Exotic Ticks

Amblyomma variegatum,
Amblyomma hebraeum,
Rhipicephalus microplus,
Rhipicephalus annulatus,
Rhipicephalus appendiculatus
Ixodes ricinus

Last Updated: September 2009

Importance

Tick bites can be irritating and/or painful. They also provide entry points for secondary bacterial invaders or screwworms. Heavy infestations can damage hides and may cause anemia, particularly when the animal is in poor condition. *Rhipicephalus appendiculatus*, the brown ear tick, damages the ears of cattle and other livestock, and some species of ticks cause tick paralysis. However, the most important risk with the introduction of exotic ticks is that they may carry the agents of exotic diseases. The greatest danger is when the tick acts as a biological vector, but pathogens carried mechanically can be introduced if they survive long enough.

Important tick species at risk for introduction into North America include *Amblyomma variegatum*, *Amblyomma hebraeum*, *Rhipicephalus microplus* (formerly *Boophilus microplus*), *Rhipicephalus annulatus* (formerly *Boophilus annulatus*), *Rhipicephalus appendiculatus* and *Ixodes ricinus.*

Disease risks

A. variegatum and *A. hebraeum* can transmit *Ehrlichia ruminantium* (formerly *Cowdria ruminantium*), the agent of heartwater. These ticks can also carry *Rickettsia africae*, which causes African tick-bite fever, and other disease agents. *I. ricinus* transmits a number of pathogens including *Babesia divergens* (babesiosis), louping ill virus and tick-borne encephalitis virus, which are exotic to the Americas. *Rhipicephalus appendiculatus* can carry *Theileria parva*, the cause of East Coast fever, as well as Nairobi sheep disease virus and other disease agents.

R. microplus and *R. annulatus* are particularly important in transmitting babesiosis, which is caused by *Babesia bigemina* and *Babesia bovis*, and anaplasmosis, caused by *Anaplasma marginale*. Babesiosis or "cattle fever" was eradicated from the United States between 1906 and 1943, by eliminating these vectors. *R. annulatus* and *R. microplus* still exist in Mexico and further south, and a permanent quarantine zone is maintained along the U.S./Mexican border to prevent their reintroduction.

Species Affected and Life Cycle

Although ticks have host preferences, which may vary with the life stage, most species will feed on a wide variety of wild and domesticated animals, as well as humans.

Three-host ticks

Amblyomma variegatum, A. hebraeum, I. ricinus and *R. appendiculatus* are 3-host ticks. Three-host ticks can be found on the host while they feed, then they drop to the ground to develop to the next stage. Larvae, nymphs and adults all require a blood meal. Once the adult female has fed and mated, she deposits her eggs in the environment.

The life cycle for *Amblyomma variegatum*, *A. hebraeum* and *I. ricinus* usually takes more than a year, and up to a few years, to complete. Immature *Amblyomma* spp. and *I. ricinus* tend to be found on smaller mammals, birds and reptiles, while the adult stages usually feed on large mammals including both livestock and wildlife

R. appendiculatus can complete one to three life cycles in a year, depending on the environment. This tick mainly infests cattle, buffalo and large antelope, but it can occur on other species including sheep and goats. Immature ticks may also be seen on small antelope, carnivores, hares and other species. Adult *R. appendiculatus* prefer to feed in the ears, but some are found on the head. Immature stages feed in the ears, on the head, and on the legs. Large numbers of ticks may be found on an animal, and heavy infestations can damage the ears.

One-host ticks

Rhipicephalus microplus and *R. annulatus* are one-host ticks: all stages are spent on a single animal. The eggs hatch in the environment and the larvae crawl up plants to find a host. Newly attached larvae ("seed ticks") are usually found on the underside of the animal, particularly on the softer skin inside the thigh, flanks and forelegs. After feeding, the larvae molt twice, to become nymphs and then adults. Each developmental stage (larva, nymph and adult) feeds only once, but the feeding takes places over several days. Adult male ticks become sexually mature after feeding, and

The Center for Food Security & Public Health

Institute for International Cooperation in Animal Biologics

Iowa State University College of Veterinary Medicine

OIE Collaborating Centre for
- Diagnosis of Animal Disease and Vaccine Evaluation in the Americas
- Day-One Veterinary Competencies and Continuing Education

USDA

www.cfsph.iastate.edu
Email: cfsph@iastate.edu

© 2009

mate with feeding females. An adult female tick that has fed and mated detaches from the host and deposits a single batch of eggs in the environment. *R. microplus* and *R. annulatus* have a life cycle than can be completed in 3 to 4 weeks. This characteristic can result in a heavy tick burden on animals.

