longer than internal spurs *A. dissimile* (plates 3e, 4d)
- External and internal coxal spurs short, bluntly rounded *A. rotundatum*
9. Marginal groove incomplete, terminating posteriorly at third festoon *A. longirostre* (plates 3h, 4g)
- Marginal groove absent 10
10. Spurs of coxa I equal or subequal in length 11
- External spur of coxa I longer than internal 13
11. Spurs of coxa I short, bluntly rounded *A. varium*
- Spurs of coxa I long, their tips pointed or blunt 12
12. Coxa IV with long spur; palpal segment 1 ventrally with small ventral process; scutum with irregular pale patch of ornamentation in anterolateral fields *A. calcaratum* (plates 3d, 4c)
- Coxa IV with short spur; palpal segment 1 ventrally with large ventral process; J-shaped patch of ornamentation in anterolateral fields *A. nodosum* (plates 3j, 4i)
13. Coxa I with very small spurs, the external a little longer than the internal; scutum and dorsum of basis capituli ornate; punctations numerous, medium-sized *A. scutatium* (plates 3ñ, 4n)
- Coxa I with external spur long and thin, the internal shorter and stouter; scutum indistinctly ornate; punctations numerous but small, giving scutum smooth appearance *A. pacae*
14. Trochanters with spurs 15
- Trochanters without spurs 16
15. Cornua small; coxa I with short, subequal spurs; scutum with few fine punctations *A. auricularium* (plates 3b, 4a)
- Cornua medium-sized; coxa I with internal spur much shorter than external; scutum with numerous fine punctations *A. parvum* (plates 3l, 4k)
16. Tibiae of legs II–IV with either one or two spurs 17
- Tibiae of legs II–IV without spurs 19
17. Two spurs on tibiae II–IV *A. maculatum* (plates 3i, 4h)
- One spur on tibiae II–IV 18
18. Festoons ventrally with a small tubercle at posterointernal angle *A. triste* (plates 3o, 4ñ)
- Festoons lacking tubercles *A. tigrinum*
19. Scutum with elongate keel-like ridge in posteromedian area *A. pecarium* (plates 3m, 4l)
- Scutum without keel-like ridge 20
20. Coxa I with two long spurs, tip of external spur curving slightly outward *A. ovale* (plates 3k, 4j)
- Tip of external spur of coxa I not curving outward 21
21. Inornate *A. inornatum* (plates 3g, 4f)
- Ornate 22
22. Spurs of coxa I slender, equal or subequal in length; elements of scutal ornamentation arranged longitudinally, conveying a striped appearance *A. oblongoguttatum*
- External spur of coxa I longer than internal spur; scutal ornamentation otherwise 23
23. Scutal ornamentation most conspicuous in anterior and median fields *A. coelebs*
- Scutal ornamentation peripheral or extensive 24
24. Ornamentation reduced and peripheral, usually confined to vicinity of marginal groove, festoons 3 and 5, and area behind eyes *A. americanum* (plate 3a)
- Ornamentation extensive 25
25. Longer (3.9–4.9 mm), broader (2.3–3.0 mm), darker species; a species complex (see text) *A. cajennense* (plates 3c, 4b)
- Shorter (2.3–3.5 mm), narrower (1.8–2.7 mm), paler species *A. imitator* (plates 3f, 4e)



PLATE 1. *Amblyomma* females, dorsal: a) *A. americanum*, b) *A. auricularium*; c) *A. cajennense*, d) *A. calcaratum*, e) *A. coelebs*, f) *A. dissimile*, g) *A. imitator*, h) *A. inornatum*, i) *A. longirostre*, j) *A. maculatum*, k) *A. ovale*, l) *A. pacae*, m) *A. parvum*, n) *A. pecarium*, ñ) *A. rotundatum*, o) *A. sabanerae*, p) *A. scutatum*, q) *A. triste*.



PLATE 2. *Amblyomma* females, ventral: a) *A. americanum*, b) *A. auricularium*, c) *A. cajennense*, d) *A. calcaratum*, e) *A. coelebs*, f) *A. dissimile*, g) *A. imitator*, h) *A. inornatum*, i) *A. longirostre*, j) *A. maculatum*, k) *A. ovale*, l) *A. pacae*, m) *A. parvum*, n) *A. pecarium*, ñ) *A. rotundatum*, o) *A. sabanerae*, p) *A. scutatum*, q) *A. triste*.

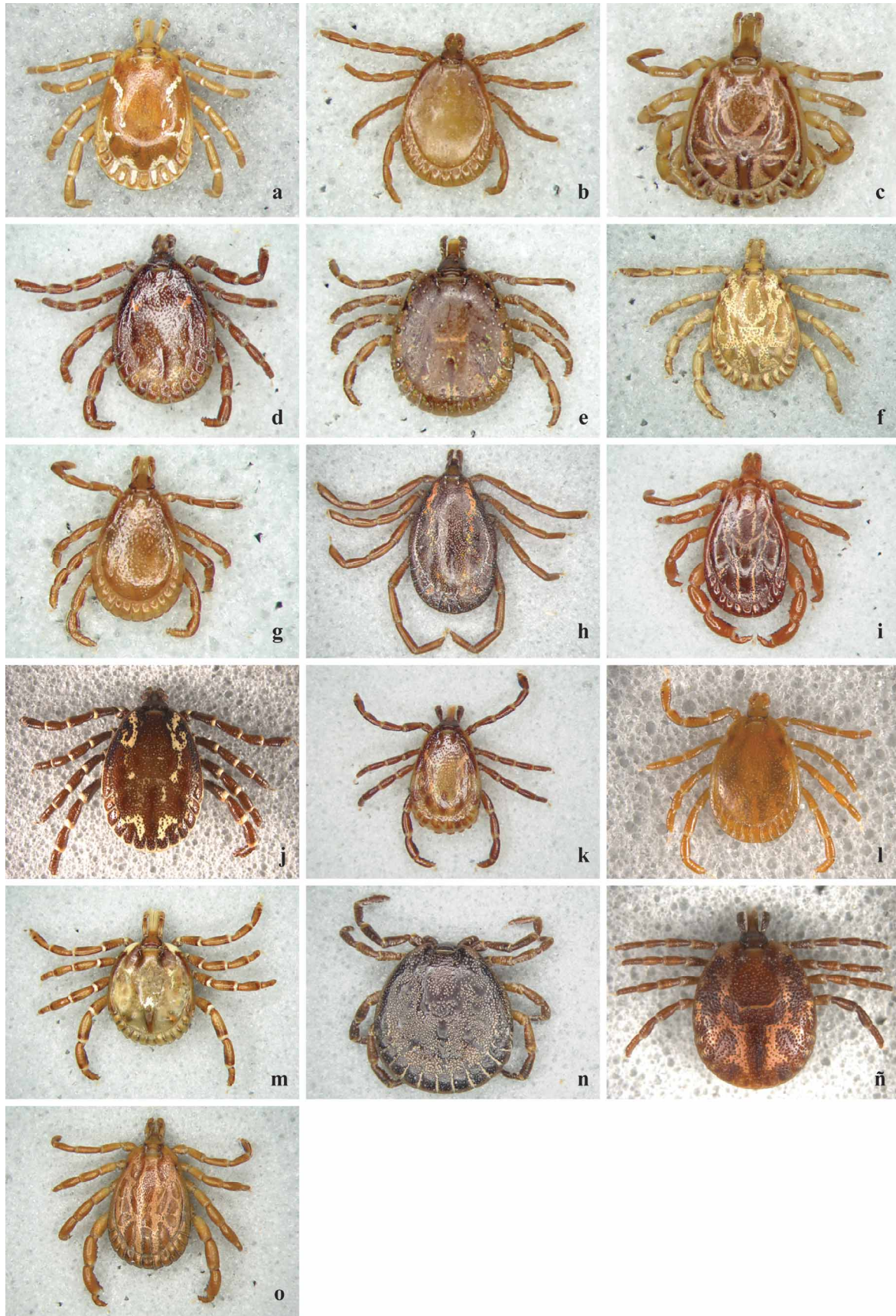


PLATE 3. *Amblyomma* males, dorsal: a) *A. americanum*, b) *A. auricularium*, c) *A. cajennense*, d) *A. calcaratum*, e) *A. dissimile*, f) *A. imitator*, g) *A. inornatum*, h) *A. longirostre*, i) *A. maculatum*, j) *A. nodosum*, k) *A. ovale*, l) *A. parvum*, m) *A. pecarium*, n) *A. sabanerae*, ñ) *A. scutatum*, o) *A. triste*.



