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Ehrlichia and *Anaplasma* in Florida[1]

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Ehrlichia and *Anaplasma* are related bacterial genera containing species that can cause disease in both humans and domestic animals. The diseases are often referred to simply as ehrlichiosis or anaplasmosis, but there are multiple species of bacteria that can cause different disease symptoms and have different vectors. The taxonomy (naming system and how they are related) was recently revised. This resulted in some species previously in *Ehrlichia* to now be in *Anaplasma*; you will find older literature using the old names. States vary in whether they require reporting of these diseases, and when reporting began. Travel complicates our understanding, as diagnosis may occur much later and in a different place than infection. Therefore, we do not have a complete picture of the epidemiology of many of these bacteria.

Currently, two species of *Ehrlichia* in the United States and one in Japan are known to cause disease in humans. Only one species of *Anaplasma* has been found in the US that causes disease in humans. However, others will likely be recognized in the future as methods of detection improve.

Humans

There is one species in each genera that is of most concern for human disease in the U.S. Human monocytic ehrlichiosis (HME) is caused by *E. chaffeensis* and human granulocytic anaplasmosis (HGA) is caused by *A. phagocytophilum*. Previously, *A. phagocytophilum* was known as *E. phagocytophila,* and the disease was called human granulocytic ehrlichiosis or HME. Clinically, they are difficult to differentiate. Symptoms for both include fever, headache, malaise, and muscle aches. Rashes occur more frequently with HME than HGA. Treatment for both is with antibiotics in the tetracycline family, most commonly doxycycline. Fatalities are rare (2–4% of diagnosed cases), but can occur as the result of complications from infection. Complete diagnosis requires serological or molecular tests to differentiate the bacterial species, but treatment should begin after clinical diagnosis. Asymptomatic infections probably occur with all *Ehrlichia* and *Anaplasma.* Improved diagnostic tools and an increased awareness of ehrlichiosis and anaplasmosis are revealing that these infections are more common than previously suspected. The incidence rates across the country have been steadily increasing.

Horses and Dogs

Both horses and dogs are susceptible to *Ehrlichia* and *Anaplasma,* although the species involved vary (see below for details). In dogs, the clinical signs for different types of ehrlichiosis and anaplasmosis are similar and difficult to separate clinically. These include fever, epilepsy, incoordination, lethargy, anemia, and bleeding episodes. Asymptomatic infections are probably common. The clinical signs in horses are more easily differentiated. Signs of equine granulocytic anaplasmosis (EGA, *A. phagocytophilum*) include fever, lethargy, anorexia, ataxia and limb edema. Potomac horse fever, *Neorickettsia risticii* (formerly equine monocytic ehrlichiosis) often manifests as colitis (inflammation of the colon), resulting in diarrhea, colic, loss of appetite, depression, and possibly laminitis.

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Biology of *Ehrlichia* and *Anaplasma*

Ehrlichia and *Anaplasma* are bacteria, related to *Rickettsia*, and are obligate intracellular parasites, meaning they cannot survive outside of a cell. These bacteria have only recently begun to receive much research attention, and there are still many questions about their transmission cycles and reservoir hosts. There are likely to be continued taxonomic revisions of *Ehrlichia* and *Anaplasma* as further research occurs. Many *Ehrlichia* and *Anaplasma* are tick-borne, although there are some species that use other invertebrates as intermediate hosts, such as snails and helminths. The transmission cycles for some species have not yet been determined.

These bacteria are often differentiated based on the mammalian cell type they infect. Monocytes, granulocytes, and neutrophils are most frequently involved, and the common name of the resulting disease reflects the cell type (e.g., monocytic or granulocytic).

Species of *Ehrlichia* and *Anaplasma* in the U.S.

Ehrlichia chaffeensis

Disease: humans (HME), rarely monocytic erhlichiosis in dogs.

Vectors: *Amblyomma americanum* (lone star tick); possibly *Dermacentor variabilis* (American dog tick).

Distribution: HME has been diagnosed from most states in the U.S. It is more common in the southeastern U.S., largely congruent with the distribution of *A. americanum.*

Reservoir hosts: probably white-tailed deer, rodents and/or dogs.

Anaplasma phagocytophilum (formerly *Ehrlichia phagocytophila*)

Disease: granulocytic anaplasmosis in humans (HGA), horses (EGA), dogs, cattle.

Vector: In the eastern U.S., *Ixodes scapularis* (black-legged tick or deer tick). Elsewhere, other members of the *I. ricinus* group (*I. ricinus, I. pacificus, I. persulcatus*).

Distribution: U.S., Europe, Asia. In the U.S., it has been reported from areas where *I. scapularis* and *I. pacificus* are present, predominately in the Northeast, Midwest and California. Cases have been identified in Florida, but the level of transmission is unclear.

Reservoir hosts: rodents, possibly deer.

A note on species nomenclature: Initially, the agent of HGE was identified as an *Ehrlichia* but not named. Later, it was determined that the agent of HGE, *E. equi* (cause of equine granulocytic ehrlichiosis), and *E. phagocytophila* (cause of ehrlichiosis in cattle and deer in Europe), were genetically almost identical and should be in the genus *Anaplasma*. The name *E. phagocytophila* had priority and therefore all three agents are now considered *A. phagocytophilum.* (Latin names have gender, and the genus and species must agree, so the specific name changed slightly to agree with the genus). Older literature may differentiate between the three originally described agents, or use the older names.

Ehrlichia canis

Disease: primarily dogs (canine monocytic ehrlichiosis). This species has been linked to disease in humans, but is rare and poorly understood in humans.