Cattle are the preferred hosts for R. annulatus. This tick is also found occasionally on other mammals, particularly large animals but also capybaras and other species. It rarely feeds on sheep and goats. R. microplus mainly infests cattle, deer and buffalo, but it can also be found on many other hosts including horses, donkeys, goats, sheep, pigs, dogs and wild animals.

Geographic Distribution

A. variegatum, A. hebraeum, R. annulatus, R. microplus and *R. appendiculatus* are found in the tropics and subtropics. *Amblyomma variegatum, A. hebraeum* and *R. appendiculatus* are endemic in Africa. *A. variegatum* has also been found in southern Arabia, and in the Caribbean and on some other islands. *R. annulatus* and *R. microplus* are more widely distributed. *R. annulatus* is endemic in parts of Africa and Asia, the southern regions of the former U.S.S.R., the Middle East, the Mediterranean, Mexico and parts of South and Central America. *R. microplus* occurs in large areas of Asia, as well as in Madagascar, Latin America including Mexico, the Caribbean, and parts of Africa and Australia. *R. annulatus* and *R. microplus* have been eradicated from the U.S., but they can be sometimes found in Texas or California, in a buffer quarantine zone along the Mexican border.

In contrast, *I. ricinus* is restricted to cool, relatively humid, shrubby or wooded areas. In addition to deciduous and mixed forests, this tick can be found in more open areas when the vegetation is dense and rainfall is abundant. It is endemic in most of Europe (with the exception of the Mediterranean region, which has a warm, dry climate). *I. ricinus* also occurs as far south as the Caspian Sea and northern Iran, as well as in northern Africa.

Identification

A. variegatum, A. hebraeum, R. microplus, R. annulatus, R. appendiculatus and *I. ricinus* are all members of the family Ixodidae (hard ticks). Hard ticks have a dorsal shield (scutum) and their mouthparts (capitulum) protrude forward when they are seen from above.

Amblyomma variegatum and *A. hebraeum* are large, ornate, variegated ticks with long, strong mouthparts. The bodies of female *A. variegatum* are brown, but the males are brightly ornamented with orange. When they are engorged, adult female *A. variegatum* are about the size of a nutmeg. *Rhipicephalus* spp. and *Ixodes* spp. have no ornamentation and are less distinctive, but they may be identified at least to the genus level using tick keys.

Tick identification to the species level can be difficult, and ticks should be submitted to an expert for identification or confirmation. Ticks that are submitted in 70% ethanol can be examined morphologically, and if necessary, tested by PCR. Both male and female ticks, and ticks from different life stages, should be submitted if they can be found.

Control

Disease Reporting

Veterinarians who encounter or suspect the presence of an exotic tick should follow their national and/or local guidelines for disease reporting. In the U.S., state or federal authorities must be notified immediately.

Prevention

Measures used to exclude exotic ticks from a country include pre-export inspection and certification that the animals are free of ectoparasites, quarantines upon entry, and treatment with acaricides. Three-host ticks spend at least 90% of their life cycle in the environment rather than on the host animal, and can be very difficult to eradicate once they have become established. *R. microplus* and *R. annulatus*, which are one-host ticks, have been successfully eliminated from some countries. Eradication programs are based on animal identification and periodic acaricide treatment of livestock, as well as public education, surveillance, quarantines and movement restrictions.

In the U.S., *R. annulatus* and *R. microplus* incursions are controlled by USDA APHIS Fever Tick Eradication Program personnel, including mounted inspectors called "tick riders." Tick riders patrol the Rio Grande river, inspect ranches in the quarantine zone, and apprehend stray and smuggled livestock from Mexico. Before being moved from the quarantine zone, cattle and horses must be inspected and given a precautionary treatment with acaricides. Farms and ranches with infestations are placed under quarantine for 6 to 9 months, depending on the time of the year, and the animals are treated for ticks. The infested pasture must remain free of all livestock for 6 to 9 months or longer, to break the tick life cycle. Deer and exotic ungulates may maintain the ticks on vacated pastures; ivermectin-based feed and pesticide treatment protocols have been established to treat wild animals visiting the field.