PLATE 4. *Amblyomma* males, ventral: a) *A. auricularium*, b) *A. cajennense*, c) *A. calcaratum*, d) *A. dissimile*, e) *A. imitator*, f) *A. inornatum*, g) *A. longirostre*, h) *A. maculatum*, i) *A. nodosum*, j) *A. ovale*, k) *A. parvum*, l) *A. pecarium*, m) *A. sabanerae*; n) *A. scutatum*, ñ) *A. triste*.

Parasite-host list

BAJA CALIFORNIA

A. cajennense: birds, domestic animals, *Homo sapiens* (Hoffmann 1961).

Note: Molecular phylogenetic analyses and examination of genetically distinct populations have led Beati, L. and Nava, S. (pers. comm.) to conclude that *A. cajennense* may comprise a number of cryptic species.

BAJA CALIFORNIA SUR

A. cajennense: ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961).

CAMPECHE

A. cajennense: birds, domestic animals, *Homo sapiens* (Hoffmann 1961); *Bos taurus*, *Equus caballus* (Hoffmann 1962); ND (Delabra *et al.* 1996); ND (Estrada-Peña *et al.* 2004); ND (Bustamante & Varela 1946). *A. dissimile*: snake (Paredes-León *et al.* 2008). *A. imitator*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. maculatum*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. parvum*: ND (Woodham *et al.* 1983). *A. sabanerae*: *Rhinoclemmys areolata* (Ernst & Ernst 1977). *A. tuberculatum*: ND (Woodham *et al.* 1983).

New records. *A. cajennense*: 2F, Campeche (19°00'00"N, 116°37'45"W), 01-XI-1944, *Bos taurus* (CNAC005100); same data except 1F (CNAC005215); 1F, Escárcega (18°37'00"N, 90°43'00"W), XII-1944, *Equus caballus* (CNAC005120); 5F, San Dimas (19°19'00"N, 90°25'00"W), XII-1944, *Bos taurus* (CNAC005129).

CHIAPAS

A. auricularium: *Dasyypus novemcinctus* (Hoffmann & López-Campos 2000). *A. cajennense*: ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); deer, *Bos taurus*, *Canis familiaris*, *Equus caballus*, *Homo sapiens* (Hoffmann 1962); ND (Delabra *et al.* 1996); *Tapirus bairdii* (Aldan *et al.* 2003); *Pecari tajacu* (Romero-Castañón *et al.* 2008). *A. coelebs*: *Tapirus bairdii* (Aldan *et al.* 2003); ND (Estrada-Peña *et al.* 2004). *A. dissimile*: *Bos taurus* (Hoffmann 1961); peccary, iguana (Hoffmann 1962); *Rhinella marina* (Paredes-León *et al.* 2008). *A. inornatum*: ND (Woodham *et al.* 1983); *Pecari tajacu*, *Tayassu pecari* (Romero-Castañón *et al.* 2008). *A. longirostre*: *Ramphocelus sanguinolentus*, *Rhynchocyclus brevirostris*, *Tolmomyias sulphurescens* (Hoffmann 1962; Hoffmann & López-Campos 2000); *Pirogale* sp. (Hoffmann & López Campos 2000). *A. maculatum*: *Urocyon cinereoargenteus* (Hoffmann *et al.* 1972; Hoffmann & López-Campos 2000); ND (Delabra *et al.* 1996); *Bos taurus*, *Odocoileus virginianus* (Romero-Castañón *et al.* 2008). *A. oblongoguttatum*: *Mazama americana*, *Pecari tajacu nelsoni*, *Tayassu pecari* (Hoffmann 1962; Hoffmann & López-Campos 2000). *A. pacae*: *Tapirus bairdii* (Guzmán-Cornejo *et al.* 2006b). *A. ovale*: *Bos taurus*, *Canis familiaris*, *Equus caballus* (Hoffmann 1961; Hoffmann & López-Campos 2000); *Canis familiaris* (Hoffmann 1962); *Tapirus bairdii* (Aldan *et al.* 2003). *A. parvum*: *Equus caballus* (Guglielmone *et al.* 1990). *A. pecarium*: *Mazama americana*, *Pecari tajacu nelsoni*, *Tayassu pecari* (Hoffmann 1962; Hoffmann & López-Campos 2000); *Pecari tajacu*, *Tayassu pecari* (Romero-Castañón *et al.* 2008). *A. rotundatum*: *Spillotes pullatus* (Hoffmann 1962); *Ctenosaura acanthura*, *Ctenosaura similis* U. S. National Parasite Collection (USNPC). *A. sabanerae*: *Rhinoclemmys pulcherrima* (Ernst & Ernst 1977).

Notes: Romero-Castañón *et al.* (2008) claim that Mexico is a new locality record for *A. cajennense* and *A. inornatum*, but both species had earlier been recorded from this country (Hoffmann 1962). Hoffmann and López-Campos (2000) recorded the host of *A. longirostre* as porcupine (*Pirogale* sp.); however, in Mexico the only two species known as porcupine are *Sphiggurus mexicanus* and *Erethizon dorsatum*, which inhabit southern and northern Mexico, respectively. Hoffmann (1962) and Hoffmann and López-Campos (2000) listed *Mazama sartorii* as a host for *A. oblongoguttatum* and *A. pecarium*, but this host is considered a synonym of *M. temama* by Wilson and Reeder (2005), while Ramírez-Pulido *et al.* (2005) classify it as a subspecies of *M. americana*.

New records. *A. cajennense*: 2F, 1M, Santa Inés (16°02'00"N, 92°52'00"W), 04-XII-1944, *Bos taurus* (CNAC005079); 1F, 1N, Finca Prusia, Jaltenango (15°55'00"N, 92°43'00"W), 21-XI-1944, deer (CNAC005058); 2F, Tuxtla Gutiérrez (16°45'10"N, 93°07'00"W), 10-IX-1979, *Tapirus bairdii* (CNA002001); 1F, 1M, 10 km W del Ejido Los Angeles, Reserva de la Biosfera La Sepultura, Villa Flores (16°14'51"N, 93°41'2.4"W), 31-VIII-2005, ND (CNAC005228). *A. coelebs*: 1F Frontera Corozal, Ocosingo (16°45'21.9"N, 91°00'32.1"W), 29-IV-2004, *Homo sapiens* (CNAC005045). *A. maculatum*: 1F, Comitán (16°15'00"N, 92°08'00"W), 09-IX-1960, ND (CNA005165). *A. ovale*: 4M, 3N, 6.5 km del Crucero Frontera, Frontera Corozal (16°46'51.6"N, 90°56'56.52"W), 09-V-2006, *Urocyon cinereoargenteus* (CNAC005264).

