

***Rhipicephalus* (incl. *Boophilus*)**

(arachnid: tick)

Overview

Arthropods are coelomate metameric invertebrate animals with a chitinous exoskeleton and jointed limbs. They undergo protostomial embryonic development and grow by cuticular moulting (ecdysis). Three main subphyla are recognized: Chelicerata, Crustacea and Hexapoda. Arachnids have chelicerate mouthparts, two tagmata (cephalothorax and abdomen), four pairs of legs and slit sensilla, but no antennae or wings. All species exhibit incomplete metamorphosis whereby eggs hatch larvae which moult to nymphs and then adults. Acarines comprise the ticks and mites which have sac-like bodies with inconspicuous segmentation and their mouthparts are confined to an anterior capitulum. Four major groups are recognized primarily on the location of their respiratory stigmata: ixodid ticks (Metastigmata), gamesid mites (Mesostigmata), trombidiform mites (Prostigmata) and sarcoptiform mites (Astigmata). Ticks have respiratory stigmata posterior to their legs. They are obligate blood-feeding ectoparasites on vertebrate hosts and their hypostomes are toothed and exposed. Two families are recognized: Argasidae and Ixodidae, known as soft and hard ticks, respectively. Ixodids have hard bodies with a dorsal scutum (shield-shaped plate) and the capitulum is not covered by the body. Larvae, nymphs and adults attach and feed on host blood, their life-cycles involving one, two or three hosts depending on whether moulting occurs on or off the host. Some 650 species of hard ticks infest mammals, birds and reptiles. Infestations by *Rhipicephalus* (incl. *Boophilus*) spp. are common as 1, 2 or 3 host ticks on mammals; most species causing irritation and toxicosis, and many transmitting infectious diseases, notably piroplasm tick fevers to domestic livestock.

Classification:

Domain: Eukaryota (membrane-bound nucleus)
Supergroup: Amorphea (unikonts with single flagellum, or nonflagellated amoebae)
Kingdom: Metazoa (multicellular eukaryotes, heterotrophs, notably animals)
Group: Protostomia (triploblastic, spiral cleavage)
Subgroup: Ecdysozoa (cuticle moulted = ecdysis)
Phylum: Arthropoda (chitinous exoskeleton, segmented body, jointed limbs, haemocoel)
Subphylum: Chelicerata (chelicerate mouthparts, two tagmata, no antennae)
Class: Arachnida (spiders & allies, four pairs of legs, slit sensilla, incomplete metamorphosis)
Subclass: Acari (Acarina) (ticks and mites, segmentation inconspicuous, sac-like body, mouthparts on capitulum)
Superorder: Parasitiformes (ticks and some mites, with posterior stigmata)
Order: Ixodida (Metastigmata) (ticks, macroscopic, stigmata posterior to legs, hypostome toothed, ectoparasites)
Family: Ixodidae (hard ticks, with dorsal scutum, capitulum projects anteriorly, attach and feed on 1, 2 or 3 hosts)
Genus: *Rhipicephalus* (incl. *Boophilus*) (parasitic on skin of mammals)
Species: various species causing skin lesions on livestock and transmitting tick fevers

Parasite biodiversity and host range: Most Metazoa are multicellular triploblastic animals with differentiated tissues, many being bilaterally symmetrical with a body cavity. Most invertebrate animals are protostomes as their embryonic development involves spiral determinate cleavage. Those that moult their external cuticles during their life-cycles (process known as ecdysis) are grouped together in the unique clade Ecdysozoa, including the nematodes (roundworms), onychophorans (velvet worms), tardigrades (water bears) and arthropods (myriapods, chelicerates, crustaceans and hexapods). Arthropods have small segmented bodies encased in chitinous exoskeletons with articulated limbs. Most species are free-living in terrestrial and aquatic habitats, although a small range are ectoparasitic on other animals, some feeding on the blood or skin of vertebrates. Five subphyla are recognized: Chelicerata, Crustacea, Hexapoda, Myriapoda and Trilobita. The chelicerates typically have appendages (cheliceræ) in the form of pincers or fangs anterior to the mouthparts, 2 body parts (cephalothorax and abdomen), but no antennae or wings. Three classes are recognized: Arachnida (spiders and allies), Merostomata (horseshoe crabs) and Pycnogonida (sea spiders). Arachnids have 8 legs, slit sensilla and life-cycles involving incomplete metamorphosis whereby larvae and nymphs resemble adults. They are classified in 4 orders: Acari (acarines), Araneae (spiders), Opiliones (harvestmen) and Scorpiones (scorpions). The Acari comprises the ticks and mites which have sac-like bodies and mouthparts confined to an anterior capitulum. Four major groups are recognized primarily on the location of their respiratory stigmata (called spiracles in insects): ixodid ticks (posterior Metastigmata), gamesid mites (middle Mesostigmata), trombidiform mites (anterior Prostigmata) and sarcoptiform mites (without stigmata = Astigmata).

Major parasitic families	Biodiversity	Hosts	Parasitic stages	Pathogenesis	Disease transmission
Superorder: Parasitiformes (ticks and some mites, with posterior stigmata)					
Order: Ixodida [Metastigmata] (ticks, macroscopic, stigmata posterior to legs) [3 families]					
Argasidae (soft ticks)	5 genera, 193 species	birds, mammals	larvae, nymphs, adults	blood-sucking	viral, bacterial
Ixodidae (hard ticks)	14 genera, 705 species	birds, mammals	larvae, nymphs, adults	blood-sucking, paralysis	viral, bacterial, protozoal
Order: Mesostigmata [Gamasida] (gamesid mites, stigmata between 2 nd & 4 th legs) [100 families, 662 genera, 5,360 species]					
Macronyssidae (sucking mites)	26 genera, 127 species	birds, reptiles, mammals	nymphs, adults	blood-sucking	bacterial
Dermanyssidae (sucking mites)	5 genera, 37 species	birds, mammals	nymphs, adults	blood-sucking	viral, bacterial
Halarachnidae (lung/ear mites)	7 genera, 10 species	mammals	nymphs, adults	mucosal erosion	-
Raillietidae (ear mites)	1 genus, 7 species	mammals	nymphs, adults	ear wax	-
Rhinonyssidae (nasal mites)	30 genera, 160 species	birds	nymphs, adults	inflammation	-
Varroidae (bee mites)	1 genus, 5 species	bees	nymphs, adults	haemolymph-feeding	viral
Superorder: Acariformes (diverse group of mites, without posterior stigmata) [351 families, 32,000 species]					
Order: Prostigmata [Trombidiformes, Actinedida] (sucking mites, stigmata on capitulum) [34 superfamilies]					
Demodecidae (follicle mites)	7 genera, 65 species	mammals	larvae, nymphs, adults	inflammation	-
Cheyletidae (fur mites)	80 genera, 500 species	mammals (dogs, cats, rabbits), birds	larvae, nymphs, adults	pruritus	-
Myobiidae (fur mites)	46 genera, 185 species	mammals (rodents, bats, marsupials)	larvae, nymphs, adults	mange	-
Psorergatidae (itch mites)	3 genera, 77 species	mammals (rodents, artiodactyls)	larvae, nymphs, adults	mange	-
Trombiculidae (chigger mites)	71 genera, 3,000 species	mammals, birds	larvae	skin-feeding	bacterial
Order: Astigmata [Sarcoptiformes, Acaridida] (fur/feather/itch/dust mites, lacking stigmata) [230 families, 15,000 species]					
Sarcoptidae (itch mites)	3 genera, 42 spp./ssp.	mammals	larvae, nymphs, adults	scabies, mange	-
Psoroptidae (scab mites)	20 genera, species	mammals (carnivores, ungulates)	larvae, nymphs, adults	mange	-
Listrophoridae (fur mites)	20 genera, 170 species	mammals (esp. rodents)	larvae, nymphs, adults	mange	-
Myocoptidae (fur mites)	10 genera, 70 species	mammals (esp. rodents)	larvae, nymphs, adults	myocoptic mange	-
Cytoditidae (airsac/nasal mites)	2 genera, 12 species	birds	larvae, nymphs, adults	respiratory signs	-
Knemidokoptidae (burrowing mites)	7 genera, 16 species	birds	larvae, nymphs, adults	scaly face, scaly leg	-
Laminosioptidae (quill/skin mites)	8 genera, 25 species	birds	larvae, nymphs, adults	flesh/skin lesions	-

The superorder Parasitiformes comprises acarines with posterior respiratory stigmata and includes two major orders: the ixodid ticks (order Metastigmata) with stigmata located posterior to the legs (behind coxae III or IV); and the gamesid mites (order Mesostigmata) where they are located between the legs, sometimes associated with sinuous processes (peritremes). Ticks are further characterized by macroscopic bodies with an exposed ventral hypostome (toothed with backwardly-directed barbs), chelicerae with only 2 joints, long legs with free articulated coxae (not fused to the body wall) and a complex sensory pit (Haller's organ) on tarsus I. They are obligate blood-sucking parasites which feed on terrestrial vertebrates (mammals, birds, reptiles and some amphibians) as larvae, nymphs and adults with 1-, 2- or 3-host life-cycles. Almost 1,000 species have been classified within some 20 genera from numerous wild and domesticated animals around the world. Two main families are recognized: the Argasidae containing ~200 species of 'soft' ticks with flexible leathery cuticles, ventral capitula, short feeding times (< 1 hour) and long life-spans (up to 20 years); and the Ixodidae containing ~800 species of 'hard' ticks with rigid dorsal scutal plates, anterior capitula, long feeding times (hours to days) and shorter life-span (2-6 years). Basic characteristics of representative genera considered in this resource are tabulated below.