Vectors: *Rhipicephalus sanguineus* (brown dog tick), possibly *A. americanum.*

Distribution: worldwide.

Ehrlichia ewingii

Disease: primarily dogs (canine granulocytic ehrlichiosis). Human disease is known but relatively rare. However, clinical signs for *E. ewingii* and *E. chaffeensis* infections are indistinguishable and serologic tests cannot differentiate the two. As testing and reporting improve, our understanding of the distribution and importance of these two species is likely to change.

Vectors: *A. americanum;* involvement of other tick species unclear at this time.

Distribution: primarily the south-central states in the United States.

Ehrlichia muris-like (EML)

This organism was recently recognized as a cause of human disease. To date, only 4 cases have been identified (none in Florida). This organism has not been fully characterized, and its role in ehrlichiosis epidemiology is unclear. It is thought to be tick-borne, and deer or dogs may serve as reservoir species.

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Neorickettsia risticii

Disease: Horses (Potomac horse fever or equine monocytic ehrlichiosis); has also been isolated from dogs. An equine vaccine is available, but protection is of short duration, and booster inoculations are required. Formerly in *Ehrlichia.*

Vector: Not tick-borne. Horses are primarily infected by ingesting intermediate hosts containing the bacteria. Aquatic insects, snails, and helminths are likely to be involved in the transmission cycle.

Distribution: much of North America, particularly the east coast; Europe. More common along major waterways and in summer.

Other *Ehrlichia, Anaplasma* and related species.

Ehrlichia and *Anaplasma*are closely related to the genus *Rickettisa.* This genus includes the agent of Rocky mountain spotted fever, *R. rickettsia*, and other disease-causing agents. Other species in *Ehrlichia* and *Anaplasma* are known veterinary pathogens, and we may find that there is involvement in human disease as we study these bacteria further. While many of these bacteria are tick-borne, some have other arthropod vectors or the transmission cycle is unknown. Further research is needed to understand this complex group of bacteria.

Florida Situation

Typically, there are 1–5 reported cases of HGA and 5–20 cases of HME in Florida each year. More cases probably occur, but are not severe enough to cause people to seek medical attention or are not confirmed by laboratory tests. Veterinary cases are not always reported, but both canine and equine anaplasmosis/ehrlichiosis occur in Florida.

Several species of ticks which transmit *Ehrlichia* spp. or *Anaplasma phagocytophilum* are present in Florida. These include *I. scapularis*, *A. americanum*, and *D. variablis* (Fig. 1).

Prevention and Management

As with any vector-borne pathogen, the primary disease preventative measure is to minimize contact with the vectors. For humans, protective clothing, such as long pants and socks tucked into pants will reduce tick contact; repellents containing DEET are effective against most ticks. Permethrin-based repellents can be sprayed on boots and clothing. For dogs, there are various treatments in sprays, spot-ons and collars (active ingredients include permethrin, fipronil, amitraz). Permethrin and pyrethroid-based sprays and spot-ons for horses will reduce tick bites. Use all pesticides in accordance with label directions.

For all host species, thorough tick checks and grooming to remove attached ticks will reduce transmission of tick-borne pathogens. Use fine-tipped forceps to remove ticks; grasp the tick near the skin and pull straight back. Do not squeeze the abdomen or apply heat or petroleum products; this may cause the tick to regurgitate into the host!

Tick population reduction is difficult and it is unclear how effective it will be in reducing infection rates. Various methods have been tested, including vegetation management, acaracide treatment, host exclusion, and host treatment. Treatment of deer, via treated feed or feeding stations that apply acaricide to hosts, are promising methods for population reduction of ticks that feed on deer.

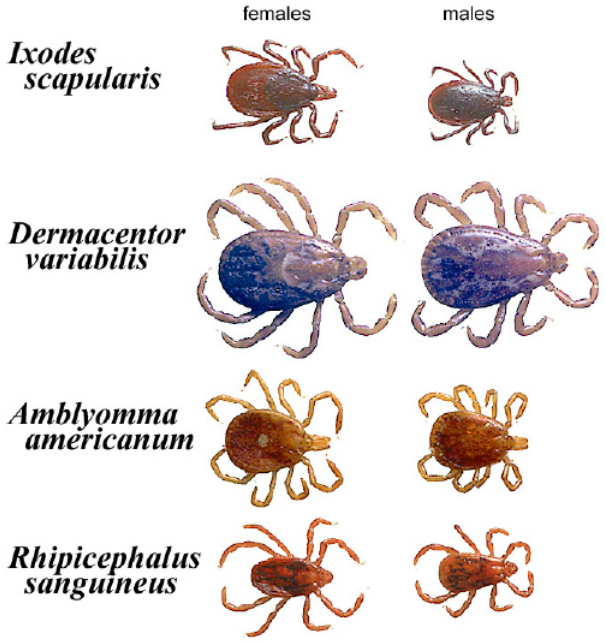

Figure 1. *Ehrlichia* vectors in Florida
Credits: James Newman

Further Information

http://www.cdc.gov/ehrlichiosis/
http://www.cdc.gov/anaplasmosis/

Dahlgren, FS, Mandel, EJ, Krebs, JW, Massung, RF and McQuiston, JH. 2011. Increasing incidence of *Ehrlichia chaffeensis* and *Anaplasma phagocytophilum* in the United States, 2000–2009. Am. J. Trop. Med. Hyg. 85: 124–131.

Ticks: http://edis.ifas.ufl.edu/IG088