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A REVIEW ON TICKS (ACARI: IXODOIDEA: IXODIDAE, ARGASIDAE), ASSOCIATED PATHOGENS AND DISEASES OF TRINIDAD AND TOBAGO

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ABSTRACT — In this review article, the authors present an overview on ticks which are found on humans and animals in Trinidad and Tobago. Hitherto, 896 valid species of ticks are reported from throughout the world, but so far only 23 tick species belonging to seven genera have been recorded in Trinidad and Tobago. The growing significance of ticks in medical and veterinary fields emphasizes the need for further studies on the ecology of ticks and the epidemiology of tick-borne diseases.

KEYWORDS — *Amblyomma*; *Rhipicephalus*; Ticks; Trinidad and Tobago

INTRODUCTION

Ticks are interesting largely because of their considerable medical and veterinary importance (Jongejan and Uilenberg 2004) and have attracted a great deal of scientific attention due to their role as vectors of numerous pathogens (Kaufman 2010). They belong to the phylum Arthropoda, class Arachnida, order Acari. A total of 896 valid tick species (702 Ixodid, 193 Argasid and 1 Nuttalliella tick (sub-) species) have been recorded from all climatic zones throughout the world (Guglielmone *et al.* 2010).

Ticks are blood-sucking obligatory ectoparasites of mammals, birds, reptiles and amphibians. They cause anaemia, restlessness, loss of condition, decrease in milk production and tick paralysis in animals, along with irritation by injury due to bites (Jonsson 2006). Gross lesions consist of focal erosions, erythema, crusted ulcers with alopecia and nodules in some individuals.

In addition, ticks are currently considered to be second only to mosquitoes as vectors of human infectious diseases in the world (Parola and Raoult 2001) and are known to transmit numerous arboviruses (e.g., tick-borne encephalitis virus and other Flaviviridae, several Reoviridae, Bunyaviridae, and Iridoviridae), bacteria (*Rickettsia*, *Ehrlichia*, *Borrelia*), and protists (*Babesia* and *Theileria*) (Sonenshine 1993). Nijhof *et al.* (2005) recorded the vector competence of ticks, including 808 tick-pathogen relationships: 322 relationships with 84 bacteria, 302 with 124 viruses, 143 with 59 apicomplexan parasites, 4 with 3 nematodes and 3 with *Trypanosoma theileri* and a further 34 species of ticks are found associated with toxicosis. These authors also recorded 233 reported cases of acaricide resistance for 20 tick species of veterinary and medical importance. The

annual global cost associated with ticks and tick-borne diseases in cattle alone is considered to be in the billions of US dollars (De Castro 1997).

To date, there has been no assembled list of tick species present in Trinidad and Tobago and their role in the transmission of tick-borne diseases in the country, despite evidence of their local importance to veterinary and human health. In this review, we compile such a list, evaluate the reliability of the recorded observations, and suggest focal areas for future research.

TICKS IN THE CARIBBEAN REGION

Cruz (2001) recorded 45 tick species from 11 genera and two families from the West Indies (the Caribbean countries). This comprised 14 species of *Ornithodoros*, 10 species of *Antricola*, nine species of *Amblyomma*, three species of *Argas*, two species each of *Boophilus* and *Ixodes*, and one species each of *Parantricola*, *Dermacentor* (*Anocentor*), *Haemaphysalis*, *Aponomma*, and *Rhipicephalus*. On the basis of a study on the vector situation of tick-borne diseases, Camus and Barré (1995) mentioned that the most important ticks transmitting diseases to ruminants in the Caribbean islands are: *Amblyomma variegatum*, vector of cowdriosis and associated with acute dermatophilosis; *A. cajennense*, potential vector of cowdriosis; *Boophilus microplus*, vector of babesiosis and anaplasmosis. The annual financial loss from livestock industry due to tick infestation has been estimated to be in the millions of dollars per year in Commonwealth Caribbean only (Rawlins and Mansingh 1987). It is believed that the most important tick in the Caribbean in terms of disease transmission, the tropical bont tick *A. variegatum*, was first imported into the area by livestock coming from West Africa to the island of Guadeloupe around the 19th century (Uilenberg *et al.* 1984). It was speculated that the tick later spread to other Caribbean islands (Barré *et al.* 1995). A programme with the primary objective to eradicate *A. variegatum* from nine islands (Anguilla, Antigua and Barbuda, Barbados, Dominica, Montserrat, Nevis, St. Kitts, St. Lucia and St. Maarteen) was launched in 1994 (Pegram *et al.* 1998) and ended in 2008 (Ahoussou *et al.* 2010).