Genus	Capitulum				Idiosoma				Usual no. of hosts
	location	basis capitulum	mouth-parts	palps	integument	festoons	eyes	male ventral plates	
Argasidae (soft ticks with leathery cuticle, stigmata between coxae III)									
<i>Argas</i>	ventral	triangular	short	leg-like	stippled with lateral suture	absent	absent	absent	>3
<i>Ornithodoros</i>	ventral	rectangular	short	leg-like	mamillated	absent	usually absent	absent	>3
<i>Otobius</i>	ventral	rectangular	short	leg-like	spinose (nymphs), granulated (adult)	absent	absent	absent	1
Ixodidae (hard ticks with sclerotized dorsal plate (scutum), stigmata behind coxae IV)									
Prostriata (anal groove anterior)									
<i>Ixodes</i>	anterior	triangular	long	long	inornate	absent	absent	present	3
Metastriata (anal groove posterior)									
<i>Amblyomma</i>	anterior	rectangular	long	long	ornate	present	present	indistinct	3
(<i>Aponomma</i>)	anterior	rectangular	long	long	often ornate	present	absent	absent	3
<i>Rhipicephalus</i>	anterior	hexagonal	short	medium	some ornate	present	present	present	3
(<i>Boophilus</i>)	anterior	hexagonal	short	short	inornate	absent	present	present	1
<i>Dermacentor</i>	anterior	rectangular	short	medium	often ornate	present	present	absent	3
<i>Haemaphysalis</i>	anterior	rectangular	short	short	inornate	present	absent	absent	3
<i>Hyalomma</i>	anterior	rectangular	long	long	inornate	present	present	present	2
<i>Bothriocroton</i>	anterior	pentagonal	long	long	ornate	present	absent	absent	3

The family Ixodidae contains 6 subfamilies (Amblyomminae, Bothriocrotoninae, Haemaphysalinae, Hyalomminae, Ixodinae and Rhipicephalinae) which vary in their morphology, biology, host ranges and specificity. [Note that some taxonomic authorities have merged the subfamilies Rhipicephalinae and Hyalomminae, while others have subsequently assigned the subfamilies Amblyomminae and Rhipicephalinae into the new family Amblyommidae, predominantly on the basis of molecular phylogenetic studies]. Hard ticks had previously been divided into 2 groups: the Prostriata (with the anal groove anterior to the anus) and the Metastriata (anal groove absent or posterior to anus). The Prostriata essentially comprises the subfamily Ixodinae with over 230 species assigned to the single extant genus *Ixodes* [plus one fossil genus (*Cornupalpatum*)], while the Metastriata contains members of the remaining subfamilies with over 600 species classified into 18 genera. The subfamily Rhipicephalinae contains 7 genera (*Anomalohimalaya*, *Cosmiomma*, *Dermacentor*, *Margaropus*, *Nosomma*, *Rhipicentor* and *Rhipicephalus*) and essentially comprises metastriate ticks (often ornate) with eyes and festoons and adult males have ventral plates. The genus *Rhipicephalus* is further characterized by short mouthparts with a hexagonal basis capitulum and short palps, long legs with bifurcate coxae I and tarsi IV bearing ventral hooks, and stigmatal plates having comma-shaped tail-like protrusions. Some 77 *Rhipicephalus* spp. have been described in mammalian hosts, including ungulates, carnivores and small ground-dwelling mammals. Most have 3-host life-cycles, but some have 2-host cycles. All species of the former genus *Boophilus* ('blue' ticks) have recently been transferred on the basis of molecular evidence to the genus *Rhipicephalus*, where they are recognized within a separate subgenus, *R. (Boophilus)*, with more diverse characteristics (notably having 1-host life-cycles, being inornate, lacking festoons, having rounded stigmatal plates, ridged palps, and an inconspicuous anal groove). Several *Rhipicephalus* (and former *Boophilus*) spp. are notorious ectoparasites of domestic livestock and companion animals, causing health and production problems due to blood loss and toxicoses as well as transmitting a range of infectious diseases, especially tick fevers caused by the protozoan parasites *Babesia* and *Theileria* spp.

<i>Rhipicephalus</i> species	Hosts	Clinical signs	Distribution
<i>R. (Boophilus) annulatus</i> (syn. <i>R. congolensis</i> , <i>I. bovis</i> , <i>dugesii</i> , <i>indentatus</i> , <i>Boophilus bovis</i>) (blue cattle tick, Texas cattle fever tick)	Artiodactyla: bovid (cattle, zebu, banteng, buffalo, water buffalo, bison, American buffalo, sheep, goat, giant eland, roan antelope, Coke's hartebeest), camelid (camel), cervid (white-tailed deer, rusa deer, sambar deer, spotted deer, muntjac), suid (pig, red river hog); Perissodactyla: equid (horse, donkey, mule); Lagomorpha: leporid (Baird's hare); Rodentia: dasyproctid (agouti), erethizontid (North American porcupine); Carnivora: canid (dog), felid (cat, lion); Primates: hominid (human); Galliformes: phasianid (fowl); Passeriformes: alaudid (lark), fringillid (chaffinch), sturnid (starling); Sauria: agamid (rock agama), lacertid (European green lizard) (1-host cycle)	trauma, irritation, anaemia (vector for babesiosis, anaplasmosis, rickettsioses)	Americas, Africa, Eurasia

<i>R. appendiculatus</i> (brown ear tick)	Artiodactyla: bovid (cattle, buffalo, forest buffalo, water buffalo, sheep, goat, puku, Gunther's dikdik, Kirk's dikdik, common duiker, blue duiker, bay duiker, red forest duiker, duikerbok, blesbok, eland, impala, lechwe, nyala, harnessed bushbuck, Cape bushbuck, waterbuck, reedbuck, mountain reedbuck, southern reedbuck, Bohor reedbuck, kudu, greater kudu, klipspringer, roan antelope, sable antelope, hartebeest, Coke's hartebeest, Lichtenstein's hartebeest, suni, Livingstone's suni, springbok, steenbuck, Ugandan kob, white-bearded gnu, common wildebeest, blue wildebeest, topi, Grant's gazelle, Thomson's gazelle, oribi, sitatunga, tsessebe), camelid (camel), cervid (deer), giraffid (giraffe), suid (pig, bushpig, red river hog, giant forest hog, desert warthog); Perissodactyla: equid (horse, donkey, mule, Burchell's zebra, Grant's zebra), rhinocerotid (white rhinoceros, black rhinoceros); Proboscidea: elephantid (African elephant); Macroscelidea: macroselidid (eastern rock elephant shrew, western rock elephant shrew, golden-rumped elephant shrew); Eulipotyphla: erinaceid (South African hedgehog); Hyracoidea: procaviid (rock hyrax, yellow-spotted rock hyrax); Pholidota: manid (Temminck's ground pangolin); Rodentia: hystricid (crested porcupine, African porcupine, Cape porcupine), murid (black rat, four-striped grass mouse, pygmy mouse, southern multimammate mouse, Natal multimammate mouse, Cape gerbil, southern African vlei rat, striped grass rat, brush-furred rat, swamp rat), pedetid (springhare), sciurid (red bush squirrel, African bush squirrel, Smith's bush squirrel, Cape ground squirrel), thryonomyid (large cane rat, greater cane rat); Lagomorpha: leporid (rabbit, hare, savannah hare, scrub hare, red rock hare, Natal red rock hare, Cape hare); Carnivora: canid (dog, hunting dog, African wild dog, black-backed jackal, side-striped jackal, bat-eared fox), felid (cat, African wildcat, serval, cheetah, leopard, lion), herpestid (meerkat, common slender mongoose, gray mongoose, banded mongoose, yellow mongoose, marsh mongoose, Egyptian mongoose, white-tailed mongoose), hyaenid (brown hyena, striped hyena, spotted hyena), mustelid (ratel, zorilla), viverrid (African civet, small spotted genet, large spotted genet, rusty-spotted genet); Primates: cercopithecid (grivet, guenon, Chacma baboon), galagid (brown greater galago), hominid (human, western gorilla); Coliiformes: coliid (white-backed mousebird); Coraciiformes: alcedinid (brown-hooded kingfisher); Galliformes: numidid (helmeted guineafowl), phasianid (chicken, common quail, crested francolin); Passeriformes: laniid (long-crested helmet shrike), passerid (yellow-throated bush sparrow), sturnid (Meve's glossy starling); Piciformes: lybiid (crested barbet), picid (golden-tailed woodpecker); Struthioniformes: struthionid (ostrich); Testudines (unspecified tortoise) (3-host cycle)	trauma, toxemia, toxicosis, sweating sickness, paralysis (vector for theileriosis, ehrlichiosis, hepatozoonosis, rickettsial fever, Thogoto virus, Nairobi sheep disease)	sub-Saharan Africa
<i>R. aquatilis</i>	Artiodactyla: bovid (cattle, sitatunga); Carnivora: felid (lion, leopard)		Africa
<i>R. arakeri</i>	Rodentia: murid (rat, mouse)		India
<i>R. armatus</i>	Artiodactyla: bovid (sheep, Grant's gazelle); Perissodactyla: equid (donkey); Eulipotyphla: erinaceid (four-toed hedgehog); Lagomorpha: leporid (Cape hare); Rodentia: murid (northern pygmy gerbil); Carnivora: canid (dog, hunting dog, golden jackal, black-backed jackal, bat-eared fox), felid (African wildcat, caracal, lion, leopard, cheetah), hyaenid (spotted hyena, striped hyena), mustelid (zorilla); Primates: hominid (human); Otidiformes: otidid (kori bustard) (3-host cycle)		Africa
<i>R. (Rhipicephalus) arnoldi</i>	Artiodactyla: bovid (klipspringer); Perissodactyla: equid (mountain zebra); Hyracoidea: procaviid (rock hyrax); Macroscelidea: macroselidid (rock elephant shrew); Lagomorpha: leporid (Cape hare, scrub hare, Jameson's red rock hare, Smith's red rock rabbit);		Africa

	Rodentia: murid (Tullberg's soft-furred mouse, four-striped grass mouse, field mouse); Carnivora: felid (caracal) (3-host cycle)		
<i>R. attenuatus</i>	Perissodactyla: equid (horse)		Africa
<i>R. aurantiacus</i>	Artiodactyla: bovid (buffalo, forest buffalo, water buffalo), suid (red river hog); Primates: hominid (human)		Africa
<i>R. (Boophilus) australis</i> (Australian cattle tick)	Artiodactyla: bovid (cattle, zebu, Himalayan zebu, gayal, nilgai, water buffalo, sheep, goat), camelid (dromedary), cervid (muntjac), suid (pig); Perissodactyla: equid (horse); Carnivora: canid (dog), felid (cat); Primates: hominid (human); Passeriformes: passerid (sparrow) (1-host cycle)	(vector for babesiosis)	Australasia
<i>R. (Rhipicephalus) bequaerti</i>	Artiodactyla: bovid (cattle, buffalo, goat), suid (red river hog, forest hog, bushpig); Primates: hominid (human)		Africa
<i>R. bergeoni</i>	Artiodactyla: bovid (cattle, sheep, goat, mountain nyala, bushbuck, greater kudu), suid (pig); Perissodactyla: equid (horse); Carnivora: hyaenid (striped hyena)		Africa
<i>R. boueti</i>	Hyracoidea: procaviid (rock hyrax)		Africa
<i>R. breviceps</i>	Eulipotyphla: erinaceid (long-eared hedgehog, collared hedgehog); Rodentia: murid (Indian gerbil)		Pakistan
<i>R. (Digineus) bursa</i> (syn. <i>R. bilenus</i> , <i>lundbladi</i>)	Artiodactyla: bovid (cattle, zebu, water buffalo, sheep, Asiatic mouflon, goat, argali, kri-kri, harnessed bushbuck, mountain gazelle), camelid (dromedary), cervid (red deer, roe deer, sika deer, sambar deer, fallow deer), suid (pig, wild boar); Perissodactyla: equid (horse, donkey); Lagomorpha: leporid (European rabbit, European hare, Somalian hare, tolai hare); Eulipotyphla: erinaceid (European hedgehog, South African hedgehog); Rodentia: cricetid (bank vole, social vole, European hamster), glirid (garden dormouse), hystricid (crested porcupine), murid (rat, wood mouse, Tristram's jird), sciurid (red squirrel); Carnivora: canid (dog, red fox), felid (cat), mustelid (marbled polecat, ferret); Primates: hominid (human); Anseriformes: anatid (goose); Bucerotiformes: upupid (Eurasian hoopoe); Galliformes: phasianid (rock partridge); Passeriformes: corvid (rook), motacillid (tree pipit), muscicapid (isabelline wheatear), sturnid (common starling); Piciformes: picid (middle spotted woodpecker); Strigiformes: strigid (long-eared owl); Sauria: lacertid (sand lizard) (2-host cycle)	trauma, irritation (vector for babesiosis, theileriosis, anaplasmosis, ehrlichiosis, Q fever, Nairobi sheep disease virus, and possibly Crimean-Congo haemorrhagic fever virus)	sub-Saharan Africa, Europe
<i>R. (Boophilus) calcaratus</i> (syn. <i>Ixodes</i>) (blue tick)	Artiodactyla: bovid (cattle, buffalo, water buffalo, sheep, urial, goat, goitered gazelle), camelid (camel), cervid (red deer, Bactrian deer, Central Asian red deer, sika deer), suid (pig, wild boar); Perissodactyla: equid (horse, donkey); Lagomorpha: leporid (European hare); Eulipotyphla: erinaceid (hedgehog); Rodentia: murid (house mouse, short-tailed bandicoot rat), sciurid (red squirrel); Carnivora: canid (dog, red fox), felid (cat), ursid (brown bear); Galliformes: phasianid (partridge); Passeriformes: alaudid (Eurasian skylark, Calandra lark), corvid (magpie), passerid (Spanish sparrow); Sauria: lacertid (sand lizard, Caucasian agama) (1-host cycle)	trauma, irritation, anaemia (vector for babesiosis, anaplasmosis)	Eurasia, Africa
<i>R. camicasi</i>	Artiodactyla: bovid (cattle, sheep, goat, gerenuk, eland), camelid (camel), suid (warthog); Perissodactyla: equid (donkey, zebra, Grevy's zebra), Lagomorpha: leporid (Cape hare); Tubulidentata: orycteropid (aardvark); Carnivora: canid (dog, bat-eared fox), felid (cheetah) (3-host cycle)	(possible vector for anaplasmosis)	Africa
<i>R. capensis</i> (syn. <i>Boophilus</i> , <i>R. gertrudae</i>) (Cape brown tick)	Artiodactyla: bovid (cattle, zebu, buffalo, forest buffalo, sheep, goat, impala, eland, greater kudu, gemsbok, grey rhebok, sable antelope, Lichtenstein's hartebeest, black wildebeest, bontebok, springbok, reedbuck, sitatunga), cervid (deer), suid (pig, bushpig, red river hog, common warthog, desert warthog); Perissodactyla: equid (horse, donkey, mountain zebra), rhinocerotid (black rhinoceros); Macroscelidea: macroscelidid (western rock elephant shrew); Lagomorpha: leporid (scrub hare, Cape hare); Rodentia:	trauma, irritation (vector for theileriosis, anaplasmosis)	Africa