CHIHUAHUA

A. cajennense: birds, domestic animals, *Homo sapiens* (Hoffmann 1961). *A. elaphense*: *Bogertophis subocularis* (Degenhardt 1986). *A. maculatum*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996).

COAHUILA

A. americanum: ND (Hoffmann 1962); ND (Delabra *et al.* 1996). *A. cajennense*: ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); *Bos taurus* (Hoffmann 1962); ND (Delabra *et al.* 1996). *A. imitator*: ND (Hoffmann & López-Campos 2000). *A. inornatum*: ND (Cooley & Kohls 1939). *A. maculatum*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. triste*: *Bos taurus* (Guzmán-Cornejo *et al.* 2006a; Mertins *et al.* 2010).

New records. *A. americanum*: La Bandera, Guerrero (29°03'00"N, 100°54'00"W), 02-V-1975, *Bos taurus* (CNAC002421).

COLIMA

A. cajennense: birds, domestic animals, *Homo sapiens* (Hoffmann 1961); squirrel, *Bos taurus*, *Homo sapiens* (Hoffmann 1962); ND (Delabra *et al.* 1996); ND (Estrada-Peña *et al.* 2004). *A. imitator*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996).

DISTRITO FEDERAL

A. cajennense: ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); *Bos taurus* (Hoffmann 1962).

New record. *A. cajennense*: 1F, ND, 15-VII-1943, *Canis familiaris* (CNA005084).

DURANGO

A. cajennense: birds, domestic animals, *Homo sapiens* (Hoffmann 1961); ND (Delabra *et al.* 1996). *A. inornatum*: *Sigmodon hispidus* (Eads & Borom 1975). *A. maculatum*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. triste*: *Bos taurus* (Mertins *et al.* 2010).

ESTADO DE MÉXICO

A. cajennense: ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); *Bos taurus* (Hoffmann 1962); ND (Delabra *et al.* 1996). *A. scutatum*: iguana (Paredes-León *et al.* 2008).

GUANAJUATO

A. cajennense: birds, domestic animals, *Homo sapiens* (Hoffmann 1961); ND (Delabra *et al.* 1996). *A. coelebs*: NA (Neumann 1899, Robinson 1926); *Tapirus bairdii*, peccaries (Hoffmann & López-Campos 2000).

GUERRERO

A. cajennense: ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); *Bos taurus* (Hoffmann 1962); ND (Delabra *et al.* 1996). *A. dissimile*: *Bos taurus* (Hoffmann 1961); *Iguana iguana* (Hoffmann 1962; Robinson 1926); snake (Robinson 1926); *Crotalus durissus*, *Spilotes pullatus* (Quintero *et al.* 1990); *Ctenosaura pectinata* (Burrige & Simmons 2003); *Iguana iguana* (Paredes-León *et al.* 2008). *A. imitator*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. parvum*: “onza” (Hoffmann 1962); *Panthera onca* (Hoffmann & López-Campos 2000). *A. scutatum*: iguana, *Ctenosaura acanthura*, *Ctenosaura pectinata* (Hoffmann 1962); iguana, *Ctenosaura pectinata* (Paredes-León *et al.* 2008).

Note: Hoffmann (1962) reported *A. parvum* in association with “onza”; later, Hoffmann and López-Campos (2000) listed *Felis onca hernandezi*, now considered a junior synonym of *Panthera onca*, as a host of *A. parvum*. Hoffmann’s 1962 record was probably *P. onca*.

New records. *A. cajennense*: 1F, km 12 Atoyac, El Paraíso, Atoyac del Álvarez (17°12’00”N, 100°26’00”W), 19-VII-2005, ND (CNAC005217); 4F, 1M, El Ocotito, km 10 a 20, Yaltepec, 10-XI-2005, ND (CNAC005227). *A. imitator*: 2F, 4M, 9N, ND, 01-III-1939, ND (CNAC005033). *A. parvum*: 1F, ND, 15-VI-1936, “onza” or “león” (CNAC002064). *A. ovale*: 1F, km 12 Atoyac, El Paraíso, Atoyac de Álvarez, 19-VII-2005, ND (CNAC005218).

Note: Under *A. parvum* above, the host referred to as “onza” or “león” may be *Puma yaguaroundi* (Lacépède, 1809); both *P. onca* and *P. yaguaroundi* occur in Guerrero, and the latter species is sometimes called “león.”

HIDALGO

A. cajennense: ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); litter (Hoffmann 1962); ND (Delabra *et al.* 1996). *A. imitator*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. maculatum*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996).

New records. *A. imitator*: 1F, 1M, San Felipe Orizatlán (21°10’19”N, 98°36’23”W), 12-IX-1979, *Bos taurus* (CNAC000268); 1F, Chapulhuacan (21°10’00”N, 98°54’00”W), 26-V-1944, litter (CNAC002030).

JALISCO

A. cajennense: birds, domestic animals, *Homo sapiens* (Hoffmann 1961); ND (Delabra *et al.* 1996). *A. coelebs*: peccary (Chavarría 1941); *Tapirus bairdii*, peccaries (Hoffmann & López-Campos 2000). *A. dissimile*: toad (Paredes-León *et al.* 2008). *A. rotundatum*: toad, *Bufo* sp. (Paredes-León *et al.* 2008). *A. imitator*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. inornatum*: ND (Woodham *et al.* 1983).

Note: Chavarría (1941) reported the host of *A. coelebs* as wild boar but clarified this to mean peccary or feral domestic pig. Paredes León *et al.* (2008) incorrectly cited Guadalajara, their collection locality for *A. rotundatum*, as a state; this city is the capital of Jalisco State.

New records. *A. cajennense*: 1F, 1M, Estación de Biología Chamela (19°29’53.051”N, 105°02’39.695”W), UNAM, 22-X-2001, *Homo sapiens* (CNAC005196); 2F, same locality, 18-VIII-2005, vegetation (CNAC005201); 1N same locality, 18-IV-2006, ND (CNAC005240); 7F, same locality, 25-X-2001, *Homo sapiens* (CNAC005229); 1M, same locality, 17-IV-2006, ND (CNAC005239); 1N, sendero educativo, Estación de Biología Chamela, UNAM, 19-IV-2006 (CNAC005242); 2M, 8N sendero perico, Estación de Biología Chamela, UNAM, 19-IV-2006, vegetation (CNAC005232); 1F, 1M, 4N, desviación sendero chachalaca, Estación de Biología Chamela, UNAM, 17-IV-2006, ND (CNAC005237); 3F, 4N sendero camino viejo norte, Estación de Biología de Chamela, UNAM, 17-IV-2006, ND (CNAC005243); 1M, 15N, puente principal Chamela, Reserva de la Biosfera Chamela-Cuixmala (19°31’38.7”N, 105°04’19.62”W), 18-IV-2006, ND (CNAC005241). *A. parvum*: 1F, 1M, Estación de Biología, Chamela, UNAM, 28-IX-2003 (CNAC005230). *A. ovale*: 1 M, sendero tejón entre el metro 1400 y 1500, Estación de Biología Chamela, UNAM, 26-IX-2005, vegetation (CNAC005244).