TICKS IN TRINIDAD AND TOBAGO

An attempt has been made to list all tick species recorded from Trinidad and Tobago, including information on their hosts and the references (Table 1). A review of the literature revealed 23 tick species, belonging to seven genera, recorded from Trinidad and Tobago. These include nine species of the genus *Amblyomma*, six of *Ornithodoros*, two of each of the genera, *Rhipicephalus*, *Ixodes* and *Argas*, and one from each of the genera *Dermacentor* (*Anocentor*) and *Haemaphysalis*. The life cycle and control of most of these tick species, with the exception of *A. cajennense* and *Rhipicephalus* (*Boophilus*) *microplus* (Aitken *et al.* 1958; Thomas 1963; Smith 1973; Dindial 1977; Polar 2007), are not considered in this review. However, other available information such as the distribution, associated pathogens and effects on hosts of the 23 species are stated below, with an emphasis on the particularly problematic species.

Argas miniatus

Argas (Persicargas) miniatus was detected from chickens in Gasparee Island, Trinidad (Kohls *et al.* 1970). This is a common parasite of chickens in Neotropical countries which might have sometimes been misidentified as *A. persicus*. Many reports of *A. persicus*, a Palearctic species found on poultry in the Neotropics, may actually represent misidentifications of *A. miniatus* or another related species (Kohls *et al.* 1970).

Argas miniatus is known to transmit *Borrelia anserina* (Borreliosis) (Jongejan and Uilenberg 2004).

Distribution: Brazil, Guyana, Colombia, Panama, Venezuela, Puerto Rico, Cuba (Guglielmone *et al.* 2003), Mexico (Hoffman and Lopez Campo 2000), USA, Peru (Cruz 2001).

Argas persicus

Hart (1899) documented the presence of the fowl tick *Argas persicus* and presumed that these ticks were imported from the United States to Trinidad and Tobago. He observed that the infested birds sat down, dropped their wings and experienced fever.

TABLE 1: List of tick species, infested hosts and the year recorded in Trinidad and Tobago