	glirid (African dormouse), hystricid (Cape porcupine), murid (hairy-footed gerbil, Cape gerbil, red veld rat, Namaqua rock rat, bush vlei rat, tropical vlei rat, South African vlei rat, bush Karoo rat, Namaqua rock mouse, four-striped grass mouse); Carnivora: canid (dog, side-striped jackal, black-headed jackal, bat-eared fox, Cape fox), felid (cat, caracal, lion, leopard, cheetah), hyaenid (aardwolf), viverrid (civet); Primates: cercopithecoid (chacma baboon), hominid (human); Galliformes: numidid (guineafowl); Passeriformes: muscicapid (unspecified flycatcher), pycnonotid (unspecified bulbul); Sauria: varanid (Nile monitor); Testudines: testudinid (geometric tortoise) (3-host cycle)		
<i>R. carnivoralis</i>	Artiodactyla: bovid (cattle, zebu); Hyracoidea: procaviid (rock hyrax, yellow-spotted rock hyrax); Carnivora: canid (dog), felid (cheetah, lion, leopard), hyaenid (spotted hyena, striped hyena); Primates: hominid (human) (3-host cycle)		Africa
<i>R. (Boophilus) caudatus</i>	Artiodactyla: bovid (cattle, buffalo, water buffalo, sheep); Perissodactyla: equid (horse, mule); Carnivora: canid (dog)		Asia
<i>R. complanatus</i>	Artiodactyla: bovid (buffalo, harnessed bushbuck), suid (pig, warthog, bushpig, desert warthog, forest hog, red river hog); Rodentia: murid (Cameroon soft-furred mouse, Tullberg's soft-furred mouse); Carnivora: viverrid (civet); Primates: hominid (human)		Africa
<i>R. compositus</i> (syn. <i>R. ayeri</i>)	Artiodactyla: bovid (cattle, buffalo, forest buffalo, sheep, goat, roan antelope, eland, bushbuck, waterbuck, puku, Lichtenstein's hartebeest, sitatunga, common duiker, roan antelope), giraffid (giraffe, Masai giraffe), suid (pig, bushpig, giant forest hog, red river hog, desert warthog); Perissodactyla: equid (donkey), rhinocerotid (black rhinoceros); Proboscidea: elephantid (African bush elephant); Rodentia: murid (African grass rat, Abyssinian grass rat, swamp rat, Nile rat, greater creek rat, Jackson's soft-furred rat, jumping mouse); Carnivora: canid (dog), felid (lion, leopard, cheetah), viverrid (African civet); Primates: hominid (human) (3-host cycle)		Africa
<i>R. confusus</i>	Artiodactyla: bovid (buffalo, waterbuck, eland, sable antelope, roan antelope, common duiker, Lichtenstein's hartebeest), suid (pig, bushpig, red river hog, desert warthog); Perissodactyla: equid (horse); Carnivora: canid (dog)		Africa
<i>R. cuspidatus</i>	Artiodactyla: bovid (eland, red-fronted gazelle, oribi), suid (red river hog, desert warthog); Rodentia: hystricid (crested porcupine), thryonomyid (greater cane rat); Tubulidentata: orycteropodid (aardvark); Carnivora: canid (golden jackal), felid (serval, leopard), herpestid (banded mongoose, white-tailed mongoose, Egyptian mongoose), hyaenid (spotted hyena, striped hyena); Galliformes: phasianid (double-spurred francolin) (3-host cycle)		Africa
<i>R. (Boophilus) decoloratus</i> (syn. <i>Boophilus flavae</i> , <i>scheepersi</i>) (African blue tick)	Artiodactyla: bovid (cattle, zebu, buffalo, water buffalo, sheep, goat, impala, eland, giant eland, harnessed bushbuck, greater kudu, sable antelope, roan antelope, royal antelope, hartebeest, Lichtenstein's hartebeest, dama gazelle, red-fronted gazelle, Grant's gazelle, blue wildebeest, gnu, nyala, tiang, impala, southern reedbuck, waterbuck, sitatunga, oryx, duiker, topi, springbok, blesbok, gemsbok, sassaby, korrigum), camelid (dromedary), giraffid (giraffe), suid (pig, bushpig, red river hog, warthog); Perissodactyla: equid (horse, donkey, mule, plains zebra, Burchell's zebra); Macroscelidea: macroscelidid (four-toed elephant shrew); Lagomorpha: leporid (rabbit, scrub hare); Rodentia: murid (multimammate mouse); Carnivora: canid (dog, African wild dog, black-backed jackal), felid (cat, lion, cheetah), herpestid (common slender mongoose); Primates: hominid (human); Charadriiformes: charadriid (three-banded plover);	trauma, irritation, anaemia (vector for babesiosis, anaplasmosis, spirochaetosis, borreliosis)	sub-Saharan Africa

	Galliformes: numidid (helmeted guineafowl, black guineafowl); Passeriformes: sturnid (common myna); Pelecaniformes: ardeid (cattle egret); Suliformes: phalacrocoracid (reed cormorant); Serpentes: pythonid (unspecified python); Testudines: testudinid (unspecified tortoise) (1-host cycle)		
<i>R. deltoideus</i>	Artiodactyla: bovid (Grant's gazelle); Lagomorpha: leporid (hare); Otidiformes: otidid (Jackson's rufous-necked bustard); Struthioniformes: struthionid (ostrich)		Africa
<i>R. distinctus</i> (syn. <i>R. punctatus</i>)	Artiodactyla: bovid (cattle, buffalo, sheep, goat, impala, roan antelope, sable antelope, common duiker, red forest duiker, waterbuck, klipspringer, gerenuk, Kirk's dik-dik, steenbok, greater kudu, gemsbok, common eland, nyala, oribi, harnessed bushbuck, topi, hartebeest, Sharpe's grysbok, tsessebe), giraffid (giraffe), suid (bushpig, desert warthog); Perissodactyla: equid (horse, donkey, plains zebra, Burchell's zebra); Hyracoidea: procaviid (rock hyrax, southern tree hyrax, yellow-spotted rock hyrax); Macroscelidea: macroscelidid (rock elephant shrew); Eulipotyphla: soricid (shrew); Lagomorpha: leporid (savannah hare, European hare, Cape hare, Jameson's red rock rabbit, Smith's red rock rabbit); Rodentia: murid (Natal multimammate mouse, Namaqua rock mouse, swamp rat, bush Karoo rat, field mouse), pedetid (springhare); Carnivora: felid (African wildcat, caracal, lion, leopard), herpestid (yellow mongoose); Primates: hominid (human) (3-host cycle)		Africa
<i>R. duttoni</i> (Angolan brown ear tick)	Artiodactyla: bovid (cattle, buffalo, sheep, goat, eland, impala, common duiker); Perissodactyla: equid (horse); Lagomorpha: leporid (savannah hare); Carnivora: canid (dog), viverrid (African civet); Otidiformes: otidid (black-bellied bustard) (3-host cycle)	otitis (vector for theileriosis)	Africa
<i>R. dux</i> (syn. <i>R. schwetzi</i>)	Artiodactyla: bovid (cattle, buffalo, forest buffalo, waterbuck), suid (pig, bushpig, red river hog, giant forest hog, desert warthog); Proboscidea: elephantid (African elephant); Primates: hominid (human)		Africa
<i>R. erlangeri</i>	Perissodactyla: equid (horse)		Africa
<i>R. evertsi</i> (incl. subspp. <i>evertsi</i> , <i>mimeticus</i>) (red-legged tick, red tick)	Artiodactyla: bovid (cattle, buffalo, sheep, goat, eland, red hartebeest, Cape hartebeest, Coke's hartebeest, Jackson's hartebeest, Lichtenstein's hartebeest, Roosevelt's hartebeest, reedbuck, blue wildebeest, black wildebeest, sable antelope, roan antelope, dwarf antelope, blesbok, greater kudu, lesser kudu, Cape kudu, impala, steenbok, common duiker, Cape duiker, blue duiker, red forest duiker, springbok, harnessed bushbuck, Cape bushbuck, Cape grysbok, Sharpe's grysbok, southern reedbuck, mountain reedbuck, waterbuck, bontebok, blesbok, grey rhebok, gemsbok, steenbok, Grant's gazelle, Thomson's gazelle, Isabella gazelle, gerenuk, oribi, kob, korrigum, tsessebe, sitatunga, Kirk's dik-dik, nilgai, nyala, fringe-eared oryx, tsessebe, topi, klipspringer, waterbuck kob, lechwe, puku), camelid (camel), giraffid (giraffe, southern giraffe), suid (pig, bushpig, desert warthog); Perissodactyla: equid (horse, donkey, mule, plains zebra, Burchell's zebra, Grant's zebra, Grevy's zebra, Hartmann's mountain zebra), rhinocerotid (white rhinoceros, black rhinoceros); Proboscidea: elephantid (African elephant); Macroscelidea: macroscelidid (rufous elephant shrew, short-snouted elephant shrew, round-eared elephant shrew); Hyracoidea: procaviid (rock hyrax, yellow-spotted rock hyrax); Rodentia: hystricid (crested porcupine, South African porcupine), murid (striped grass mouse, Namaqua rock mouse, tree rat, Abyssinian grass rat, red veld rat), nesomyid (Gambian pouched rat, short-tailed pouched mouse, fat mouse), pedetid (springhare, South African springhare), sciurid (Smith's bush squirrel, Huet's bush squirrel, unstriped ground squirrel), thryonomyid (greater cane rat); Lagomorpha: leporid (rabbit, Smith's red rock rabbit, European hare, scrub hare,	trauma, irritation, paralysis (vector for babesiosis, theileriosis, anaplasmosis, borreliosis, spirochaetosis)	sub-Saharan Africa