MICHOACÁN

A. auricularium: *Dasypus novemcinctus* (Hoffmann 1962; Hoffmann & López-Campos 2000). *A. cajennense*: birds, domestic animals, *Homo sapiens* (Hoffmann 1961); *Bos taurus* (Hoffmann 1962); ND (Delabra *et al.* 1996).

A. dissimile: *Bufo* sp. (Paredes-León *et al.* 2008). *A. inornatum*: ND (Woodham *et al.* 1983). *A. rotundatum*: *Rhinella marina*, *Phrynosoma* sp. (Hoffmann 1962). *A. scutatum*: *Ctenosaura pectinata* (Paredes-León *et al.* 2008).

New records. *A. auricularium*: 1F, Tumbiscatio (18°31'00"N, 102°21'00"W), 28-III-1980, iguana (CNAC002062) originally identified as *A. parvum*. *A. cajennense*: 1F, Playa de la Soledad, 24-V-1976, ND (CNAC002091).

MORELOS

A. cajennense: ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961). *A. inornatum*: hares, rabbits (Tovar 1944; Hoffmann & López-Campos 2000); ND (Hoffmann 1962). *A. scutatum*: iguana (Hoffmann 1962); iguana (Paredes-León *et al.* 2008).

Note: Hoffmann (1962) notes that the record of *A. scutatum* from iguana was described by Hoffmann (1946) as *A. boneti*, a junior synonym of *A. scutatum*.

NAYARIT

A. cajennense: birds, domestic animals, *Homo sapiens* (Hoffmann 1961); *Bos taurus*, *Equus asinus*, *Homo sapiens* (Hoffmann 1962); ND (Delabra *et al.* 1996); ND (Estrada-Peña *et al.* 2004). *A. dissimile*: *Boa constrictor*, *Ctenosaura pectinata* (Paredes-León *et al.* 2008). *A. imitator*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. inornatum*: ND (Woodham *et al.* 1983). *A. maculatum*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. parvum*: ND (Woodham *et al.* 1983).

New records. *A. auricularium*: 1F, 4M, Tepic (21°30'00"N, 104°54'00"W), 11-IX-1974, *Dasyopus novemcinctus* (CNAC002065) originally identified as *A. parvum*. *A. cajennense*: 1F, km 14 ½ San Blas, VI-1968, ND (CNAC0002000); 1M, San Blas (21°32'23"N, 105°17'08"W), 2-VII-1962, *Homo sapiens* (CNAC002386).

NUEVO LEÓN

A. americanum: ND (Hoffmann 1962); ND (Delabra *et al.* 1996). *A. cajennense*: birds, domestic animals, *Homo sapiens* (Hoffmann 1961); ND (Estrada-Peña *et al.* 2004); ND (Medina-Sánchez *et al.* 2005); vegetation (Gordillo-Pérez *et al.* 2009); *A. imitator*: *Bos taurus*, vegetation (Medina-Sánchez *et al.* 2005); ND (Delabra *et al.* 1996); ND (Oliveira *et al.* 2010). *A. inornatum*: ND (Woodham *et al.* 1983). *A. maculatum*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996).

Note: Hoffmann (1962) speculated that *A. imitator* would be found in Nuevo León.

OAXACA

A. cajennense: ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); *Bos taurus*, *Canis familiaris*, *Dasyopus novemcinctus*, *Equus caballus* (Hoffmann 1962); *Equus caballus* (Keirans 1985); ND (Delabra *et al.* 1996); ND (Estrada-Peña *et al.* 2004). *A. dissimile*: *Rhinella marina*, iguana (Macías-Valadez 1923); toad (Hoffmann 1962); *Rhinoclemmys rubida*, *Rhinoclemmys pulcherrima* (Ernst & Ernst 1977); *Iguana iguana* (Keirans 1985); *Rhinella marina*, toad, *Phrynosoma* sp., *Ctenosaura pectinata* (Paredes-León *et al.* 2008); *Ctenosaura pectinata* (Camacho & Pérez-Lara 2009). *A. inornatum*: ND (Woodham *et al.* 1983). *A. oblongoguttatum*: ND (Kohls 1958); Hoffmann & López-Campos 2000). *A. sabanerae*: *Rhinoclemmys pulcherrima* (Paredes-León *et al.* 2008). *A. scutatum*: iguana (Hoffmann 1962); *Ctenosaura pectinata* (Paredes-León 2003); iguana (Paredes-León *et al.* 2008); *Iguana iguana* (Camacho & Pérez-Lara 2009).

New records. *A. cajennense*: 5F, 21M, 9N, Donají (17°13'35"N, 95°03'04"W), 21-V-1976, ND (CNAC002098); 7F, 13M, Tres Picos, 7-IX-1958, ND (CNAC002203). *A. inornatum*: 4F, 1M, Santa Catarina de Sena, Tlaxiactac de Cabrera (17°02'53"N, 96°36'34"W), 27-VIII-1976, *Canis familiaris* (CNAC002053). *A. parvum*: 1F, 2M, 21-IX-1948, *Didelphis* sp. (CNAC05119); 1F, 12M, Ixtaltepec, Nizanda, Municipio Asunción (16°39'27"N, 95°00' 38"W), 15-III-2001, *Dasyopus novemcinctus* (CNAC005191). *A. pecarium*: 5F, 14M, 1N, Itsmo de Tehuantepec, ND, Okapi (sic) (CNAC002003).

PUEBLA

A. cajennense: ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); *Bos taurus* (Hoffmann 1962); ND (Delabra *et al.* 1996). *A. imitator*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. inornatum*: ND (Woodham *et al.* 1983). *A. maculatum*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996).

New records. *A. cajennense*: 7F, 2M, Villa Juárez (20°18'00"N, 95°03'04"W), 22-X-1950, *Equus caballus* (CNAC005130); 1M, El Ajengibre (20°26'17"N, 97°40'43"W), 16-V-1953, ND (CNAC005043). *A. ovale*: 1M, Ahuaxintila (20°15'15"N, 97°53'41"W), 09-II-1949, "onza real" (CNAC005095).

Note: Under *A. ovale* above, the host referred to as "onza real" may be *Puma yaguaroundi* (Lacépède, 1809).

QUERÉTARO

A. cajennense: birds, domestic animals, *Homo sapiens* (Hoffmann 1961); ND (Delabra *et al.* 1996). *A. imitator*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. maculatum*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996).

New records. *A. cajennense*: 1F, Cadereyta (20°42'00"N, 99°49'00"W), 16-II-1951, ND (CNAC005028). *A. imitator*: 1F, Jalpan near San Martín (21°12'15.6"N, 99°31'9.24"W), 23-VI-2006, on rocks of Jalpan River (CNAC002193).

QUINTANA ROO

A. cajennense: ND (Bustamante & Varela 1946); *Bos taurus*, *Equus caballus*, *Sus scrofa* (Macías-Valadez 1923); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); *Equus caballus* (Hoffmann 1962); ND (Delabra *et al.* 1996). *A. imitator*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. sabanerae*: *Rhinoclemmys areolata* (Ernst & Ernst 1977; Hoffmann 1962). *A. ovale*: ND (Woodham *et al.* 1983). *A. tuberculatum*: ND (Woodham *et al.* 1983).

New record. *A. cajennense*: 1M, Tres Garantías (18°11'33"N, 88°58'58"W), 11-XI-2002, ND (CNAC005236).

