What's Eating You? *Hyalomma* Ticks

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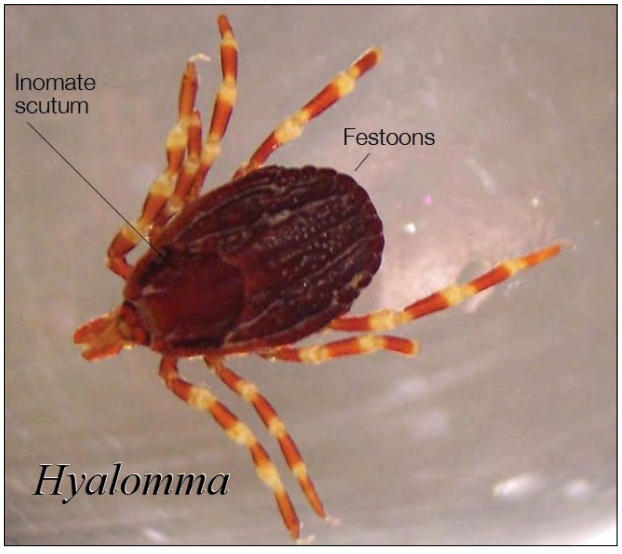
Ticks belonging to the genus *Hyalomma* are hard bodied; as members of the Ixodidae family, their relatives include *Ixodes* and *Amblyomma* ticks. This relatively small genus includes at least 30 species and several subspecies.[1] They are widely distributed throughout Africa, southwest Asia, and southern Europe.[2] Thus far they have not been reported in the Americas or Australia. These ticks and their young flourish mainly in arid climates, having evolved to survive and reproduce in dry desert regions.[3]

A scutum, or sclerotic plate, covers the rostral dorsal surface of the body (Figure).[1] Although each species of *Hyalomma* varies slightly in morphology,[4] as a group they are brown in color and the scutum is generally inornate. The lateral mouthparts (known as palpi) have greater length than width and they have arcuate markings (festoons) on the caudal portion of the abdomen.[5] The cuticle is covered by a waxy coating, which helps to prevent desiccation in hot dry environments. They possess 2 eyes, one on each side of the scutum, and also are observed to have a longitudinal anal groove posterior to the anus.[5] This latter feature helps to differentiate them from *Ixodes* ticks, which have an anterior anal groove.

Most *Hyalomma* ticks are 3-host ticks, with the nymph, larvae, and adult forms of the tick each feeding on a different host.[6,7] Both young forms and adult ticks spend 2 to 13 days attached to the host by the hypostome, the central mouthpart of the tick that is embedded in the skin while the tick feeds.[3,6] The palpi, which are located laterally to the hypostome, remain outside the skin. After they have completed their feeding, the ticks detach from the host and live freely until their next life stage.[3] Interestingly, Wilson et al[8] reported that some *Hyalomma truncatum* ticks, a species found throughout Africa, were able to survive for more than 1 year in a laboratory without any feeding. The number of hosts utilized in the tick life cycle varies by individual species and also may vary within the same species of *Hyalomma*.[4,9] Young ticks usually obtain their blood meals from small mammals such as rodents, hares, hedgehogs, or small ground-dwelling birds. Adult ticks tend to feed on larger animals such as cattle, sheep, goats, horses, pigs, camels, and frequently humans.[7]



Hyalomma tick. Photograph courtesy of the late Harry Hoogstraal, PhD, US Naval Medical Research Unit 3, Cairo, Egypt.

Unlike many other hard-bodied ticks that exhibit questing behavior in which they wait atop foliage for a host to come along, *Hyalomma* ticks utilize a more active hunting strategy (known as the hunter or ambush strategy) to seek out their hosts. In searching for a suitable host, *Hyalomma* ticks wait in low-lying foliage or crevices on the ground to minimize their risk for desiccation. After sensing certain stimuli such as carbon dioxide, ammonia, vibration, or a particular scent from unsuspecting hosts, *Hyalomma* ticks will

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run as far as 3 m to attack. *Hyalomma* ticks have eyes unlike some other ixodid ticks and may be able to use visual cues to locate a host.[3] Warmer temperatures in the spring and summer have been associated with increased hunting in adult as well as young *Hyalomma* ticks.[10]