	savannah hare, Cape hare, Natal red rock hare); Carnivora: canid (dog, hunting dog, side-striped jackal, black-backed jackal), felid (cat, African wildcat, caracal, leopard, cheetah, lion), herpestid (meerkat, banded mongoose, marsh mongoose, common slender mongoose), hyaenid (aardwolf), mustelid (ratel), viverrid (African civet, genet); Primates: cercopithecoid (Chacma baboon, yellow baboon, vervet monkey, colobus monkey), hominid (human); Accipitriformes: accipitrid (pale chanting goshawk); Coliiformes: coliid (white-backed mousebird); Galliformes: numidid (helmeted guineafowl), phasianid (crested francolin); Passeriformes: alaudid (red-capped lark), hirundinid (greater striped swallow), leiothrichid (arrow-marked babbler), malaconotid (brown-crowned tchagra), ploceid (red-billed quelea); Suliformes: phalacrocoracid (reed cormorant); Testudines: testudinid (leopard tortoise) (2-host cycle)		
<i>R. exophthalmos</i>	Artiodactyla: bovid (cattle, sheep, goat, impala, eland, springbok, gemsbok, steenbok, grey rhebok, mountain reedbuck, greater kudu), suid (pig, desert warthog); Perissodactyla: equid (horse, donkey, Burchell's zebra); Lagomorpha: leporid (scrub hare, Cape hare); Macroscelidea: macroscelidid (Cape elephant shrew, Smith's rock elephant shrew, short-eared elephant shrew); Rodentia: murid (Namaqua rock rat); Carnivora: canid (dog), felid (lion); Galliformes: phasianid (chicken) (3-host cycle)		Africa
<i>R. follis</i>	Artiodactyla: bovid (cattle, buffalo, sheep, black wildebeest, springbok, eland, bushbuck, greater kudu, gemsbok), giraffid (giraffe), suid (bushpig); Perissodactyla: equid (horse, mountain zebra); Rodentia: murid (four-striped grass mouse, swamp rat); Carnivora: canid (dog), felid (caracal, cheetah); Primates: hominid (human) (3-host cycle)		Africa
<i>R. (Pterygodes) fulvus</i>	Artiodactyla: bovid (sheep, Barbary sheep, goat), camelid (camel); Rodentia: ctenodactylid (common gundi), murid (northern pygmy gerbil); Primates: hominid (human)		Africa, Europe
<i>R. (Boophilus) geigy</i>	Artiodactyla: bovid (cattle, sheep, tiang, kongoni); Carnivora: canid (dog), felid (cat); Primates: hominid (human) (1-host cycle)	(possible vector for babesiosis)	sub-Saharan Africa
<i>R. glabroscutatus</i> (syn. <i>R. glabroscutatum</i>)	Artiodactyla: bovid (cattle, buffalo, sheep, goat, red hartebeest, black wildebeest, bontebok, blesbok, springbok, steenbok, gemsbok, grey rhebok, eland, greater kudu, common duiker, mountain reedbuck); Perissodactyla: equid (horse, mountain zebra); Hyracoidea: procaviid (rock hyrax); Lagomorpha: leporid (scrub hare, Smith's red rock rabbit); Rodentia: murid (fur-striped grass mouse), pedetid (springhare); Carnivora: canid (dog), felid (caracal); Primates: hominid (human); Galliformes: numidid (helmeted guineafowl) (2-host cycle)		Africa
<i>R. gladiger</i>	Artiodactyla: bovid (goat); Perissodactyla: equid (horse)		Africa
<i>R. guilhoni</i>	Artiodactyla: bovid (cattle, sheep, goat, kob, korrigum, red-fronted gazelle, roan antelope, sing-sing waterbuck), camelid (camel), giraffid (giraffe), suid (warthog); Perissodactyla: equid (horse, donkey); Lagomorpha: leporid (hare); Eulipotyphla: erinaceid (four-toed hedgehog); Rodentia: murid (gerbil, African grass rat, Nile rat), sciurid (striped ground squirrel); Carnivora: canid (dog, jackal, pale fox), felid (cat, African wildcat, caracal, serval), hyaenid (spotted hyena), mustelid (striped polecat), viverrid (African civet); Primates: hominid (human); Accipitriformes: accipitrid (martial eagle, white-backed vulture); Ciconiiformes: ciconiid (saddle-billed stork, Maribou stork); Galliformes: phasianid (red junglefowl); Otidiformes: otidid (Arabian bustard, Denham's bustard); Strigiformes: strigid (barn owl); Struthioniformes: struthionid (ostrich) (3-host cycle)	(possible vector for rickettsiosis, Q fever, Crimean-Congo haemorrhagic fever, Wad Medani and Ngoye viruses)	Africa

<i>R. haemaphysaloides</i>	Artiodactyla: bovid (cattle, gaur, zebu, buffalo, water buffalo, goat, sheep, goral, Nilgiri tahr, Himalayan tahr, serow), camelid (dromedary), cervid (chital deer, sambar deer, spotted deer, Indian muntjac), suid (pig, banded pig, Indian boar, Philippine warty pig); Perissodactyla: equid (horse, donkey, mule), rhinocerotid (Javan rhinoceros); Eulipotyphla: soricid (Asian house shrew, Anderson's shrew); Lagomorpha: leporid (Bengal hare, Indian hare, black-napped hare); Rodentia: hystricid (Malayan porcupine), murid (black rat, lesser bandicoot rat, greater bandicoot rat, soft-furred rat, Cutch rat, Blanford's rat, Indian bush rat, house mouse, flat-haired mouse, little Indian field mouse, Indian brown spiny mouse, Indian gerbil), sciurid (bobak marmot, jungle palm squirrel, Indian giant squirrel); Carnivora: canid (dog, dhole, wolf, golden jackal, red fox), felid (Asian golden cat, marbled cat, fishing cat, leopard, tiger, herpestid (Indian grey mongoose), mustelid (greater hog badger, European pine marten), ursid (sloth bear); Primates: cercopithecoid (northern plains gray langur), hominid (human); Cuculiformes: cuculid (crow pheasant); Galliformes: phasianid (chicken, red junglefowl); Passeriformes: muscicapid (orange-breasted flycatcher), paradoxornithid (Oriental yellow-eyed babbler), turdid (brown-headed thrush) (3-host cycle)		Indo-China
<i>R. hilgerti</i>	Carnivora: canid (variegated wolf)		Africa
<i>R. humeralis</i>	Artiodactyla: bovid (cattle, buffalo, sheep, goat, eland, bushbuck, waterbuck, Coke's hartebeest, Speke's gazelle), camelid (camel), suid (bushpig, warthog, Somali warthog); Perissodactyla: equid (donkey), rhinocerotid (black rhinoceros); Proboscidea: elephantid (African elephant); Rodentia: sciurid (unstriped ground squirrel); Carnivora: canid (dog, black-backed jackal, bat-eared fox, sand fox), felid (lion); Primates: cercopithecoid (Hamadryas baboon), galagid (greater bushbaby), hominid (human); Accipitriformes: accipitrid (great sparrowhawk) (3-host cycle)		Africa
<i>R. hurti</i>	Artiodactyla: bovid (cattle, buffalo, eland, harnessed bushbuck, sitatunga, common duiker, roan antelope), giraffid (giraffe), suid (pig, bushpig, red river hog, warthog); Perissodactyla: rhinocerotid (black rhinoceros); Rodentia: murid (Angoni vlei rat); Carnivora: canid (dog, jackal), felid (lion, leopard), viverrid (genet); Primates: hominid (human) (3-host cycle)		Africa
<i>R. interventus</i>	Artiodactyla: bovid (cattle, sheep, topi, Grant's gazelle, oribi, Cape grysbok, bushbuck, unspecified antelope); Carnivora: canid (dog)		Africa
<i>R. jeanneli</i>	Artiodactyla: bovid (cattle, buffalo, sheep, goat, common eland, bongo, bushbuck, greater kudu, common duiker), suid (pig, wild boar, bushpig, forest hog, warthog); Perissodactyla: equid (horse, Burchell's zebra), rhinocerotid (black rhinoceros); Rodentia: murid (brush-furred rat, swamp rat), spalacid (East African mole-rat); Carnivora: canid (dog), felid (lion); Primates: hominid (human); Galliformes: phasianid (spurfowl) (3-host cycle)		Africa
<i>R. kochi</i> (syn. <i>R. mossambicus</i> , <i>naevii</i>)	Artiodactyla: bovid (cattle, buffalo, sheep, goat, eland, impala, harnessed bushbuck, waterbuck, southern reedbuck, Bohor reedbuck, greater kudu, fringe-eared oryx, roan antelope, sable antelope, suni, nyala, oribi, klipspringer, steenbok, common duiker, red forest duiker, yellow-backed duiker, blue wildebeest, Lichtenstein's hartebeest, Grant's gazelle, Thomson's gazelle, Kirk's dik-dik, Cape grysbok), camelid (camel), giraffid (Masai giraffe), suid (red river hog, bushpig, desert warthog); Proboscidea: elephantid (African elephant); Perissodactyla: equid (horse, donkey, plains zebra, Burchell's zebra), rhinocerotid (black rhinoceros); Lagomorpha: leporid (European hare, Cape hare, scrub hare, savannah hare); Macroscelidea: macroscelidid (four-toed elephant shrew); Rodentia: hystricid (Cape porcupine); Carnivora:		Africa