SAN LUIS POTOSÍ

A. cajennense: ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); mule, *Bos taurus*, *Canis familiaris*, *Equus caballus*, *Homo sapiens*, (Hoffmann 1962); ND (Delabra *et al.* 1996). *A. imitator*: *Homo sapiens* (Kohls 1958); *Bos taurus* (Hoffmann 1962); ND (Delabra *et al.* 1996). *A. ovale*: ND (Woodham *et al.* 1983). *A. maculatum*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996).

New records. *A. cajennense*: 4F, 2N, El Salto (22°26'16" N, 101°03'07"W), 28-XII-1949, vegetation, *Homo sapiens* (CNAC005060); same data except 1F, 1N, 114L, 29-XII-1950 vegetation, *Homo sapiens* (CNAC005146); 1M, 3N, Rancho La Providencia, Los Cocos, 18-II-1951, ND (CNAC005029); 4F, 1M, 2N Aserradero, Tamuín (21°56'07"N, 98°50'11"W), 06-IX-1975, *Bos taurus* (CNAC002004). *A. imitator*: 1F, 1M, Barrancón, Tanlajás (21°40'22"N, 98°51'37"W), 18-V-1975, *Bos taurus* (CNAC002412); 2M, 4N, Los Sabinos (21°55'00"N, 98°48'00"W), 03-IV-1942, *Canis familiaris* (CNAC002028); same data except 2F, 3M, 57N (CNAC002036); same data except 1F, 1N, 10-V-1950, *Homo sapiens* (CNAC005088); same data except 4F, 3M, 23N, 1L (CNAC005112); 1F, 1N, Tamazunchale (21°15'56"N, 98°47' 45"W), 01-V-1950, *Homo sapiens* (CNAC00005094); 4F, 14N, 8L, El Salto, *Homo sapiens* (CNAC002351).

SINALOA

A. auricularium: *Dasyus novemcinctus* (Hoffmann 1962; Hoffmann & López-Campos 2000). *A. cajennense*: ND (Hoffmann 1925); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); paddock (Hoffmann 1962); ND (Estrada-Peña *et al.* 2004). *A. imitator*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. inornatum*: ND (Hoffmann 1962); *Bos taurus* (Hoffmann & López-Campos 2000). *A. maculatum*: *Canis familiaris* (Hoffmann

1925; Tovar 1944; Hoffmann & López-Campos 2000); ND (Hoffmann 1962); ND (Delabra *et al.* 1996). *A. oblongoguttatum*: *O. virginianus* (Hoffmann 1962; Hoffmann & López-Campos 2000).

New record. *A. inornatum*: 1F, ND, 21-VIII-1975, *Bos taurus* (CNAC002052).

SONORA

A. cajennense: birds, domestic animals, *Homo sapiens* (Hoffmann 1961). *A. inornatum*: ND (Woodham *et al.* 1983). *A. maculatum*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. triste*: undetermined deer, probably *Odocoileus virginianus* (Guzmán-Cornejo *et al.* 2006a) (CNAC002072).

TABASCO

A. cajennense: ND (Bustamante & Varela 1946); *Bos taurus* (Bequaert 1938); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); *Bos taurus*, iguana, (Hoffmann 1962); *Didelphis* sp., *Tayassu* sp. (Keirans 1982); ND (Delabra *et al.* 1996); ND (Estrada-Peña *et al.* 2004). *A. inornatum*: ND (Woodham *et al.* 1983). *A. maculatum*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. oblongoguttatum*: *Bos taurus*, *Tapirus bairdii* (Chavarría 1941; Hoffmann & López-Campos 2000); *Bos taurus* (Hoffmann 1961). *A. ovale*: *Bos taurus*, *Equus caballus* (Chavarría 1941); *Bos taurus*, *Canis familiaris*, *Equus caballus* (Hoffmann 1961; Hoffmann & López-Campos 2000). *A. parvum*: *Dasypus novemcinctus* (Hoffmann *et al.* 1972; Hoffmann & López-Campos 2000). *A. pecarium*: *Tayassu* sp. (Keirans 1982).

Note: The only species in the genus *Tayassu* is *T. pecari* (Ramírez-Pulido *et al.* 2005), but we cannot know with certainty the species of peccary from which the specimens of *A. cajennense* cited in Keirans (1982) were collected.

New records. *A. auricularium*: 2M, Teapa (17°32'56"N, 92°57'12"W), V-1964, *Dasypus novemcinctus* (CNAC002061). *A. cajennense*: 14F, Tenosique (17°28'21"N, 91°25'36"W), 01-I-1945, *Equus caballus* (CNAC005080); 1F, Emiliano Zapata, 27-V-1970, vegetation (CNAC005071); 2F, Teapa, 26-I-1976, *Bos taurus* (CNAC001996); same data except 1F, 2M, 1N, V-1964, *Dasypus novemcinctus* (CNAC002026); same data except, 3F, 10M, 5-III-1971, *Equus caballus* (CNAC002265); 1F, 7M, 54N, Macuspana (17°45'36"N, 92°35'51"W), II-1971, *Equus caballus* (CNAC002035); 1M, Tecoluta, Nacajuca (18°08'00"N, 93°01'00"W), ND (22-V-1978) (CNAC002197); 3F, Amacohíte, Huimanguillo (17°51'00"N, 93°23'00"W), 5-III-1971, *Equus caballus* (CNAC002267); 1F, 2N, Finca Cholula, Comalcalco (18°17'1"N, 93°12'39"W), 12-V-2006, *Canis familiaris* (CNAC005256); same data except 1F, 3N, *Canis familiaris* (CNAC005257); 1F, Río Playa, Comalcalco (18°20'2"N, 93°17'46"W), 13-V-2006, *Equus caballus* (CNAC005259). *A. maculatum*: 2M, Finca Cholula, Comalcalco, 12-V-2006, *Equus caballus* (CNAC0055258); 2M, Río Playa, Comalcalco, 13-V-2006, *Canis familiaris* (CNAC005260).

TAMAULIPAS

A. americanum: "wild hog, javelina" (Bequaert 1945); ND (Hoffmann 1962); ND (Delabra *et al.* 1996); ND (Estrada-Peña *et al.* 2004). *A. auricularium*: *Dasypus novemcinctus* (Hoffmann 1962; Hoffmann & López-Campos 2000). *A. cajennense*: mule, *Bos taurus*, *Equus asinus*, *Equus caballus*, *Homo sapiens* (Macías-Valadez 1923); chickens, *Canis familiaris*, *Equus caballus*, *Homo sapiens* (Roberts 1934); chickens, *Canis familiaris*, *Equus caballus* (Roberts 1934); ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); mule, *Bos taurus*, *Equus caballus*, *Sus scrofa* (Hoffmann 1962); ND (Delabra *et al.* 1996); *Bos taurus*, *Canis familiaris* (Gordillo-Pérez *et al.* 2009). *A. dissimile*: snake (Paredes-León *et al.* 2008). *A. imitator*: ND (Hoffmann 1962); ND (Sundman 1965); ND (Delabra *et al.* 1996). *A. inornatum*: ND (Woodham *et al.* 1983). *A. maculatum*: ND (Woodham *et al.* 1983). *A. ovale*: ND (Woodham *et al.* 1983). *A. parvum*: ND (Woodham *et al.* 1983). *A. triste*: ND (Woodham *et al.* 1983). *A. scutatum*: iguana (Paredes-León *et al.* 2008).

Note: Hoffmann (1962) speculated that *A. imitator* would be found in Tamaulipas.