In regions where *A. variegatum, A. hebraeum, R. microplus, R. annulatus, R. appendiculatus* or *I. ricinus* are already endemic, control methods include acaricide treatment, pasture rotation, environmental modification, and integrated biologic and chemical control strategies. Acaricides can eliminate the ticks from the animal, but they do not prevent reinfestation and must be repeated periodically. Ticks can become resistant to these chemicals. The use of resistant breeds is an important means of tick control in some countries. European (*Bos taurus*) breeds of cattle usually remain fairly susceptible to ixodid ticks, even after multiple exposures. However, some cattle such as zebu (*Bos indicus*) or zebu crosses can become resistant to

B. microplus after exposure. Vaccines against *R. microplus* have been introduced.

Public Health

Tick bites can be irritating or painful, and the wound may become infected. *Amblyomma* spp. cause particularly large wounds and are difficult to remove. Exotic ticks can transmit exotic diseases such as African tick bite fever and tick-borne encephalitis to humans.

Internet Resources

Acarology WWW Home Page
http://www.nhm.ac.uk/hosted_sites/acarology/

The Merck Veterinary Manual
http://www.merckvetmanual.com/mvm/index.html

The University of Edinburgh. The Tick Collection.
http://www.nhc.ed.ac.uk/index.php?page=24.25.121

Tick Identification Key from the University of Lincoln
http://webpages.lincoln.ac.uk/fruedisueli/FR-webpages/parasitology/Ticks/TIK/tick-key/index.htm

United States Animal Health Association. Foreign Animal Diseases.
http://www.aphis.usda.gov/emergency_response/downloads/nahems/fad.pdf

United States Department of Agriculture. Animal and Plant Health Inspection Service (USDA APHIS)
http://www.aphis.usda.gov

World Organization for Animal Health (OIE)
http://www.oie.int

OIE Terrestrial Animal Health Code
http://www.oie.int/international-standard-setting/terrestrial-code/access-online/

Acknowledgements

This factsheet was written by Anna Rovid-Spickler, DVM, PhD, Veterinary Specialist from the Center for Food Security and Public Health. The U.S. Department of Agriculture Animal and Plant Health Inspection Service (USDA APHIS) provided funding for this factsheet through a series of cooperative agreements related to the development of resources for initial accreditation training.

The following format can be used to cite this factsheet. Spickler, Anna Rovid. 2009. *Exotic Ticks*. Retrieved from http://www.cfsph.iastate.edu/DiseaseInfo/factsheets.php.

References

Arthur DR. Ticks and disease. New York: Pergamon Press; 1961. Diagnosis of *Rhipicephalus appendiculatus*; p. 70–73.

Arthur DR. Ticks and disease. New York: Pergamon Press; 1961. Genus *Amblyomma*; p. 77–79.

Beugnet F, Marié JL. Emerging arthropod-borne diseases of companion animals in Europe. Vet Parasitol. 2009;163(4):298-305.

Corwin RM, Nahm J. *Boophilus* spp [online]. University of Missouri, College of Veterinary Medicine; 1997. Available at: http://www.parasitology.org/Arthropods/Arachnida/Boophilus.htm.* Accessed 2001 Nov 29.

Estrada-Pena A, Bouattour A, Camicas JL, Guglielmone A, Horak I, Jongejan F, Latif A, Pegram R, Walker AR. The known distribution and ecological preferences of the tick subgenus *Boophilus* (Acari: Ixodidae) in Africa and Latin America. Exp Appl Acarol. 2006;38:219-35.

Figueiredo LT, Badra SJ, Pereira LE, Szabo MP. Report on ticks collected in the Southeast and Mid-West regions of Brazil: analyzing the potential transmission of tick-borne pathogens to man. Rev Soc Bras Med Trop. 1999;32:613-9.