	canid (dog, side-striped jackal), felid (lion, leopard), viverrid (African civet); Primates: hominid (human); Galliformes: phasianid (yellow-necked spurfowl); Otidiformes: otidid (black-bellied bustard) (3-host cycle)		
<i>R. (Boophilus) kohlsi</i>	Artiodactyla: bovid (cattle, sheep, goat), camelid (camel); Perissodactyla: equid (horse, mule) (1-host cycle)		Middle-East
<i>R. leporis</i>	Artiodactyla: bovid (goat), cervid (red deer); Eulipotyphla: erinaceid (European hedgehog, desert hedgehog, Brandt's hedgehog, long-eared hedgehog); Lagomorpha: leporid (desert hare, tolai hare, Cape hare); Rodentia: dipodid (small five-toed jerboa), murid (great gerbil); Carnivora: canid (dog, wolf, golden jackal, red fox), mustelid (steppe polecat, marbled polecat) (3-host cycle)		Central Asia
<i>R. longiceps</i>	Artiodactyla: bovid (cattle, buffalo, klipspringer, gemsbok, Lichtenstein's hartebeest), giraffid (giraffe), suid (pig, warthog); Perissodactyla: rhinocerotid (rhinoceros)		Africa
<i>R. longicoxatus</i> (syn. <i>R. camelopardalis</i>)	Artiodactyla: bovid (buffalo, sheep, goat, dik-dik), camelid (camel), giraffid (Masai giraffe), suid (bushpig, red river hog); Carnivora: canid (dog), felid (serval)		Africa
<i>R. longus</i> (syn. <i>R. cliffordi</i> , <i>falcatus</i> , <i>pseudolongus</i>)	Artiodactyla: bovid (cattle, zebu, buffalo, forest buffalo, sheep, goat, common eland, giant eland, impala, mountain nyala, bongo, waterbuck, sable antelope, roan antelope, blue wildebeest, Lichtenstein's hartebeest), suid (pig, bushpig, red river hog, forest hog, desert warthog); Perissodactyla: equid (horse, Burchell's zebra), rhinocerotid (black rhinoceros); Proboscidea: elephantid (African elephant); Tubulidentata: orycteropodid (aardvark); Lagomorpha: leporid (Cape hare); Macroscelidea: macroscelidid (elephant shrew); Rodentia: murid (typical striped grass mouse); Carnivora: canid (dog, African wild dog, side-striped jackal, bat-eared fox), felid (lion, leopard), herpestid (banded mongoose), hyaenid (spotted hyena); Primates: hominid (human); Charadriiformes: recurvirostrid (black-winged stilt) (3-host cycle)		Africa
<i>R. lounsburyi</i>	Artiodactyla: bovid (sheep, eland, black wildebeest, bontebok, grey rhebok, mountain reedbuck); Rodentia: murid (four-striped grass mouse); Carnivora: felid (caracal) (3-host cycle)		Africa
<i>R. maculatus</i>	Artiodactyla: bovid (cattle, buffalo, sheep, goat, eland, roan antelope, sable antelope, suni, oribi, waterbuck, southern reedbuck, bushbuck, eland, nyala, lesser kudu, greater kudu, common duiker, red forest duiker, blue wildebeest, Lichtenstein's hartebeest, impala), suid (pig, bushpig, red river hog, common warthog, desert warthog); Perissodactyla: equid (Burchell's zebra), rhinocerotid (black rhinoceros, white rhinoceros); Proboscidea: elephantid (African elephant, African bush elephant); Lagomorpha: leporid (scrub hare); Macroscelidea: macroscelidid (elephant shrew); Hyracoidea: procaviid (hyrax); Carnivora: felid (lion, cheetah, serval), hyaenid (spotted hyena), viverrid (African civet); Primates: hominid (human); Sauria: varanid (Nile monitor) (3-host cycle)		Africa
<i>R. masseyi</i> (syn. <i>R. tendeiroi</i>)	Artiodactyla: bovid (cattle, buffalo, sheep, impala, eland, nyala, harnessed bushbuck, greater kudu, sable antelope), suid (bushpig, red river hog, warthog); Perissodactyla: equid (horse, Burchell's zebra); Tubulidentata: orycteropodid (aardvark); Lagomorpha: leporid (hare); Rodentia: sciurid (Cape ground squirrel); Carnivora: canid (dog, Cape fox), felid (lion, leopard), herpestid (meerkat, yellow mongoose, marsh mongoose)		Africa
<i>R. (Boophilus) microplus</i> (syn. <i>Haemaphysalis micropla</i> , <i>Boophilus</i>)	Artiodactyla: bovid (cattle, banteng, gaur, zebu, buffalo, water buffalo, sheep, goat, sable antelope, black wildebeest, grey rhebok), camelid (camel), cervid (red deer, sambar deer, white-tailed deer, marsh deer, pampas deer, brown brocket, grey brocket, red brocket,	trauma, irritation, anaemia (vector for	Asia, Australia, Americas, Africa

<p><i>distans, fallax, intraoculatus, krijgsmani, longiscutatus, rotundiscutatus, sinensis, sharifi</i> (incl. clades A and B) (pantropical cattle tick, southern cattle tick, Asiatic blue tick) [note that the ‘Australian cattle tick’ has been renamed <i>R. australis</i>]</p>	<p>chital, Philippine deer), suid (pig, wild boar), tayassuid (white-lipped peccary, collared peccary, Chacoan peccary); Perissodactyla: equid (horse, donkey), tapirid (South American tapir, Baird’s tapir); Lagomorpha: leporid (rabbit, European hare); Rodentia: caviid (capybara), erethizontid (orange-spined hairy dwarf porcupine), murid (mouse); Diprotodontia: macropodid (wallaby, kangaroo); Didelphimorphia: didelphid (big-eared opossum); Pilosa: bradypodid (pale-throated sloth), myrmecophagid (giant anteater); Carnivora: canid (dog, dingo, maned wolf, pampas fox, hoary fox, gray fox, crab-eating fox), felid (cat, pampas cat, colocolo, ocelot, oncilla, jaguar, jaguarundi, cougar, lion), herpestid (small Indian mongoose), procyonid (South American coati); Chiroptera: phyllostomid (little yellow-shouldered bat); Primates: atelid (Colombian red howler), cercopithecoid (Formosan rock macaque), hominid (human); Anura: bufonid (cane toad); Accipitriformes: accipitrid (roadside hawk); Falconiformes: falconid (yellow-headed caracara); Passeriformes: passerid (house sparrow); Pelecaniformes: ardeid (cattle egret) (1-host cycle)</p>	<p>babesiosis, anaplasmosis, borreliosis, Q fever)</p>	
<p><i>R. moucheti</i></p>	<p>Artiodactyla: bovid (cattle); Carnivora: canid (dog), viverrid (African civet); Primates: cercopithecoid (common patas monkey) (3-host cycle)</p>		<p>Africa</p>
<p><i>R. muelhensi</i></p>	<p>Artiodactyla: bovid (cattle, buffalo, sheep, goat, bushbuck, roan antelope, sable antelope, nyala, impala, suni, reedbuck, steenbok, gemsbok, waterbuck, greater kudu, lesser kudu, gerenuk, common duiker, red forest duiker, Cape duiker, eland, harnessed bushbuck, Lichtenstein’s hartebeest, Grant’s gazelle), giraffid (giraffe), suid (bushpig, red river hog, warthog); Perissodactyla: equid (plains zebra), rhinocerotid (black rhinoceros, white rhinoceros); Proboscidea: elephantid (African elephant); Lagomorpha: leporid (scrub hare); Hyracoidea: procaviid (rock hyrax); Macroscelidea: macroscelidid (elephant shrew); Rodentia: sciurid (Smith’s bush squirrel); Carnivora: canid (dog, black-backed jackal), felid (leopard), herpestid (common slender mongoose, white-tailed mongoose, lesser mongoose), hyaenid (hyena), viverrid (civet); Primates: hominid (human) (3-host cycle)</p>		<p>Africa</p>
<p><i>R. muhsamae</i></p>	<p>Artiodactyla: bovid (cattle, buffalo, sheep, goat, bushbuck, roan antelope, kob, oribi, Bohor reedbuck), suid (pig, red river hog, warthog); Perissodactyla: equid (horse, donkey); Rodentia: hystricid (crested porcupine), murid (Nile rat), sciurid (striped ground squirrel, Geoffroy’s ground squirrel); Lagomorpha: leporid (hare); Carnivora: canid (dog, side-striped jackal), felid (lion, leopard), hyaenid (spotted hyena), mustelid (striped polecat), viverrid (African civet); Primates: hominid (human) (3-host cycle)</p>		<p>Africa</p>
<p><i>R. neumanni</i></p>	<p>Artiodactyla: bovid (sheep, goat, black wildebeest, springbok, gemsbok, grey rhebok, mountain reedbuck); Perissodactyla: equid (horse); Rodentia: murid (Namaqua rock mouse); Carnivora: canid (dog) (3-host cycle)</p>		<p>Africa</p>
<p><i>R. nitens</i></p>	<p>Artiodactyla: bovid (cattle, buffalo, sheep, goat, harnessed bushbuck, bontebok, springbok, grey rhebok), suid (warthog); Perissodactyla: equid (horse, mountain zebra); Lagomorpha: leporid (scrub hare); Carnivora: canid (dog, African wild dog); Galliformes: numidid (guineafowl) (3-host cycle)</p>		<p>Africa</p>
<p><i>R. oculatus</i></p>	<p>Artiodactyla: bovid (cattle, sheep, goat, impala, eland, kudu, springbok, gemsbok, steenbok, Cape bushbuck, Grant’s gazelle, duiker, mountain reedbuck), giraffid (giraffe), suid (pig); Perissodactyla: equid (horse, donkey); Macroscelidea: macroscelidid (short-snouted elephant shrew); Lagomorpha: leporid (mountain hare, scrub hare, Cape hare, Smith’s red rock</p>		<p>Africa</p>