New records. *A. cajennense*: 1F, Cerro del Bernal (22°45'15"N, 98°35'31"W), 21-XII-1949, ND (CNAC005022); 3F, 1M, 3N Rancho La Bolsa, Tampico, 25-II-1951; ND (CNAC005026); 1F, Cerro del Bernal, 21-XII-1949, ND (CNAC005022); 4F, 1M, El Apuro, Aldama (22°39'37"N, 97°55'34"W), 05-VIII-1978, *Bos tau-*

rus (CNAC001999). *A. imitator*: 1F, Cerro Bernal, 21-XII-1949, ND (CNAC005021); 1F, Rancho La Bolsa, Tampico, 25-II-1951, ND (CNAC005027); 1F, 2M, 51N, Rancho La Bolsa, 25-II-1951, *Bos taurus* (CNA005124). *A. maculatum*: 6F, 2M, Los 3 García, Reynosa, 26-VIII-1976, *Bos taurus* (CNAC002059).

VERACRUZ

A. cajennense: ND (Dugès 1893); ND (Neumann 1899); ND (Maquivar 1938); ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); litter, mule, peccary, *Bos taurus*, *Canis familiaris*, *Equus caballus* (Hoffmann 1962); ND, litter in banana truck (Eads *et al.* 1966); *Bos taurus* (Calderon & Reyna 1980); ND (Delabra *et al.* 1996); ND (Estrada-Peña *et al.* 2004); *Bos taurus* (González-Cerón *et al.* 2009). *A. calcaratum*: *Tamandua mexicana* (Guzmán-Cornejo *et al.* 2006b). *A. dissimile*: *Bos taurus* (Gibson & Carrillo 1959; Hoffmann 1961); toad, *Iguana iguana* (Hoffmann 1962); *Bufo* sp., *Rhinella marina*, “Mazacuata,” iguana, *Iguana iguana* (Paredes-León *et al.* 2008). *A. imitator*: ND (Kohls 1958); ND (Delabra *et al.* 1996). *A. inornatum*: *Homo sapiens* (Gibson & Carrillo 1959, Hoffmann & López-Campos 2000). *A. longirostre*: *Coendu mexicanus* (Hoffmann *et al.* 1972, Hoffmann & López-Campos 2000). *A. maculatum*: *Bos taurus* (Hoffmann & López Campos 2000). *A. nodosum*: *Myrmecophaga tridactyla* (Keirans 1982). *A. ovale*: *Bos taurus* (Gibson & Carrillo 1959); *Bos taurus*, *Canis familiaris*, *Equus caballus* (Hoffmann & López-Campos 2000). *A. scutatatum*: iguana (Hoffmann 1962); *Iguana iguana* (Paredes-León *et al.* 2008).

Note: Keirans’ (1982) record of *A. nodosum* is suspect because *Myrmecophaga tridactyla* does not occur in Mexico.

New records. *A. cajennense*: 1F, 6 km al N de Coatzacoalcos, 02-XI-1957, ND (CNAC005025); 46F, 37M, Allende (18°08’60”N, 94°24’18”W), IX-1944, *Equus caballus* (CNAC005030); 106F, 9M, Región del Chapo, VIII-1944, *Equus caballus* (CNAC005031); 14F, 12M, Las Choapas (17°54’36”N, 94°05’34”W), XII-1944, *Bos taurus* (CNAC005034); 6F, 2M, 1N, around Rancho La Encantada, San Andrés Tuxtla (18°26’58.920”N, 95°12’43.920” W, 30-VIII-2003, *Homo sapiens* (CNAC005044); 2F, San Andrés Tuxtla (18° 27’ 00” N, 95° 12’ 43” W), 05-XI-2002, on vegetation (CNAC005046); 2F, 1M, 28N, 10L, around Rancho La Encantada, 09-VII-2005, *Homo sapiens* (CNAC005102); 1F, 2M, Coaxtla, 04-XI-1960, *Equus asinus* (CNAC002012); 1F, 6N, Isla del Lago Catemaco, Playa Azul, 08-V-1965, heron (CNAC002005); 1F, km 270 Carretera México-Tuxpan, X-1965, ND (CNAC002009). *A. ovale*: 1M, Miahuapa (20°37’00”N, 97°37’00”W), 14-XI-1949, *Equus caballus* (CNAC005052); same data except 1M, 14-IV-1949, Host ND (CNAC005178); 1M, around Rancho la Encantada, San Andrés Tuxtla, 09-VII-2005, *Homo sapiens* (CNAC005163).

YUCATÁN

A. cajennense: ND (Neumann 1899); vegetation, *Equus caballus* (Bequaert 1933); *Sus scrofa* (Brumpt 1933); turtle, bat feces, *Artibeus jamaicensis*, *Homo sapiens* (Wharton 1938); ND (Bustamante & Varela 1946); birds, domestic animals, *Homo sapiens* (Hoffmann 1961); *Bos taurus*, *Equus caballus* (Hoffmann 1962); ND (Hoffmann *et al.* 2004); ND (Delabra *et al.* 1996); *Canis familiaris* (Zavala-Velázquez *et al.* 2002); ND (Estrada-Peña *et al.* 2004). *A. dissimile*: *Rhinella marina*, *Rhinoclemmys areolata*, *Kinosternon leucostomum*, *Terrapene carolina* (Pearse 1936); turtle (Wharton 1938); turtle (Paredes-León *et al.* 2008). *A. imitator*: ND (Woodham *et al.* 1983); ND (Delabra *et al.* 1996). *A. inornatum*: ND (Delabra *et al.* 1996). *A. parvum*: *Dasytus novemcinctus* (Hoffmann 1950; Hoffmann & López-Campos 2000). *A. rotundatum*: *Rhinoclemmys areolata* (Ernst & Ernst 1977). *A. sabanerae*: *Terrapene carolina* (Hoffmann 1962). *Amblyomma* sp.: *Heteromys gaumeri* (Quintero *et al.* 2001); *A. tuberculatum*: ND (Woodham *et al.* 1983).

Note: Hoffmann (1950) originally recorded *A. parvum* as *Amblyomma curruca* Schulze, 1936.

New records. *A. cajennense*: 27F, 23M, 14N, Tizimín (21°08’33”N, 88°09’53”W), 19-V-1975, *Equus caballus* (CNAC002022); 1F, 1M, San Antonio, Tizimín (21°11’35”N, 88°09’30”W), 19-V-1975, *Equus caballus* (CNAC002413); 2F, 2M, 15L, Kikil Tizimín (21°11’27”N, 88°10’04”W), 26-XII-2004, *Homo sapiens* (CNAC005101).

ZACATECAS

A. cajennense: birds, domestic animals, *Homo sapiens* (Hoffmann 1961); ND (Delabra *et al.* 1996). *A. imitator*: ND (Woodham *et al.* 1983). *A. inornatum*: ND (Woodham *et al.* 1983). *A. maculatum*: ND (Delabra *et al.* 1996); ND (Delabra *et al.* 1996).