Food and Agriculture Organization of the United Nations [FAO]. *Boophilus* [online]. FAO; 1998. Available at: http://www.fao.org/WAICENT/faoInfo/Agricult/AGA/AGAH/PD/pages/ticksp4.htm.* Accessed 15 Feb 2007.

Food and Agriculture Organization of the United Nations [FAO]. Caribbean *Amblyomma* Programme (CAP) [online]. Available at: http://www.fao.org/AG/AGAINFO/projects/en/cap/home.html.* Accessed 11 Dec 2006.

Gray JH, Payne RL, Schubert GO, Garnett WH. Implication of white-tailed deer in the *Boophilus annulatus* tick eradication program. Proc Annu Meet U S Anim Health Assoc. 1979;(83):506-15.

Gray JS. Biology of Ixodes species ticks in relation to tick-borne zoonoses. Wien Klin Wochenschr. 2002;114(13-14):473-8.

Gray JS, Kahl O. Ticks as vectors of zoonotic pathogens in Europe. In: Halliday RB, Walter DE, Proctor HC, Norton RA, Colloff MJ, editors. Acarology: Proceedings of the 10th International Congress. Melbourne: CSIRO Publishing; 2001. p. 547-51.

Horak IG, Camicas JL, Keirans JE. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida): a world list of valid tick names. Exp Appl Acarol. 2002;28:27-54.

Kahn CM, Line S, editors. The Merck veterinary manual [online]. Whitehouse Station, NJ: Merck and Co; 2006. *Amblyomma* spp. Available at: http://www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/72107.htm. Accessed 11 Dec 2006.

Kahn CM, Line S, editors. The Merck veterinary manual [online]. Whitehouse Station, NJ: Merck and Co; 2006. *Boophilus* spp. Available at: http://www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/72108.htm. Accessed 15 Feb 2007.

Kahn CM, Line S, editors. The Merck veterinary manual [online]. Whitehouse Station, NJ: Merck and Co; 2006. Ixodes spp. Available at: http://www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/72112.htm. Accessed 27 Sept 2009.

Kahn CM, Line S, editors. The Merck veterinary manual [online]. Whitehouse Station, NJ: Merck and Co; 2006. Rhipicephalus spp. Available at: http://www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/72115.htm. Accessed 30 Sept 2009.

Kahn CM, Line S, editors. The Merck veterinary manual [online]. Whitehouse Station, NJ: Merck and Co; 2006. Tick control. Available at: http://www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/72120.htm. Accessed 15 Feb 2007.

Kahn CM, Line S, editors. The Merck veterinary manual [online]. Whitehouse Station, NJ: Merck and Co; 2006. Ticks: Introduction. Available at: http://www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/72100.htm. Accessed 15 Feb 2007.

Kelly PJ, Fournier PE, Parola P, Raoult D. A survey for spotted fever group rickettsiae and ehrlichiae in *Amblyomma variegatum* from St. Kitts and Nevis. Am J Trop Med Hyg. 2003;69:58-9.

Kettle DS. Medical and veterinary entomology. Tucson, AZ: CAB International; 1990. *Rhipicephalus appendiculatus*;" p. 472–5.

Kolonin GV. Fauna of Ixodid ticks of the world. Moscow; 2009. Genus *Rhipicephalus* Koch, 1844. Available at: http://www.kolonin.org/17.html. Accessed 30 Sept 2009.

Linthicum KJ, Bailey CL. Ecology of Crimean-Congo hemorrhagic fever. Biology of ticks. Host preferences. In: Sonenshine DE, Mather TN, editors. Ecological dynamics of tick-borne zoonoses. New York: Oxford University Press; 1994. p 423.

Little S. Arthropod livestock pests and disease vectors. In: Foreign animal diseases. 7th edition. Boca Raton, FL: United States Animal Health Association; 2008. p. 125-35.

Madder M, Speybroeck N, Bilounga A, Helleputte D, Berkvens D. Survival of unfed R*hipicephalus appendiculatus* and *Rhipicephalus zambeziensis* adults.. Med Vet Entomol. 2005;19(3):245-50.

Merial New Zealand. Sheep disease information [online]. Merial; 2001. Parasite profiles: Ticks. Available at: http://nz.merial.com/farmers/sheep/disease/haema.html.* Accessed 11 Dec 2006.