Tick species	Infested hosts	References
Argas miniatus	Fowl	Kohls *et al.* 1970; Jones *et al.* 1972
Argas persicus	Fowl	Hart 1899
Ornithodoros (*Alectorobius*) *azteci*	Bats (*Desmodus rotundus rotundus* , *Lonchorhina aurita*)	Kohls *et al.* 1969
O. (A.) capensis	Birds – Brown noddy tern (*Anous stolidus*), Spotted sandpiper (*Actitis macularia*)	Kohls *et al.* 1965; Aitken *et al.* 1968b
O. (A.) denmarki	Birds – Sooty tern (*Sterna fuscata*) & noddy terns (*Anous stolidus*)	Kohls *et al.* 1965; Aitken *et al.* 1968; Aitken *et al.* 1969; Jonkers *et al.* 1973
O. (A.) hasei	Bat (*Noctilio leporinus leporinus)*	Kohls *et al.* 1965; Jones *et al.* 1972
O. (A.) puertoricensis	Rodents (*Proechimys guyanensis trinitatus, Nectomys squamipes*)	Kohls *et al.* 1965; Endris *et al.* 1989
O. (Subparmatus) viguerasi	Bats (*Pteronotus davyi* & *P.r. rubiginosa* & *Mormoops megalophylla tumidiceps*)	Kohls *et al.* 1965; Aitken *et al.* 1968a
Amblyomma auricularium	Armadillos	Jones *et al.* 1972; Voltzit 2007
A. cajennense	Cattle, Sheep, Goats, Horses, Donkeys, Buffaloes, Dogs and Man	Neumann 1899; Nuttall *et al.* 1926; Aitken *et al.* 1958; Clarkson 1969; Smith 1973; Smith 1974; Smith 1975; Dindial 1977
A. calcaratum	Anteaters (*Tamandua longicaudata*), Birds, Small wild animals, Man	Aitken *et al.* 1968a; Jones *et al.* 1972; Smith 1974
A. dissimile	Snake, Lizard (*Ameiva ameiva* & *Tupinambis nigropunctatus*), Caimans, Toad (*Bufo marinus*) Amphibians, Small wild animals, *Lachesis mutus* , Iguana	Nuttall 1926 ; Turk 1948; Aitken *et al.* 1968a; Aitken *et al.* 1969; Smith 1974; Keirans 1982; Voltzit 2007
A. humerale	Tortoise (*Geochelone denticulate*), Reptiles, Rodents (*Oryzomys capito* and *Proechimys guyannensis*)	Aitken *et al.* 1968a; Everard and Tikasingh 1973; Robbins *et al.* 2003; Voltzit 2007
A. longirostre	Birds, Porcupines, Small wild animals	Aitken *et al.* 1968a; Aitken *et al.* 1969; Smith 1974
A. nodosum	Birds and Anteaters	Jones et *al.* 1972; Nava *et al.* 2007
A. ovale	Dogs	Smith 1974
A. rotundatum	Toads	Jones *et al.* 1972
Dermacentor nitens	Horses, Donkeys	Smith 1974; Dindial 1977
Haemaphysalis juxtakochi	Brocket deer *(Mazama rufa)* Paca (*Coelogenys paca)*	Kohls 1960; Dindial 1977
Ixodes downsi	Bat (*Anoura g. geoffroyi*)	Kohls 1957
I. luciae	Rodents (*Oryzomys capito, O. laticeps, O. concolor, Proechimys guyannensis, Zygodontomys, Heteromys, Didelphis marsupialis* & *Marmosa*), Marsupials, Small wild animals	Fairchild *et al.* 1966; Aitken *et al.* 1968a; Aitken *et al.* 1969; Smith 1974; Dindial 1977
Rhipicephalus (Boophilus) microplus	Cattle	Thomas 1963; Aitken *et al.* 1968a; Aitken *et al.* 1969; Clarkson 1969; Smith 1973; Smith 1974; Dindial 1977
R. sanguineus	Dogs	Aitken *et al.* 1968a; Aitken *et al.* 1969; Smith 1974; Dindial 1977

He also reported that dressing infested fowl with petroleum killed the ticks.

As mentioned above, *Argas persicus*, a Palearctic species, can be easily confounded with other *Argas* species during identification, and many reports of *A. persicus* on poultry in the Neotropics may actually represent misidentifications of *A. miniatus* or another related species (Kohls *et al.* 1970).

Argas persicus is known to transmit *Borrelia anserina* (Borreliosis) and *Aegyptionella pullorum* (Aegyptianellosis) (Jongejan and Uilenberg 2004) and also transmits Slovakia virus, Slovakia (Labuda and Nuttall 2004). Larval ticks produce a toxin which causes paralysis in chickens (Walker *et al.* 2007).

Distribution: Cosmopolitan (Cruz 2001).

Ornithodoros (Alectorobius) azteci

Ornithodoros (A.) azteci has been collected from bats in Trinidad (Cooley and Kohls 1944; Fairchild *et al*. 1965; Kohls 1969). This species was also found on vampire bats (*Desmodus rotundus rotundus*) from Croney Cave, Diego Martin in 1958 and from *Lonchorhina aurita*, Paromin, Maraval from Trinidad in 1960 (Kohls *et al.* 1965).

Distribution: Colombia, Cuba, Jamaica, Islands of the Lesser Antilles, Mexico, Panama, Venezuela (Kohls *et al.* 1965; Cruz 2001).