	rabbit); Rodentia: pedetid (springhare), murid (field mouse); Primates: hominid (human); Galliformes: numidid (helmeted guineafowl) (3-host cycle)		
<i>R. oreotragi</i>	Artiodactyla: bovid (klipspringer)		Africa
<i>R. phthirioides</i>	Perissodactyla: equid (horse)		Africa
<i>R. pilans</i>	Artiodactyla: bovid (cattle, water buffalo, sheep, goat), cervid (Javan rusa, Timor deer, sambar deer), suid (pig); Perissodactyla: equid (horse); Eulipotyphla: soricid (house shrew, black-footed shrew, Sulawesi white-toothed shrew); Rodentia: murid (montane bunomys, greater bandicoot rat, Sulawesi rat, Oriental spiny rat, chestnut rat, ricefield rat, lesser moonrat, Malaysian field rat, Pacific rat, Tanezumi rat, black rat); Carnivora: canid (dog), felid (tiger), viverrid (common palm civet); Chiroptera: pteropid (Leschenault's rousette); Primates: hominid (human) (3-host cycle)		Asia
<i>R. piresi</i>	Artiodactyla: bovid (impala, nyala, suni, common duiker); Lagomorpha: leporid (scrub hare); Rodentia: sciurid (red bush squirrel, Smith's bush squirrel)		Africa
<i>R. planus</i>	Artiodactyla: bovid (cattle, buffalo, impala, waterbuck, common duiker), suid (pig, bushpig, red river hog, black forest hog, warthog); Proboscidea: elephantid (African elephant); Tubulidentata: orycteropid (aardvark); Lagomorpha: leporid (scrub hare, Cape hare); Rodentia: hystricid (crested porcupine, Cape porcupine), murid (Tullberg's soft-furred mouse, striped grass rat); Carnivora: canid (side-striped jackal); Primates: hominid (human) (3-host cycle)		Africa
<i>R. plumbeus</i>	Artiodactyla: bovid (cattle, sheep, goat), suid (pig); Perissodactyla: equid (horse, donkey, mule); Lagomorpha: leporid (rabbit, European hare); Eulipotyphla: erinaceid (European hedgehog); Carnivora: canid (dog), felid (cat); Charadriiformes: charadriid (European golden plover); Galliformes: phasianid (common partridge); Passeriformes: alaudid (crested lark, Eurasian skylark, Calandra lark), fringillid (common linnet, European goldfinch), motacillid (white wagtail, yellow wagtail, meadow pipit, tree pipit), muscicapid (wheatear, European stonechat)		Europe, North Africa
<i>R. pomezanzevi</i>	Lagomorpha: leporid (desert hare, tolai hare)		Central Asia
<i>R. praetextatus</i>	Artiodactyla: bovid (cattle, buffalo, sheep, goat, Coke's hartebeest, blue wildebeest, topi, dorcas gazelle, Grant's gazelle, Thomson's gazelle, steenbok, eland, nyala, bushbuck, greater kudu, common duiker, red forest duiker, sable antelope, gemsbok, Bohor reedbuck), camelid (camel), giraffid (giraffe), hippopotamid (hippopotamus), suid (pig, boar, bushpig, forest hog, warthog); Perissodactyla: equid (horse, donkey, Burchell's zebra, Grevy's zebra), rhinocerotid (black rhinoceros); Proboscidea: elephantid (African elephant); Eulipotyphla: erinaceid (Somali hedgehog); Tubulidentata: orycteropid (aardvark); Pholidota: manid (Temminck's ground pangolin); Lagomorpha: leporid (Cape hare); Rodentia: hystricid (crested porcupine), murid (four-striped grass mouse, striped grass rat, swamp rat, Nile rat, black-tailed gerbil), sciurid (unstriped ground squirrel); Carnivora: canid (dog, hunting dog, side-striped jackal, black-backed jackal, golden jackal, bat-eared fox), felid (cat, African wildcat, caracal, serval, lion, leopard, cheetah), herpestid (white-tailed mongoose, marsh mongoose), hyaenid (striped hyena, spotted hyena, aardwolf), viverrid (African civet, small spotted genet); Primates: cercopithecid (vervet monkey, baboon), hominid (human); Galliformes: phasianid (chicken) (3-host tick)	irritation, paralysis (vector for Nairobi sheep disease)	Africa
<i>R. pravus</i> (syn. <i>R. neavi</i>)	Artiodactyla: bovid (cattle, buffalo, sheep, goat, Bright's gazelle, Grant's gazelle, Soemmerring's gazelle, Thomson's gazelle, Waller's gazelle, harnessed bushbuck, waterbuck, sitatunga, kob, silver dik-dik, Kirk's dik-dik, Gunther's dik-dik, common duiker,		Africa

	<p>bay duiker, red forest duiker, yellow-backed duiker, eland, gerenuk, impala, greater kudu, lesser kudu, nyala, gerenuk, oribi, fringe-eared oryx, East African oryx, korrigum, southern reedbeek, Bohor reedbeek, Coke's hartebeest, Jackson's hartebeest, Lichtenstein's hartebeest, Roosevelt's hartebeest, blue wildebeest, sable antelope, roan antelope, klipspringer, steenbok, gemsbok, dibatag, suni, steenbok, tsessebe), camelid (camel), giraffid (giraffe, Masai giraffe), suid (pig, red river hog, warthog);</p> <p>Perissodactyla: equid (horse, donkey, Burchell's zebra), rhinocerotid (black rhinoceros); Proboscidea: elephantid (African elephant); Eulipotyphla: erinacid (four-toed hedgehog, Sudanese hedgehog); Tubulidentata: orycteropid (aardvark); Lagomorpha: leporid (scrub hare, red rock hare, European hare, Somalia hare, Cape hare, African savanna hare, Bunyoro rabbit); Macroscelidea: macroscelidid (dusky-footed elephant shrew, rufous elephant shrew, western rock elephant shrew, short-snouted elephant shrew, bushveld elephant shrew, four-toed elephant shrew); Hyracoidea: procaviid (rock hyrax); Rodentia: dipodid (jerboa), hystricid (Cape porcupine), murid (Namaqua rock rat, red rock rat, red veld rat, whistling rat, southern multimammate mouse, Natal multimammate mouse, field mouse), sciurid (unstriped ground squirrel, Cape ground squirrel, Smith's bush squirrel), thryonomyid (greater cane eared fox), felid (lion, leopard), herpestid (yellow mongoose), hyaenid (spotted hyena, striped hyena), viverrid (genet); Chiroptera: megadermatid (heart-nosed bat), vespertilionid (banana bat); Primates: cercopithecid (yellow baboon, olive baboon), hominid (human); Accipitriformes: accipitrid (great sparrowhawk), sagittariid (secretary bird); Charadriiformes: glareolid (three-banded courser); Otidiformes: otidid (black-bellied bustard, kori bustard); Passeriformes: hirundinid (banded martin), laniid (telephonus shrike), malaconotid (tropical boubou, southern tchagra); Struthioniformes: struthionid (ostrich); Suliformes: phalacrocoracid (reed cormorant); Testudines (unspecified tortoise)</p> <p>(3-host cycle)</p>		
<p><i>R. pulchellus</i> (ivory-ornamented tick, zebra tick, yellow-backed tick)</p>	<p>Artiodactyla: bovid (cattle, buffalo, forest buffalo, sheep, goat, eland, impala, gnu, topi, dibatag, gemsbok, hartebeest, red hartebeest, Coke's hartebeest, blue wildebeest, black wildebeest, blackbuck, waterbuck, bushbuck, Grant's gazelle, Soemmerring's gazelle, Speke's gazelle, Thomson's gazelle, gerenuk, fringe-eared oryx, East African oryx, steenbok, lesser kudu, greater kudu, silver dik-dik, Gunther's dik-dik, red forest duiker, sable antelope), camelid (camel), giraffid (giraffe), suid (pig, bushpig, warthog);</p> <p>Perissodactyla: equid (horse, donkey, mule, plains zebra, Burchell's zebra, Grant's zebra), rhinocerotid (black rhinoceros); Proboscidea: elephantid (African elephant); Eulipotyphla: erinacid (Somali hedgehog); Tubulidentata: orycteropid (aardvark); Lagomorpha: leporid (scrub hare, savannah hare, Cape hare, Ethiopian hare); Macroscelidea: macroscelidid (four-toed elephant shrew); Rodentia: caviid (guinea pig), murid (spiny mouse, black rat, Angoni vlei rat, southern multimammate mouse, black-tailed gerbil), sciurid (Huet's bush squirrel); Tubulidentata: orycteropodid (aardvark); Carnivora: canid (dog, hunting dog, black-backed jackal, bat-eared fox), felid (African wildcat, cheetah, leopard, lion), herpestid (slender mongoose, white-tailed mongoose), hyaenid (striped hyena, aardwolf), viverrid (small spotted genet, large spotted genet); Chiroptera: rhinopomatid (lesser mouse-tailed bat), vespertilionid (Cape serotine); Primates: cercopithecid (yellow baboon), hominid (human); Galliformes: phasianid (double-spurred francolin, yellow-necked francolin); Struthioniformes: struthionid (ostrich)</p> <p>(3-host cycle)</p>	<p>trauma, irritation (vector for theileriosis, babesiosis, trypanosomiasis, rickettsioses, Crimean-Congo haemorrhagic disease, Nairobi sheep disease, kajiado, kismayo, dugbe, Barbur)</p>	<p>Africa</p>
<p><i>R. (Rhipicephalus)</i></p>	<p>Artiodactyla: bovid (cattle, sheep, argali, goat, goitered gazelle,</p>		<p>Central Asia</p>

<i>pumilio</i>	saiga antelope), camelid (camel), cervid (red deer, roe deer), suid (pig); Perissodactyla: equid (horse, donkey, onager); Eulipotyphla: erinaceid (long-eared hedgehog, Brandt's hedgehog); Lagomorpha: leporid (rabbit, European hare, desert hare, mountain hare, tolai hare, Yarkand hare), ochotonid (Pallas's pika); Rodentia: cricetid (flat-headed vole, narrow-headed vole, European snow vole, European water vole, Eversmann's hamster, European hamster, yellow steppe lemming), dipodid (small five-toed jerboa, northern three-toed jerboa), murid (house mouse, wood mouse, Black Sea field mouse, midday jird, Libyan jird, Tamarisk jird, great gerbil), sciurid (red-cheeked ground squirrel, yellow ground squirrel, little ground squirrel, relict ground squirrel, long-clawed ground squirrel); Carnivora: canid (dog, wolf, golden jackal, red fox), felid (cat, African wildcat), mustelid (European badger, least weasel, steppe polecat, marbled polecat); Primates: hominid (human); Accipitriformes: accipitrid (tawny eagle, shikra, black kite); Columbiformes: columbid (European turtle dove); Coraciiformes: coraciid (European roller); Galliformes: phasianid (grey partridge); Otidiformes: otidid (great bustard, little bustard); Passeriformes: acrocephalid (Blyth's reed warbler), alaudid (Eurasian skylark), corvid (rook, Eurasian magpie), laniid (red-tailed shrike, woodchat shrike), motacillid (white wagtail), muscicapid (isabelline wheatear, common nightingale, African stonechat), passerid (house sparrow), sturnid (common starling), sylviid (lesser whitethroat); Serpentes: viperid (Amur pit viper) (3-host cycle)		
<i>R. (Rhipicephalus) pusillus</i>	Artiodactyla: cervid (red deer), suid (pig); Eulipotyphla: erinaceid (Algerian hedgehog), soricid (greater white-toothed shrew); Lagomorpha: leporid (European rabbit); Rodentia: cricetid (muskrat), glirid (garden dormouse), murid (house mouse, orchard rat, Algerian mouse, brown rat); Carnivora: canid (dog, red fox, Iberian fox), felid (Eurasian lynx, Iberian lynx), mustelid (ferret, weasel, European badger), viverrid (genet); Primates: hominid (human); Strigiformes: strigid (unspecified owl) (3-host cycle)	(vector for rickettsiosis)	Eurasia
<i>R. ramachandrai</i>	Rodentia: murid (Indian gerbil, Indian desert gerbil, lesser bandicoot rat, sand-coloured rat, soft-furred field rat), sciurid (jungle striped squirrel); Carnivora: canid (dog, Bengal fox) (3-host cycle)		India
<i>R. reichenowi</i>	Artiodactyla: bovid (cattle, buffalo, waterbuck, oribi, steenbok, common duiker, nyala, Lichtenstein's hartebeest), suid (warthog, red river hog); Perissodactyla: equid (plains zebra); Tubulidentata: orycteropodid (aardvark); Rodentia: hystricid (Cape porcupine, Ethiopian crested porcupine); Carnivora: canid (side-striped jackal), felid (lion); Primates: hominid (human)		Africa
<i>R. rhipicephali</i>	Primates: hominid (human)		Africa
<i>R. (Rhipicephalus) rossicus</i>	Artiodactyla: bovid (cattle, water buffalo, sheep, goat, goitered gazelle), camelid (camel), cervid (red deer), suid (pig); Perissodactyla: equid (horse); Lagomorpha: leporid (European rabbit, mountain hare, European hare), ochotonid (Pallas's pika); Eulipotyphla: erinaceid (long-eared hedgehog, European hedgehog); Rodentia: cricetid (common vole, social vole, bank vole, European water vole, European hamster, Ciscaucasian hamster, grey dwarf hamster), dipodid (great jerboa), glirid (forest dormouse), murid (house mouse, yellow-necked mouse, wood mouse, Black Sea field mouse, brown rat, Tamarisk jird), sciurid (little ground squirrel, speckled ground squirrel, European ground squirrel, bobak marmot), smynthid (southern birch mouse); Carnivora: canid (dog, wolf, golden jackal, red fox), felid (cat, jaguar), mustelid (steppe polecat, marbled polecat, least weasel); Chiroptera: vespertilionid (serotine bat); Primates: hominid (human); Accipitriformes: accipitrid (common buzzard, western marsh harrier); Galliformes: phasianid (common quail);	(vector for tularemia, Crimean-Congo haemorrhagic fever and West Nile virus and possibly piroplasmosis and Q fever)	Eurasia