Mtambo J, Madder M, Van Bortel W, Berkvens D, Backeljau T. *Rhipicephalus appendiculatus* and *R. zambeziensis* (Acari: Ixodidae) from Zambia: a molecular reassessment of their species status and identification. Exp Appl Acarol. 2007;41(1-2):115-28.

New South Wales Department of Agriculture. Identification of the paralysis tick *I. holocyclus* and related ticks [online]. New South Wales Department of Agriculture; 2001 Feb. Available at: http://members.ozemail.com.au/~norbertf/identification.htm.* Accessed 29 November 2001.

New South Wales Department of Agriculture. Larval stages of the paralysis tick *Ixodes holocyclus*, the cattle tick *Boophilus microplus* and the bush tick *Haemaphysalis longicornis*. New South Wales Department of Agriculture; 2001 Feb. Available at: http://members.ozemail.com.au/~norbertf/larvae.htm.* Accessed 29 Nov 2001.

New South Wales Department of Agriculture. Nymphal stages of the paralysis tick *Ixodes holocyclus*, the cattle tick *Boophilus microplus* and the bush tick *Haemaphysalis longicornis*. New South Wales Department of Agriculture; 2001 Feb. Available at: http://members.ozemail.com.au/~norbertf/nymphs.htm.* Accessed 29 Nov 2001.

Parola P, Inokuma H, Camicas JL, Brouqui P, Raoult D. Detection and identification of spotted fever group Rickettsiae and Ehrlichiae in African ticks. Emerg Infect Dis. 2001;7:1014-7.

Pegram RG, Eddy C. Progress towards the eradication of *Amblyomma variegatum* from the Caribbean. Exp Appl Acarol. 2002;28:273-81.

Pegram RG, Rota A, Onkelinx R, Wilson DD, Bartlette P, Nisbett BS, Swanston G, Vanterpool P, de Castro JJ. Eradicating the tropical bont tick from the Caribbean [online]. Available at: http://www.fao.org/DOCREP/W2650T/w2650t06.htm. Accessed 11 Dec. 2006.

Pelzel AM (APHIS Area Epidemiology Officer). Cattle fever tick surveillance in Texas. NAHSS Outlook [online]. USDA APHIS; 2005 Aug. Available at: http://www.aphis.usda.gov/vs/ceah/ncahs/nsu/outlook/issue7/cattle_fever_tick_surveillance.pdf. Accessed 15 Feb 2007.

Rajput ZI, Hu SH, Chen WJ, Arijo AG, Xiao CW Importance of ticks and their chemical and immunological control in livestock. J Zhejiang Univ Sci B. 2006;7:912-21.

United States Animal Health Association [USAHA] Committee on Parasitic Diseases. Tropical bont tick eradication programs in the Caribbean [online]. In: USAHA 2005 Proceedings; 2005 Nov. 3-9; Hershey, PA. Available at: http://www.usaha.org/committees/resolutions/2005/resolution49-2005.pdf. Accessed 11 Dec. 2006.

United States Department of Agriculture [USDA] Animal and Plant Health Inspection Service [APHIS]. Controlling cattle fever ticks [online]. USDA APHIS; 2002 Feb . Available at: http://www.aphis.usda.gov/lpa/pubs/fsheet_faq_notice/fs_ahcfever.html.* Accessed 15 Feb 2007.

Walker JB, Keirans JE, Horak I. The genus *Rhipicephalus* (Acari, Ixodidae): a guide to the brown ticks of the world. Cambridge, NY: Cambridge University Press; 2000. *Rhipicephalus appendiculatus*; p. 59-71.

Wall R, Shearer D. Veterinary entomology: Arthropod ectoparasites of veterinary importance. London: Chapman & Hall; 1997. Ixodes; p. 117–20.

Wilson DD, Bram RA. Foreign pests and vectors of arthropod–borne diseases. In: Foreign Animal Diseases. Richmond, VA: United States Animal Health Association; 1998. Available at: http://www.vet.uga.edu/vpp/gray_book02/fad/fpv.php.* Accessed 11 Dec 2006.

*Link defunct