Ornithodoros (Alectorobius) capensis

Kohls *et al.* (1965) recorded *O.* (*A.*) *capensis* from spotted sandpipers, *Actitis macularia* from Laventile swamp, Port of Spain, Trinidad. Aitken *et al.* (1969) further recorded *O.* (*A.*) *capensis* during their survey of arthropods for natural virus infection.

Between 1962 and 1965, 15 strains of Hughes virus were isolated from Soldado Rock, a small limestone island located about 9.6 km off the southwestern tip of Trinidad. Seven isolates came from ticks of the *O. capensis* complex and eight from nestling terns *Sterna fuscata* (Aitken *et al.* 1968b). Jonkers *et al.* (1973) reported Soldado virus (TRVL 52214), a new viral agent, isolated from a pool of nymphal *O. capensis* ticks (either *Ornithodoros capensis sensu stricto* or *O. denmarki*) collected from a brown noddy (*Anous stolidus*) on Soldado Rock. *O.* (*A.*) *capensis* is also known to transmit other Soldado viruses in Hawaii, Seychelles, Trinidad and Ethiopia (Labuda and Nuttall 2004); Johnston Atoll virus, Abal virus in Central Pacific Islands, Australia, New Zealand, SW Africa (Hoogstraal 2003); Upolu virus in Australia; Baku virus in Azerbaijan; Aransas Bay virus in Texas, USA; Saumarez Reef virus in Tasmania; Hirota virus on Aomatsushima Island, Japan and, Midway virus in Hawaii (Labuda and Nuttall 2004).

Distribution: Dassen Island and Malagas Island (South Africa), Australia, Central Pacific, Ethiopia, Hawaii, Marshall Islands, New Zealand, Texas, Dominica, Jamaica, Cuba (Kohls *et al.* 1965; Cruz 2001).

Ornithodoros (Alectorobius) denmarki

The larvae, nymphs and adults of *O.* (*A.*) *denmarki*, a new species (Kohls *et al.* 1965), which was provisionally identified as *O.* (*A.*) *capensis* from Trinidad by Denmark and Clifford (1962), were found in nesting sites of sooty and noddy terns on Soldado Rock, Trinidad. Aitken *et al.* (1969) recorded *O.* (*A.*) *denmarki*, during their survey of arthropods for natural virus infection.

Ornithodoros (*A.*) *denmarki* is known to transmit Hughes viruses in USA Florida, NW Mexico, Venezuela, Cuba and Trinidad; Farallon virus in California, Oregon, USA; Soldado in Hawaii, Seychelles, Ethiopia and Trinidad; Raza virus in USA and Midway virus in Hawaii, Mexico (Labuda and Nuttall 2004).

Distribution: California, Hawaii, Florida, Ethiopia, Mexico, Jamaica and Cuba (Kohls *et al.* 1965; Guglielmone *et al.* 2003)

Ornithodoros (Alectorobius) hasei

Kohls *et al.* (1965) recorded *O.* (*A.*) *hasei* from bats (*Noctilio leporinus leporinus*), North Manzanilla, Trinidad.

Distribution: Barbuda, Brazil, Guyana, Colombia, Costa Rica, Dominica, Guadeloupe, Guatemala, Martinique, Mexico, Nicaragua, Panama, Bolivia, Peru, Uruguay, St. Croix (Cruz 2001), Venezuela, Bolivia (Kohls *et al.* 1965), Argentina (Nava *et al.* 2007a), Paraguay (Nava *et al.* 2007b), Jamaica (Guglielmone *et al.* 2003)

Ornithodoros (Alectorobius) puertoricensis

This tick was first identified from rats in Puerto Rico (Fox 1947). Kohls *et al.* (1965) recorded *O.* (*A.*) *puertoricensis* from the spiny rat (*Proechimys guyanensis trinitatus*) from Cumaca, Trinidad. A redescription by scanning electron microscope of *O.* (*A.*) *puertoricensis* was done by Endris *et al* (1989). They also reported host records for larvae of *O.* (*A.*) *puertoricensis* from rodents (*Proechimys guyanensis trinitatus* and *Nectomys squamipes*) in Trinidad.