	<p>Passeriformes: alaudid (crested lark, Mediterranean short-toed lark), corvid (Eurasian magpie), emberizid (Ortolan bunting), fringillid (hawfinch), muscicapid (bluethroat), passerid (Eurasian tree sparrow); Sauria: lacertid (sand lizard, European green lizard); Testudines: testudinid (Greek tortoise)</p> <p>(3-host cycle)</p>		
<p><i>R. (Rhipicephalus) sanguineus</i> (syn. <i>R. beccarii</i>, <i>brevicollis</i>, <i>limbatus</i>, <i>macropis</i>, <i>punctatissimus</i>, <i>rubicundus</i>, <i>rutilus</i>, <i>secundus</i>, <i>siculus</i>, <i>stigmaticus</i>, <i>sulcatus</i>) (brown dog tick, kennel tick)</p>	<p>Artiodactyla: bovid (cattle, zebu, buffalo, forest buffalo, water buffalo, sheep, Asiatic mouflon, goat, chamois, roan antelope, sable antelope, oribi, common eland, kob, impala, red hartebeest, Lichtenstein's hartebeest, common duiker, bay duiker, Maxwell's duiker, red forest duiker, waterbuck, southern reedbuck, korrigum, dama gazelle, dorcas gazelle, red-fronted gazelle, goitered gazelle, Arabian gazelle, Grant's gazelle, Thomson's gazelle, kudu, greater kudu, sitatunga, lechwe, klipspringer, fringe-eared oryx, gemsbok, steenbok, Bohor reedbuck, saiga antelope, harnessed bushbuck, kongoni, Gunther's dik-dik), camelid (dromedary, Bactrian camel), cervid (white-tailed deer, fallow deer), giraffid (giraffe, okapi), suid (pig, wild boar, red river hog, desert warthog, Philippine warty pig), tayassuid (peccary); Perissodactyla: equid (horse, donkey, mule, plains zebra), rhinocerotid (black rhinoceros), tapirid (South American tapir); Proboscidea: elephantid (elephant); Didelphimorphia: didelphid (white-eared opossum); Lagomorpha: leporid (Egyptian hare, Ethiopian hare, Togo hare, scrub hare, desert hare, mountain hare, grass hare, Cape hare, European hare, Indian hare, tolai hare, African savanna hare, European rabbit, Bunyoro rabbit, black-tailed jackrabbit, Jameson's red rock hare, common tapeti); Eulipotyphla: erinaceid (long-eared hedgehog, collared hedgehog, four-toed hedgehog, desert hedgehog, European hedgehog, northern white-breasted hedgehog, North African hedgehog, South African hedgehog, Sudanese hedgehog), soricid (greater white-toothed shrew, Asian house shrew); Macroscelidea: macroscelidid (four-toed elephant shrew, rufous elephant shrew, North African elephant shrew); Tubulidentata: orycteropodid (aardvark); Hyracoidea: procaviid (rock hyrax, yellow-spotted rock hyrax); Pholidota: manid (pangolin, Chinese pangolin); Pilosa: bradypodid (pale-throated sloth), myrmecophagid (northern tamandua, southern tamandua); Rodentia: caviid (capybara, guinea pig, Brazilian guinea pig, Patagonian mara), cricetid (common vole, silver mountain vole, social vole, Gunther's vole, grey dwarf hamster, European hamster, northern mole vole, meadow mouse), ctenodactylid (common gundi), dipodid (four-toed jerboa, greater Egyptian jerboa), hystricid (crested porcupine, Indian crested porcupine), murid (brown rat, black rat, Turkestan rat, short-tailed bandicoot rat, fat sand rat, unicoloured rice rat, yellow-breasted rat, African grass rat, Abyssinian grass rat, house mouse, Asian house mouse, fat mouse, typical striped grass mouse, four-striped grass mouse, yellow-necked mouse, steppe mouse, wood mouse, Tullberg's soft-furred mouse, eastern spiny mouse, Cairo spiny mouse, great gerbil, bushy-tailed gerbil, Anderson's gerbil, Cheesman's gerbil, Kemp's gerbil, lesser Egyptian gerbil, greater Egyptian gerbil, North African gerbil, Tarabul's gerbil, midday jird, Libyan jird, Shaw's jird, Sundevall's jird, Tamarisk jird, gracile tateril), nesomyid (Gambian pouched rat), petetid (springhare), sciurid (marmot, red squirrel, Gambian sun squirrel, Congo rope squirrel, long-clawed ground squirrel), thryonomyid (greater cane rat); Carnivora: canid (dog, African wild dog, wolf, variegated wolf, African wolf, coyote, golden jackal, silver jackal, black-backed jackal, side-striped jackal, bat-eared fox, crab-eating fox, red fox, pale fox, fennec fox, hoary fox, Cape fox, Ruppell's fox), felid (cat, marbled cat, fishing cat, African wildcat, jungle cat, cougar, lynx, serval, leopard, lion, jaguar, tiger, cheetah, caracal), herpestid (common slender mongoose, white-tailed mongoose, marsh mongoose, Egyptian mongoose), hyaenid (spotted hyena,</p>	<p>trauma, irritation, toxicosis, paralysis (vector for ehrlichiosis, babesiosis, hepatozoonosis, anaplasmosis, rickettsioses, Boutonneuse fever, Rocky Mountain spotted fever, Nairobi sheep disease)</p>	<p>worldwide</p>

	<p>striped hyena, brown hyena, aardwolf), mustelid (striped polecat, steppe polecat, marbled polecat, European polecat, European badger, lesser grison), procyonid (South American coati), ursid (sloth bear, brown bear), viverrid (common genet, rusty-spotted genet, Cape genet, African civet); Chiroptera: phyllostomid (common vampire bat); Primates: callitrichid (black-tailed marmoset, pied tamarin, Geoffroy's tamarin), cercopithecoid (olive baboon, grivet, greater spot-nosed monkey, red monkey, patas monkey), galagid (brown greater galago, Senegal bushbaby, Zanzibar bushbaby), hominid (human); Accipitriformes: accipitrid (tawny eagle, martial eagle, grasshopper buzzard, long-legged buzzard, white-tailed hawk, black kite, hooded vulture, white-backed vulture, cinerous vulture, Griffon vulture, European honey buzzard), sagittariid (secretary bird); Bucerotiformes: bucerotid (white-thighed hornbill), upupid (Eurasian hoopoe);</p> <p>Columbiformes: columbid (rock dove, European turtle dove); Coraciiformes: coraciid (European roller), meropid (European bee-eater); Charadriiformes: burhinid (Eurasian stone curlew); Ciconiiformes: ciconiid (African openbill, Marabou stork, Abdim's stork); Coliiformes: coliid (mousebird); Columbiformes: columbid (ringed pigeon); Cuculiformes: cuculid (African emerald cuckoo, Senegal coucal); Falconiformes: falconid (common kestrel); Galliformes: phasianid (chicken, common quail, rock partridge, grey partridge); Otidiformes: otidid (white-bellied bustard, black-bellied bustard, greater bustard, lesser bustard, Arabian bustard, Kori bustard, Denham's bustard); Passeriformes: alaudid (red-capped lark, crested lark, woodlark, Eurasian skylark, Calandra lark), corvid (raven, rook, western jackdaw, Eurasian magpie), fringillid (common chaffinch), hirundinid (sand martin), icterid (Chopi blackbird), motacillid (white wagtail), muscicapid (western black-eared wheatear, isabelline wheatear, common redstart), passerid (house sparrow, Spanish sparrow), sturnid (common starling), thraupid (bananaquit); Pelecaniformes: scopid (hamerkop), threskiornithid (Hadada ibis); Pteroclitiformes: pteroclid (black-bellied sandgrouse); Strigiformes: strigid (little owl, striped owl, short-eared owl, Eurasian eagle-owl, Pharaoh eagle-owl); Struthioniformes: struthionid (ostrich, Masai ostrich, Somali ostrich); Serpentes: boid (boa), viperid (puff adder); Crocodylia: crocodylid (spectacled caiman); Testudines: testudinid (Greek tortoise)</p> <p>(3-host cycle)</p>		
<p><i>R. (Pomerantzevia) sculpturatus</i></p>	<p>host unknown, collected from environment</p>		<p>Asia</p>
<p><i>R. (Rhipicephalus) schulzei</i></p>	<p>Artiodactyla: bovid (cattle, sheep, goat, goitered gazelle, saiga antelope), camelid (camel), cervid (red deer), suid (pig); Perissodactyla: equid (horse, donkey); Lagomorpha: leporid (European hare, tolai hare), ochotonid (Pallas's pika); Eulipotyphla: erinaceid (long-eared hedgehog), soricid (lesser white-toothed shrew); Rodentia: cricetid (common vole, flat-headed vole, European water vole, northern mole vole, social vole, grey dwarf hamster, European hamster, Eversmann's hamster, steppe lemming), dipodid (great jerboa, small five-toed jerboa, northern three-toed jerboa, thick-tailed three-toed jerboa, dwarf fat-tailed jerboa), glirid (forest dormouse), murid (house mouse, striped field mouse, Eurasian harvest mouse, wood mouse, midday jird, Libyan jird, Tamarisk jird, great gerbil), sciurid (little ground squirrel, red-cheeked ground squirrel, large-toothed ground squirrel, long-tailed ground squirrel, yellow ground squirrel, russet ground squirrel, Tien Shan ground squirrel, European ground squirrel, long-clawed ground squirrel, bobak marmot), sminthid (southern birch mouse); Carnivora: canid (dog, wolf, golden jackal, red fox), felid (cat, lynx), mustelid (least weasel, European badger, steppe polecat, marbled polecat); Primates: hominid (human);</p>		<p>Europe, Africa</p>