As with many other ticks of the Ixodidae family, *Hyalomma* ticks are thought to be vectors for a number of bacterial and viral pathogens, including *Rickettsia aeschlimannii*,[11] *Babesia* species,[12] and West Nile virus.[13] Since the 1940s, these ticks also have been widely implicated as vectors of Crimean-Congo hemorrhagic fever virus (CCHFV), a virus of the Bunyaviridae family.[14] Although other ticks have been observed to carry CCHFV, *Hyalomma* ticks are considered the most notable vectors for the virus.[15] This single-stranded RNA virus causes high fevers; chills; abdominal pain; and, in some cases, confusion and aggressive behavior. Patients will then develop petechiae and ecchymoses, which are seen prominently on both the skin and mucous membranes. Melena, hematemesis, epistaxis, gingival bleeding, and conjunctivitis also are common manifestations. The acute hemorrhagic period also may be complicated by the development of disseminated intravascular coagulation, which portends a poor prognosis.[16] Domestic animals such as cattle, goats, sheep, and wild hares and hedgehogs are known reservoirs of CCHFV.[15] Birds appear to resist CCHFV infection but act as a host for infected ticks, possibly contributing to dissemination of the virus.[2] However, ostriches experimentally infected with CCHFV developed viremia without overt signs of disease.[17] At this time, humans and newborn mice appear to be the only species that manifest hemorrhagic fever following inoculation with CCHFV.[15]

Crimean-Congo hemorrhagic fever virus has been detected in various species of *Hyalomma* ticks with disease prevalence corresponding closely to the distribution of *Hyalomma* ticks. *Hyalomma marginatum marginatum*, which is prevalent in southern Europe; *Hyalomma marginatum rufipes* found in West Africa and southern Africa; and *Hyalomma asiaticum* in China have been known to carry CCHFV.[2,14] Experimental evidence shows that ticks infected with CCHFV have high concentrations of virus in the salivary glands, a finding that supports tick bites as a means of exposing a host to CCHFV. The virus also can be spread directly from an infected female tick to her young by transstadial transmission.[18] One study also noted sexual transmission of CCHFV from a male *H truncatum* tick to a female.[19] These observations suggest that *Hyalomma* ticks and their young can act as reservoirs for the virus without the need for a vertebrate carrier.[15]

In endemic areas, people who work outdoors and have contact with large domestic animals such as cattle or sheep are at the highest risk for contracting CCHFV. *Hyalomma* ticks have increased activity in spring and summer, which theoretically increases the risk for bites from infected ticks during warmer seasons.[3,14] Coming into contact with infected blood by butchering animals, inadvertently crushing infected ticks, or caring for patients manifesting CCHFV also have been documented as modes of disease spread.[15,20]

Treatment of patients who develop CCHFV is mainly supportive with particular attention to intravascular volume depletion and repletion of blood products to prevent further hemorrhage.[14,15] Some studies have shown that ribavirin may be effective in treating CCHFV infection. An observational study of 52 patients with CCHFV in Turkey showed that the case-fatality rate was lower in the group of patients who were given ribavirin within 4 days of symptom onset than in patients who were given ribavirin later in the course of disease[21]; however, no randomized clinical trials have been conducted to validate this treatment.[22] A vaccine against CCHFV derived from inactivated mouse brain has been used in Bulgaria, though its efficacy has not been well-studied and it is not available elsewhere.[2,23]

Although *Hyalomma* ticks have not yet been observed in the Americas, they appear to have the potential to spread, possibly by latching onto migrating birds and livestock or being inadvertently carried on the clothing of international travelers.[14,24,25] Both young and adult forms of *Hyalomma* species have been found on European and Asiatic birds migrating south to Africa.[25] To reduce the risk for exposure to tick-borne diseases, inhabitants of *Hyalomma* enzootic areas should use protective measures such as *N*,*N*-diethyl-*m*-toluamide–containing insect repellants and should perform regular examinations of skin and clothing to search for any ticks.[15] Permethrin-impregnated clothing may be of use in repelling ticks, though one species (*Hyalomma dromedarii*) has shown tolerance and paradoxic stimulation to bite when exposed to permethrin.[26] This reaction has not yet been observed in other *Hyalomma* species.[27] Acaricides used on domestic animals 10 to 14 days prior to slaughter or export also may be useful to control tick infestations.[15] In countries that have been spared of these ticks thus far, being vigilant of tick bites in people as well as animals and identifying any offending ticks could aid in monitoring the spread of *Hyalomma* species.

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