Distribution: Colombia, Jamaica, Panama, Virgin Islands, Puerto Rico, Guadeloupe, Nicaragua, Surinam, Uruguay, Argentina, Bolivia, Brazil, Paraguay, St. Croix, Venezuela (Cruz 2001).

Ornithodoros (Subparmatus) viguerasi

Kohls *et al.* (1965) recorded *O.* (*S.*) *viguerasi* from *Mormoops megalophylla tumidiceps* bats at Mount Tamana, and from *Pteronotus r. rubiginosa* bats in Port of Spain, Tamana Hill cave, and Diego Martin. Aitken *et al.* (1968a) recorded *O.* (*S.*) *viguerasi* from the lesser naked-backed bat (*Pteronotus davyi*) from Bush Forest.

Distribution: Cuba, Dominican Republic, Jamaica, Puerto Rico, Venezuela. Costa Rica, Haiti and Mexico (Cruz 2001; Guglielmone *et al.* 2003)

Amblyomma auricularium

Jones *et al.* (1972) and Voltzit (2007) mentioned the presence of *A. auricularium* in Trinidad. This species feeds on different *Xenarthra* species (anteaters and armadillos), mainly armadillos (Guglielmone *et al.* 2003).

Distribution: ranges from Mexico to Argentina (Jones *et al.* 1972; Voltzit 2007)

Amblyomma cajennense

Neumann (1899) is credited for the identification of *A. cajennense* from Trinidad. Nuttall *et al.* (1926) mentioned that *A. cajennense*, a common tick species in the West Indies and Central and South America, was often a troublesome pest at certain seasons of the year, when the larvae swarm in thousands in the grass and herbage and attack both man and domestic animals with avidity. Aitken *et al.* (1958) recorded 'The 1958 Cayenne tick outbreak' at the Lagoon Doux Estate, south of Mayaro, where only the labourers showed serious effects of tick exposure, such as bout and skin irritations. These authors found *A. cajennense* on a variety of animals including man. Spraying dichlorodiphenyltrichloroethane (DDT), Gamma Benzene Hexachloride (GBH), chlordane and dieldrin helped to control the tick population. Smith (1973) found very large populations of *A. cajennense* ticks in infested areas with uncontrolled grass growth and suggested that a reduction in grass length and the removal of tree shade could help reduce the tick populations. He also studied the distribution of *A. cajennense* in Trinidad and Tobago; this tick was found only in Trinidad on the Cedros peninsula and on east coast at Mayaro. Smith (1974) recorded *A. cajennense* in ruminants, equines, dogs and man. The ecology and life cycle of this tick was also investigated by Dindial (1977) and Smith (1975), respectively. Dindial (1977) found that *A. cajennense* was present in the coastal regions of Manzanilla, Mayaro, Guayaguauare and the Cedros Peninsula area of Trinidad and was absent in Tobago. The presence of *A. cajennense* on cattle was also established by Clarkson (1969) and Rawlins (1977) in Trinidad. Lans (2002) reported a second outbreak of this tick from 1994 to 1996 in Cedros and Mayaro linked to the presence of free-ranging cattle on the coconut estates.

Amblyomma cajennense is known to transmit Wad Medani in Jamaica and *Rickettsia rickettsii* (Rocky Mountain Spotted Fever) (Jongejan and Uilenberg 2004).

Distribution: ranges from southern USA to northern Argentina and Caribbean Islands (Cruz 2001; Voltzit 2007).

Amblyomma calcaratum

Amblyomma calcaratum was recorded from Trinidad on anteaters, birds (Aitken *et al.* 1968a), small wild animals and humans (Smith 1974).

Distribution: Brazil, Bolivia, Colombia, Costa Rica, Belize, Guyana, Ecuador, Panama, Paraguay,

Venezuela, Argentina, Peru (Jones *et al.* 1972; Caceres *et al.* 2002; Guglielmone *et al.* 2003; Voltzit 2007).