MEXICO (State Not Determined)

A. americanum: peccaries, *Bos taurus*, *Canis familiaris*, *Equus caballus* (Chavarría 1941); ND (Vargas 1955); *Bos taurus*, *Canis familiaris*, *Equus caballus*, (Hoffmann 1961); ND (Bishopp & Trembley 1945); tinamou (Bequaert 1945). *A. cajennense*: ND (Macías-Valadez 1923). *A. auricularium*: ND (Guglielmone *et al.* 2003). *A. coelebs*: ND (Vargas 1955), *Bos taurus* (Neumann 1911); *Mazama americana* (Fairchild *et al.* 1966); ND (Keirans 1985). *A. dissimile*: NA (Koch 1844); reptiles (Chavarría 1941); ND (Vargas 1955); toads (Paredes-León *et al.* 2008); *Homo sapiens* (Quintero & Ramírez 2008); black iguana, turtle, *Python* sp., *Boa constrictor*, *Iguana iguana* (Quintero *et al.* 2008). *A. humerale*: ND (Vargas 1955). *A. imitator*: *Pecari tajacu* (Meleney 1975); various hosts, *Sciurus aureogaster* (Kohls 1958). *A. inornatum* ND (Vargas 1955). *A. maculatum*: *Tupinambis teguixin* (Neumann 1901, 1911); ND (Bishopp & Hixson 1936, Bishopp & Trembley 1945); ND (Vargas 1955). *A. multipunctum*: ND (Vargas 1955). *A. nodosum*: *Tamandua tetradactyla* (Keirans 1985). *A. longirostre*: birds (Fairchild *et al.* 1966). *A. oblongoguttatum*: ND (Vargas 1955). *A. ovale*: ND (Koch 1844; Neumann 1899); ND (Vargas 1955); *Mazama americana temama*, *Nasua narica* (Aragão & Fonseca 1961); ND (Fairchild *et al.* 1966). *A. sabanerae*: reptile (Keirans & Durden 2001). *A. scutatum*: ND (Vargas 1955). *A. tigrinum*: ND (Graham *et al.* 1975). *A. varium*: ND (Vargas 1955).

Notes: *Amblyomma scutatum* was reported by Vargas (1955) as *A. boneti*. Aragão & Fonseca (1961) list *Mazama sartorii* as a host of *A. ovale*, but *M. sartorii* is considered a synonym of *M. temama* by Wilson & Reeder (2005), and Ramírez-Pulido *et al.* (2005) classify it as a subspecies of *M. americana*. Keirans' (1982) record of *A. nodosum* is suspect because *Tamandua tetradactyla* does not occur in Mexico. Quintero & Ramírez (2008) reported *A. dissimile* from a human, who probably acquired the tick at León, Guanajuato. Quintero *et al.* (2008) notes that ticks were recovered from a wild animal shelter or a local animal market, so the succession of hosts is unknown.

Host-parasite list

litter	<i>A. cajennense</i> , <i>A. imitator</i>
vegetation	<i>A. cajennense</i> , <i>A. ovale</i> , <i>A. imitator</i>
domestic animals	<i>A. cajennense</i>
on rocks	<i>A. cajennense</i>
paddock	<i>A. cajennense</i>
AVES	
birds	<i>A. cajennense</i> , <i>A. longirostre</i>
chickens	<i>A. cajennense</i>
Ciconiiformes	
Ardeidae	
heron	<i>A. cajennense</i>
Tinamiformes	
Tinamidae	
“Tinamou”	<i>A. americanum</i>

Passeriformes

Tyrannidae

Rhynchocyclus brevirostris (Cabanis) *A. longirostre*

Tolmomyias sulphureus (Spix) *A. longirostre*

Thraupidae

Ramphocelus sanguinolentus (Lesson) *A. longirostre*

AMPHIBIA

Anura

toad *A. dissimile, A. rotundatum*

Bufo

Rhinella marina (Linnaeus) *A. dissimile, A. rotundatum*

Bufo sp. *A. rotundatum, A. dissimile*

REPTILIA

reptiles

A. dissimile, A. sabanerae

“mazacuata” *A. dissimile*

snake *A. dissimile*

Boidae

Boa constrictor (Linnaeus) *A. dissimile*

Pythonidae

Python sp. *A. dissimile*

(does not occur in Mexico)

Colubridae

Bogertophis subocularis (Brown) *A. elaphense*

Spilotes pullatus (Linnaeus) *A. dissimile, A. rotundatum*

Viperidae

Crotalus durissus Linnaeus *A. dissimile*

Iguanidae

iguana *A. dissimile, A. scutatum, A. auricularium, A. cajennense*

Ctenosaura acanthura (Shaw) *A. rotundatum, A. scutatum*

Ctenosaura pectinata (Wiegmann) *A. dissimile, A. scutatum*

Ctenosaura similis (Gray) *A. rotundatum*

Iguana iguana (Linnaeus) *A. dissimile, A. scutatum*

Teiidae

Tupinambis teguixin (Linnaeus) (originally recorded as *Podinema tejuixin*), not found in Mexico *A. maculatum*

Phrynosomatidae

Phrynosoma sp. *A. rotundatum, A. dissimile*

Testudines

turtle *A. cajennense, A. dissimile*

Emydidae

Terrapene carolina (Linnaeus) *A. dissimile, A. sabanerae*

Geoemydidae	
<i>Rhinoclemmys pulcherrima</i> (Gray)	<i>A. sabanerae</i> , <i>A. dissimile</i>
<i>Rhinoclemmys areolata</i> (Duméril & Bibron)	<i>A. sabanerae</i> , <i>A. rotundatum</i> , <i>A. dissimile</i>
<i>Rhinoclemmys rubida</i> (Cope)	<i>A. dissimile</i>
Kinosternidae	
<i>Kinosternon leucostomum</i> (Duméril & Bibron)	<i>A. dissimile</i>
MAMMALIA	
Artiodactyla	
Bovidae	
<i>Bos taurus</i> (Linnaeus)	<i>A. americanum</i> , <i>A. cajennense</i> , <i>A. dissimile</i> , <i>A. maculatum</i> , <i>A. oblongoguttatum</i> , <i>A. ovale</i> , <i>A. triste</i> , <i>A. coelebs</i> , <i>A. imi-</i> <i>tator</i> , <i>A. inornatum</i>
Cervidae	
deer	<i>A. cajennense</i> , <i>A. triste</i>
<i>Odocoileus virginianus</i> (Zimmermann)	<i>A. maculatum</i> , <i>A. oblongoguttatum</i>
<i>Mazama americana</i> (Erxleben)	<i>A. coelebs</i> , <i>A. pecarium</i> , <i>A. oblongoguttatum</i> , <i>A. ovale</i>
Equidae	
mule	<i>A. cajennense</i>
<i>Equus asinus</i> Linnaeus	<i>A. cajennense</i>
<i>Equus caballus</i> Linnaeus	<i>A. americanm</i> , <i>A. cajennense</i> , <i>A. ovale</i> , <i>A. parvum</i> , <i>A. mac-</i> <i>ulatum</i>
Suidae	
<i>Sus scrofa</i> Linnaeus	<i>A. cajennense</i>
Tayassuidae	
“wild hog, javelina” (= peccary)	<i>A. americanum</i>
peccary	<i>A. americanum</i> , <i>A. cajennense</i> , <i>A. coelebs</i> , <i>A. dissimile</i>
<i>Pecari tajacu</i> (Linnaeus)	<i>A. cajennense</i> , <i>A. inornatum</i> , <i>A. oblongoguttatum</i> , <i>A.</i> <i>pecarium</i>
<i>Tayassu pecari</i> (Link)	<i>A. cajennense</i> , <i>A. imitator</i> , <i>A. inornatum</i> , <i>A. oblongogut-</i> <i>tatum</i> , <i>A. pecarium</i>
Cingulata	
Dasypodidae	
<i>Dasypus novemcinctus</i> Linnaeus	<i>A. auricularium</i> , <i>A. cajennense</i> , <i>A. parvum</i>
Carnivora	
Canidae	
<i>Canis familiaris</i> Linnaeus	<i>A. americanum</i> , <i>A. cajennense</i> , <i>A. maculatum</i> , <i>A. ovale</i> , <i>A.</i> <i>inornatum</i> , <i>A. imitator</i>
<i>Urocyon cinereoargenteus</i> (Schreber)	<i>A. maculatum</i> , <i>A. ovale</i>
Felidae	
<i>Panthera onca</i> (Linnaeus)	<i>A. parvum</i>
Procyonidae	
<i>Nasua narica</i> (Linnaeus)	<i>A. ovale</i>
Chiroptera	