Amblyomma dissimile

Neumann (1899) is credited for the identification of *A. dissimile* in Trinidad. Nuttall *et al.* (1926) recorded this tick in Trinidad from snakes (*Lachesis mutans*) and iguanas. Turk (1948) found *Amblyomma trinitatis*, a synonym of *A. dissimile*, on a ground lizard at St. Augustine. Aitken *et al.* (1968a and 1969) recorded *A. dissimile*, during their survey of arthropods for natural virus infection and found it on various species of snake, large lizards, caimans, large toads and tortoises. Dindial (1977) reported the presence of *A. dissimile* from iguanas, frogs and snakes both in Trinidad and Tobago. Voltzit (2007) also mentioned the presence of *A. dissimile* which feeds on reptiles and toads.

Distribution: Florida, Mexico, Georgia, West Indies to Argentina (Cruz 2001; Voltzit 2007).

Amblyomma humerale

Amblyomma humerale was collected from yellow-footed tortoise, *Geochelone denticulate* from Mayaro (Aitken *et al.* 1968a; Robbins *et al.* 2003). Everard and Tikasingh (1973) found *A. humerale* on rodents (*Oryzomys capito* and *Proechimys guyannensis*) from Turure Forest, Trinidad. Nava *et al.* (2007b) and Voltzit (2007) also mention the presence of *A. humerale* in Trinidad. Other observed hosts include birds (Morshed et al. 2005), lizards, opossums, anteaters (Labruna *et al.* 2002), and dogs (Barros-Battesti *et al.* 2006).

Distribution: Brazil, Guyana, Venezuela, Colombia, Ecuador and French Guiana (Guglielmone *et al.* 2003; Voltzit 2007).

Amblyomma longirostre

Nuttall *et al.* (1926) recorded this tick from Trinidad. Aitken *et al.* (1968a and 1969) recorded *A. longirostre* during their survey of arthropods for natural virus infection and its immature stages frequently parasitized birds. Everard and Tikasingh (1973) found this tick on rodents (*Oryzomys capito* and *Proechimys guyannensis*) from Turure Forest. Smith (1974) recorded *A. longirostre* in Trinidad from small wild animals. Nava *et al.* (2007b) also indicated the presence of tick *A. longirostre* in Trinidad. Voltzit (2007) mentioned that in 1955 T.H.G. Aitken collected 2 males and a female *A. longirostre* respectively from porcupines (*Coendou prehensilis*) and birds (*Turdus nudigensis*) at Sangre Grande, Trinidad.

Distribution: ranges from Mexico to Argentina (Voltzit 2007; Nava *et al.* 2010)

Amblyomma nodosum

The presence of *A. nodosum*, a tick that feeds on birds and anteaters, was recorded in Trinidad by several authors (Jones *et al.* 1972; Nava *et al.* 2007b; Voltzit 2007).

This tick is known to transmit rickettsial infections (Ogrzewalska *et al.* 2009).

Distribution: Brazil, Bolivia, Costa Rica, Colombia, Guatemala, Nicaragua, Panama, Venezuela, Argentina, Mexico and Paraguay (Nava *et al.* 2007b; Voltzit 2007; Ogrzewalska *et al.* 2009)

Amblyomma ovale

Everard and Tikasingh (1973) and Smith (1974) recorded *A. ovale* from dogs. Dindial (1977) found *A. ovale* associated with hunting dogs at Sans Souci and Charlotteville, Trinidad.

Distribution: Mexico to Argentina (Jones *et al.* 1972; Voltzit 2007).

Amblyomma rotundatum

Jones *et al.* (1972) stated that *Amblyomma rotundatum*, exclusively a parasite of cold-blooded animals (Floch and Fauman 1958), was exploited toads in Trinidad.

Distribution: ranges from southern US to northern Argentina and Caribbean Islands (Jones *et al.* 1972; Voltzit 2007; Guglielmone and Nava 2010).

Dermacentor nitens

Smith (1974) and Rawlins (1977) recorded *D. nitens* from equines in Trinidad.

Dermacentor nitens is known to transmit *Babesia caballi* (Equine babesiosis) (Jongejan and Uilenberg 2004). Asgarali *et al.* (2007) investigated 93 horses in Trinidad for serum antibodies to *Theileria equi* and *Babesia caballi* using an immunofluorescent antibody test and found 77 to be seropositive. However, the authors did not study the transmitted agents. Earlier, Floch and Fauman (1958) confirmed the presence of the tick, *D. nitens*, in Trinidad. Very recently, Georges (2010) diagnosed some tick-transmitted haemopathogens (*Anaplasma platys, Babesia canis vogeli, B. caballi, Theileria equi*) in companion animals using molecular tools.

Distribution: throughout the West Indies, Central America, Bolivia, Brazil (Cruz 2001).

Haemaphysalis juxtakochi

Kohls (1960) first recorded the identity of *H. juxtakochi*, collected by T.H.G. Aitken on 24 June 1954 from Cumaca, Trinidad. This tick parasitizes deer (*Mazama rufa*) and paca (*Coelogenys paca*). Keirans (1982) also recorded this tick from Caparo, Trinidad.

Distribution: ranges from USA to northern Argentina (Guglielmone *et al.* 2003)

Ixodes downsi

Kohls (1957) first recorded a new species of tick, *I. downsi* on bats (*Anoura geoffroyi*) in Aripo Cave, Trinidad. Gonzalez-Acuna *et al.* (2008) mentioned the presence of this tick in Trinidad and Tobago and stated that it is unclear whether the principal hosts are Chiroptera or Aves.

Distribution: Venezuela (Gonzalez-Acuna *et al.* 2008).

Ixodes luciae

Aitken *et al.* (1969) recorded *I. luciae* during their survey of arthropods for natural viral infections. Everard and Tikasingh (1973) found *I. luciae* on rodents (*Oryzomys capito* and *Proechimys guyannensis*) from Turure Forest. In 1974, Smith recorded *I. luciae* from small wild animals from Trinidad.

Distribution: Argentina, Brazil, Bolivia, Colombia, Guyana, Guatemala, Peru, Mexico, Nicaragua, Surinam, Venezuela. Belize, Costa Rica, Ecuador, French Guiana and Panama (Guglielmone *et al.* 2011)

Rhipicephalus (Boophilus) microplus

Aitken *et al.* (1958) recorded a few specimens of the southern cattle tick *R.* (*B.*) *microplus* from cattle and sheep in Trinidad. Williams and Gonzalez (1968) observed that Holstein heifers imported into Trinidad from Canada with the intent to develop a dairy industry were exposed to tick-infested pastures and that these exotic cattle suffered from a febrile disease associated with marked anaemia, occasional haemoglobinuria and sometimes death within two to six weeks after importation and introduction to tick-infested pastures. They also confirmed the detection of *Babesia* spp. and *Anaplasma marginale* from the blood of the infected cattle. This established the presence of *R.* (*B.*) *microplus* ticks in Trinidad, as these ticks are vectors of both the pathogens. The presence of *R.* (*B.*) *microplus* on cattle in Trinidad was confirmed by Aitken *et al.* (1969), Clarkson (1969) and Rawlins (1977). Smith (1973) studied the distribution of *R.* (*B.*) *microplus* in Trinidad and Tobago. *Rhipicephalus* (*B.*) *microplus* was found throughout both islands, except on land newly cleared from forest. Furthermore, Smith (1974) recorded this tick exploiting ruminants and equines. The prevalence and biology of *R.* (*B.*) *microplus* was investigated by Dindial (1977) and he also found the presence of *R.* (*B.*) *microplus* ticks all over the country. Spraying dichlorodiphenyltrichloroethane (DDT), Gamma Benzene Hexachloride (GBH), chlordane and dieldrin was reported to have helped to control this tick population in Trinidad. Polar and co-investigators (2005) reported the use of entomopathogenic fungi *Metarhizium anisopliae* to control *R.* (*B.*) *microplus* at Aripo livestock station in Trinidad. Polar (2007) found that *Metarhizium anisopliae* was effective against all development stages of *R.* (*B.*) *microplus* and *Rhipicephalus sanguineus*, except larvae of the latter.