bat feces	<i>A. cajennense</i>
Phyllostomidae	
<i>Artibeus jamaicensis</i> (Leach)	<i>A. cajennense</i>
Didelphimorphia	
Didelphidae	
<i>Didelphis</i> sp.	<i>A. cajennense</i> , <i>A. parvum</i>
Lagomorpha	
hares	<i>A. inornatum</i>
rabbits	<i>A. inornatum</i>
Perissodactyla	
Tapiridae	
<i>Tapirus bairdii</i> (Gill)	<i>A. cajennense</i> , <i>A. coelebs</i> , <i>A. oblongoguttatum</i> , <i>A. ovale</i> , <i>A. pacae</i>
Pilosa	
Myrmecophagidae	
<i>Tamandua mexicana</i> (de Saussure)	<i>A. calcaratum</i>
<i>Tamandua tetradactyla</i> Linnaeus (does not occur in Mexico)	<i>A. nodosum</i>
<i>Myrmecophaga tridactyla</i> Linnaeus (does not occur in Mexico)	<i>A. nodosum</i>
Primates	
Hominidae	
<i>Homo sapiens</i> Linnaeus	<i>A. cajennense</i> , <i>A. coelebs</i> , <i>A. inornatum</i> , <i>A. dissimile</i> , <i>A. imitator</i> , <i>A. ovale</i>
Rodentia	
Erethizontidae	
<i>Sphiggurus mexicanus</i> (Kerr)	<i>A. longirostre</i>
Cricetidae	
<i>Sigmodon hispidus</i> Say & Ord	<i>A. inornatum</i>
Sciuridae	
Squirrel	<i>A. cajennense</i>
<i>Sciurus aureogaster</i> (Cuvier)	<i>A. imitator</i>

Discussion

Twenty-six of the 130 known species of *Amblyomma* (20% of the total) have been recorded from Mexico. These 26 species are associated with 43 nominal vertebrate taxa (40 identified to the species level). In light of the fact that approximately 2,306 species of terrestrial vertebrates occur in Mexico (Flores-Villela 1993, Ramírez-Pulido *et al.* 1996, Ceballos & Márquez 2000, Flores-Villela & Canseco-Márquez 2004, Ceballos & Oliva 2005), our knowledge of Mexican *Amblyomma* is clearly far from complete, since only 1.86% of the vertebrate fauna has been examined for these ticks. The most widespread species is *A. cajennense*, while *A. elaphense*, *A. calcaratum* and *A. nodosum* have each been recorded from just a single Mexican state. Mexican records of *A. humerale*, *A. multipunctum*, *A. tigrinum*, *A. tuberculatum* and *A. varium* are doubtful because they lack specific host or locality data; further collecting will be needed in order to confirm their presence in the country. We have nonetheless included these species in our checklist and keys.

Although records of *Amblyomma* exist for 30 of Mexico's 32 federal entities, information about the geographic distribution of particular species is scattered and scarce. Currently, the states of Chiapas, Tamaulipas and Veracruz possess the richest amblyommine faunas, with 14, 11 and 10 species, respectively, followed by Jalisco, Oaxaca, Tabasco and Yucatán, with eight species each. By contrast, in some states the genus is represented by just a single species, *i.e.*, Baja California, Baja California Sur, and Distrito Federal, where the only records are of the seemingly ubiquitous *A. cajennense*. In other cases (*A. elaphense* on Colubridae in Chihuahua, *A. calcaratum* and *A. nodosum* on Myrmecophagidae in Veracruz), tick records are isolated or confined to a limited range of hosts, suggesting either insufficient collecting or extreme host specificity. In the present work, we supply new locality records for 19 Mexican states, increasing the mean number of species per state from 4.9 to 5.16. The greatest diversity of *Amblyomma* species (10) was found on *Bos taurus*, while *A. cajennense* was recorded from the broadest range of hosts (18).

In Mexico, members of the genus *Amblyomma* may be found on all classes of terrestrial vertebrates. Thus, a group of five species (*A. dissimile*, *A. elaphense*, *A. rotundatum*, *A. sabanerae*, *A. scutatatum*) is chiefly associated with amphibians and reptiles. Most other *Amblyomma* species appear to be specific to certain orders of mammals, *e.g.*, Artiodactyla (*A. pecarium*), Cingulata (*A. auricularium*), Pilosa (*A. calcaratum*, *A. nodosum*). *Amblyomma coelebs* and *A. ovale* have been recorded from Perissodactyla and Carnivora, respectively; however, we also have records of these species from Artiodactyla. Nymphs of *A. longirostre* parasitize birds, which carry this stage well outside the range of the rodents that are the principal hosts of adults (Fairchild *et al.* 1966). Although we lack Mexican host data for some tick species that are known to occur in this country, principal hosts of these species have been listed by Camicas *et al.* (1998) and Guglielmone *et al.* (2003): Reptilia for *A. humerale* and *A. tuberculatum*; Perissodactyla for *A. multipunctum*; Aves (larvae and nymphs) and Carnivora (adults) for *A. tigrinum*; and Pilosa for *A. varium*.

Only two of the 26 *Amblyomma* species (*A. americanum* and *A. elaphense*) have Nearctic affinities. Other species (*e.g.*, *A. nodosum*, *A. longirostre*, *A. pecarium*, *A. sabanerae*) are confined to the Neotropical Region. However, there is a third group of species whose distribution encompasses both zoogeographic realms; among the species in this group are *A. auricularium*, *A. cajennense*, *A. dissimile*, *A. imitator*, *A. inornatum*, *A. maculatum*, *A. ovale*, *A. parvum*, and *A. scutatatum*. *Amblyomma triste* was formerly thought to be an exclusively Neotropical tick, since there was no convincing evidence of its presence in Mexico (Guglielmone *et al.*, 2003), but Guzmán-Cornejo *et al.* (2006a) provided *bona fide* records of this species from the northern states of Coahuila and Sonora, which are well within the Nearctic Region. Recently, Mertins *et al.* (2010) described additional Coahuila collections, plus one from the state of Durango, also in northern Mexico. Examination of new and previously misidentified collections of *A. triste* has demonstrated that further foci of this species exist in southeastern Arizona and southwestern Texas (Mertins *et al.* 2010).

Our knowledge of Mexican *Amblyomma* is still far from complete because so many potential hosts remain to be examined and collections have yet to be made in large areas of the country. Thus, the CNAC collections, which are the finest in Mexico, contain only 18 species: *A. americanum*, *A. auricularium*, *A. calcaratum*, *A. cajennense*, *A. coelebs*, *A. dissimile*, *A. imitator*, *A. inornatum*, *A. maculatum*, *A. longirostre*, *A. nodosum*, *A. ovale*, *A. pacae*, *A. pecarium*, *A. parvum*, *A. sabanerae*, *A. scutatatum* and *A. triste*. There is an urgent need for further systematic collecting of host vertebrates and their parasites. Such collections will facilitate studies of tick ecology, biogeography, host-parasite coevolution, and zoonotic infections.

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