R. (*B.*) *microplus* is known to transmit numerous parasites: *Babesia bovis* and *B. bigemina* (Bovine babesiosis), *Anaplasma marginale* (bovine anaplasmosis) and *Theileria equi* (equine piroplasmosis) (Jongejan and Uilenberg 2004). A virus, Wad Medani has also been reported to be transmitted by *R.* (*B.*) *microplus* in Singapore and Malayasia (Labuda and Nuttall 2004).

Distribution: Cosmopolitan

Rhipicephalus sanguineus

Aitken *et al.* (1969) recorded *R. sanguineus* during their survey of arthropods for natural virus infection. Smith (1974) documented *R. sanguineus* from dogs.

This tick is known to transmit *Ehrlichia canis* (canine ehrlichiosis), *Babesia vogeli* (canine babesiosis), *Hepatozoon canis* (canine hepatozoonosis), *Rickettsia conorii* (tick bite fever in humans) (Jongejan and Uilenberg 2004) and also transmits Wad Medani virus in Sudan, East Africa, Asia and Jamaica (Labuda and Nuttall 2004).

Distribution: Cosmopolitan

CONCLUSION

Trinidad and Tobago harbour a high diversity of tick species, some of which are known to play a significant role in animal and human health. The reported detection of a total of 23 different tick species may be considered to be very high considering the relatively small size of the twin Island country (Trinidad – 4828 km^2; Tobago – 300 km^2). Tobago, being the smaller of the two islands, has fewer animal populations and recorded lower tick species richness. *Amblyomma cajennense*, the main species of concern to humans and animals, is found only in some pockets of Trinidad and has not been reported from Tobago. The main factor limiting the distribution of this tick appears to be its intolerance of wet soil and high rainfall. The relatively small areas infested with this species have common features such deep sandy well-drained soil with a well-marked dry season and low rainfall (Smith 1973).

All reported surveys of ticks in the Caribbean suggest the absence of *Antricola mexicanus* and *Amblyomma variegatum* in Trinidad and Tobago, except an unpublished report (Rawlins *et al.* 1992) and an unconfirmed record by Rawlins *et al.* (1993) which was published in a newsletter. Alderink and McCauley (1988) mentioned Trinidad and Tobago as one of the 12 non-infested *A. variegatum* island groups in the Lesser Antilles. The absence of *A. variegatum* in Trinidad and Tobago may be due to strict vigilance during animal importation. In addition, according to the annual report on Animal Health 2009, cowdriosis, a ricksettial pathogen transmitted by *Ambylomma* spp, is considered absent in Trinidad and Tobago (Anon. 2010). Though *A. cajennense* is an experimental and potential vector of cowdriosis, it is thought to be a poor vector as successful transmission by this tick species seems to be low (Uilenberg 1983; Jongejan 1992). Moreover, *A. cajennense* has not been incriminated so far in the natural transmission of this disease (http://www.oie.int). All the facts lead us to conclude that *A. variegatum* may be absent in this country.

Hunter (1945) reported the presence of *R. (B.) annulatus* in Trinidad. However, Smith (1974) concluded that the presence of this species was probably an incorrect identification of *R. (B.) microplus*, a species found in abundance throughout Trinidad and Tobago. Subsequently, there has been no record of the presence of *R. (B.) annulatus* from Trinidad.

Since 1977, there has been no comprehensive study on ticks in Trinidad and Tobago and only sporadic information is available on disease transmission. Future studies on the ecology of ticks and epidemiology of tick-borne diseases in Trinidad and Tobago will therefore be rewarding, and veterinarians and researchers should be encouraged to update the list of prevalent ticks as this will lead to a better understanding of the epidemiology of tick-borne human and animal diseases in the country.

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