	Accipitriformes: accipitrid (steppe eagle, long-legged buzzard); Serpentes: colubrid (blotched rat snake) (3-host cycle)		
<i>R. sculptus</i>	Artiodactyla: bovid (buffalo, roan antelope, sable antelope, hartebeest, waterbuck), giraffid (giraffe), suid (pig); Perissodactyla: equid (Burchell's zebra); Carnivora: canid (dog) (3-host cycle)		Africa, North America
<i>R. senegalensis</i>	Artiodactyla: bovid (cattle, buffalo, sheep, goat, bongo, kanki, eland, common duiker, black duiker, bay duiker, red-flanked duiker, Maxwell's duiker, blue wildebeest, Lichtenstein's hartebeest, roan antelope, royal antelope, oribi, harnessed bushbuck, kob, Bohor reedbuck), giraffid (giraffe), suid (pig, red river hog, desert warthog); Perissodactyla: equid (horse), rhinocerotid (black rhinoceros); Proboscidea: elephantid (African elephant); Macroscelidea: macroscelidid (elephant shrew); Eulipotyphla: soricid (white-toothed shrew); Pholidota: manid (giant ground pangolin); Lagomorpha: leporid (Cape hare); Tubulidentata: orycteropodid (aardvark); Rodentia: herpestid (banded mongoose), hystricid (crested porcupine, African brush-tailed porcupine), murid (typical striped grass mouse, soft-furred rat, striped grass rat, gerbil), nesomyid (giant pouched rat), sciurid (African striped squirrel, Cuvier's tree squirrel), thryonomyid (greater cane rat); Carnivora: canid (dog, hunting dog, golden jackal), felid (lion, leopard), herpestid (banded mongoose), viverrid (small spotted genet, African civet); Primates: cercopithecid (spot-nosed monkey), hominid (human); Anseriformes: anatid (white-faced whistling duck) (3-host cycle)		Africa
<i>R. serranoi</i>	Artiodactyla: bovid (klipspringer); Hyracoidea: procaviid (rock hyrax, yellow-spotted rock hyrax, tree hyrax); Carnivora: felid (leopard)		Africa
<i>R. simpsoni</i>	Artiodactyla: bovid (buffalo, black duiker, red-flanked duiker, Maxwell's duiker, bushbuck, royal antelope, kob), suid (red river hog); Rodentia: hystricid (tufted-tailed porcupine, African brush-tailed porcupine, crested porcupine), murid (marsh rat, African grass rat), nesomyid (Gambian pouched rat), thryonomyid (greater cane rat, lesser cane rat); Carnivora: felid (leopard), viverrid (African civet); Primates: cercopithecid (Skye's monkey); Passeriformes: acrocephalid (African yellow warbler), viduid (village indigobird) (3-host cycle)		Africa
<i>R. (Rhipicephalus) simus</i> (syn. <i>R. longoides</i> , <i>perpulcher</i> , <i>shipleyi</i>) (glossy brown tick)	Artiodactyla: bovid (cattle, zebu, buffalo, sheep, goat, korrigum, dikdik, Gunther's dikdik, common duiker, red-flanked duiker, common eland, giant eland, Grant's gazelle, Thomson's gazelle, greater kudu, oribi, southern reedbuck, bohor reedbuck, bushbuck, harnessed bushbuck, waterbuck, roan antelope, sable antelope, steenbok, tiang, blue wildebeest, impala, nyala, lechwe, red hartebeest, Lichtenstein's hartebeest, bongo, topi, gemsbok, kob, klipspringer), camelid (dromedary), giraffid (giraffe), hippopotamid (hippopotamus), suid (pig, bushpig, forest hog, red river hog, South African river hog, common warthog, desert warthog); Perissodactyla: equid (horse, donkey, mule, plains zebra, Burchell's zebra), rhinocerotid (black rhinoceros, white rhinoceros); Proboscidea: elephantid (African elephant); Eulipotyphla: erinaceid (long-eared hedgehog, South African hedgehog), soricid (white-toothed shrew); Tubulidentata: orycteropodid (aardvark); Pholidota: manid (Temminck's ground pangolin); Lagomorpha: leporid (rabbit, Cape hare, African savanna hare, scrub hare); Macroscelidea: macroscelidid (short-snouted elephant shrew, four-toed elephant shrew, black-and-rufous elephant shrew); Hyracoidea: procaviid (rock hyrax); Rodentia: caviid (guinea pig), glirid (woodland dormouse, spectacled dormouse), hystricid (crested porcupine, Cape	trauma, irritation, paralysis (vector for babesiosis, anaplasmosis, rickettsioses)	Africa

	<p>porcupine), murid (Abyssinian grass rat, African swamp rat, Karoo rat, groove-toothed swamp rat, rock rat, red veld rat, bush vlei rat, tropical vlei rat, Angoni vlei rat, South African vlei rat, Sloggett's vlei rat, gray brush-furred rat, African soft-furred rat, African grass rat, Namaqua rock rat, whistling rat, tree rat, house mouse, single-striped mouse, typical striped grass mouse, four-striped grass mouse, buffoon striped grass mouse, Griselda's striped grass mouse, Cameroon soft-furred mouse, Jackson's soft-furred mouse, Tullberg's soft-furred mouse, Namaqua rock mouse, southern multimammate mouse, Natal multimammate mouse, eastern spiny mouse, Cairo spiny mouse, African pygmy mouse, savannah gerbil, bushveld gerbil, Cape gerbil, Kemp's gerbil, savannah gerbil, king jird), nesomyid (South African pouched rat), pedetid (South African springhare), sciurid (striped ground squirrel, Cape ground squirrel, African striped squirrel, Kuhl's tree squirrel, Smith's bush squirrel), thryonomyid (greater cane rat); Carnivora: canid (dog, hunting dog, African wild dog, variegated wolf, African wolf, golden jackal, side-striped jackal, black-backed jackal, Cape fox, bat-eared fox), felid (cat, African wildcat, cheetah, leopard, lion, serval, caracal, tiger), herpestid (marsh mongoose, water mongoose, yellow mongoose, banded mongoose, white-tailed mongoose, meerkat), hyaenid (spotted hyena, striped hyena, brown hyena, aardwolf), mustelid (ratel, honey badger), viverrid (African civet, common genet, rusty-spotted genet, Cape genet); Chiroptera: rhinolophid (lesser horseshoe bat); Primates: cercopithecid (olive baboon, king colobus), galagid (brown greater galago), hominid (human); Galliformes: numidid (helmeted guineafowl), phasianid (chicken); Passeriformes: cisticolid (green-capped eremomela, rattling cisticola), estrildid (blue waxbill), malaconotid (black-backed puffback); Pelecaniformes: phalacrocoracid (reed cormorant); Sauria: scincid (African striped skink); Testudines: testudinid (Greek tortoise)</p> <p>(3-host cycle)</p>		
<i>R. supertritus</i> (syn. <i>R. coriaceus</i>)	<p>Artiodactyla: bovid (cattle, buffalo, goat, eland, giant eland, greater kudu, Coke's hartebeest, Lichtenstein's hartebeest, sable antelope, roan antelope, oribi, greater kudu, common eland, giant eland), giraffid (giraffe), suid (desert warthog); Perissodactyla: equid (horse, plains zebra, Burchell's zebra), rhinocerotid (rhinoceros); Hyracoidea: procaviid (rock hyrax); Rodentia: hystricid (South African porcupine); Carnivora: canid (dog, hunting dog), felid (lion), hyaenid (spotted hyena, striped hyena); Primates: hominid (human)</p>		Africa
<i>R. tetracornus</i>	<p>Eulipotyphla: soricid (Chinese mole shrew); Rodentia: cricetid (unspecified), murid (red spiny rat, Himalayan field rat, Gairdner's shrewmouse)</p>		Asia
<i>R. theileri</i>	<p>Artiodactyla: bovid (cattle, sheep); Eulipotyphla: erinaceid (South African hedgehog); Pholidota: manid (Temminck's ground pangolin); Rodentia: murid (Namaqua rock mouse), sciurid (Cape ground squirrel, Smith's bush squirrel); Carnivora: canid (dog, black-backed jackal, Cape fox), herpestid (yellow mongoose, meerkat)</p> <p>(3-host cycle)</p>		Africa
<i>R. tricuspis</i> (syn. <i>R. glyphis</i> , <i>lunulatus</i>)	<p>Artiodactyla: bovid (cattle, zebu, buffalo, forest buffalo, sheep, goat, oribi, tiang, roan antelope, sable antelope, hartebeest, red hartebeest, Jackson's hartebeest, Lelwel hartebeest, Lichtenstein's hartebeest, blue wildebeest, steenbok, korrigum, common duiker, red forest duiker, waterbuck, bushbuck, southern reedbuck, impala, gemsbok, greater kudu, Grant's gazelle, common eland, nyala, kob, tiang, kongoni, Sharpe's grysbok), camelid (camel), giraffid (giraffe), suid (pig, bushpig, forest hog, red river hog, warthog); Perissodactyla: equid (horse, plains zebra, Burchell's zebra), rhinocerotid (black rhinoceros); Eulipotyphla: erinaceid (South African hedgehog); Tubulidentata: orycteropodid (aardvark);</p>		Africa

	Lagomorpha: leporid (rabbit, scrub hare, Cape hare); Rodentia: hystricid (crested porcupine), murid (four-striped grass mouse, Natal multimammate mouse, gray brush-furred rat, Namaqua rock rat), pedetid (South African springhare); Carnivora: canid (dog, African wild dog, Cape fox, side-striped jackal, black-backed jackal, bat-eared fox, Cape fox), felid (caracal, lion, leopard, serval), hyaenid (brown hyena, aardwolf), viverrid (African civet); Chiroptera: pteropodid (unspecified flying fox); Primates: hominid (human); Anseriformes: anatid (white-faced whistling duck); Gruiformes: rallid (red-knobbed coot); Otidiformes: otidid (black bustard, white-bellied bustard); Strigiformes: strigid (barn owl) (3-host cycle)		
<i>R. (Rhipicephalus) turanicus</i>	Artiodactyla: bovid (cattle, buffalo, water buffalo, sheep, argali, goat, goitered gazelle, Grant's gazelle, Thomson's gazelle, eland, greater kudu, common duiker, roan antelope, gemsbok, lechwe, saiga antelope), camelid (dromedary, camel), cervid (red deer, Bactrian deer), suid (pig, warthog); Perissodactyla: equid (horse, donkey, mule, Burchell's zebra, onager); Tubulidentata: orycteropid (aardvark); Lagomorpha: leporid (European rabbit, Corsican hare, European hare, Indian hare, Cape hare, scrub hare, desert hare, tolai hare); Eulipotyphla: erinaceid (northern white-breasted hedgehog, long-eared hedgehog, European hedgehog, Brandt's hedgehog, Indian hedgehog), soricid (greater white-toothed shrew, common European white-toothed shrew, Asian house shrew); Rodentia: cricetid (common vole, social vole, Afghan vole, Gunther's vole, European snow vole, European water vole, European hamster, grey dwarf hamster), dipodid (William's jerboa), glirid (European edible dormouse), hystricid (Indian crested porcupine), murid (house mouse, yellow-necked mouse, wood mouse, broad-toothed mouse, black rat, brown rat, Turkestan rat, lesser bandicoot rat, short-tailed bandicoot rat, great gerbil, Indian gerbil, Indian desert gerbil, Libyan jird, Persian jird, Tristram's jird, Tamarisk jird), sciurid (yellow ground squirrel, long-clawed ground squirrel, Indian palm squirrel, long-tailed marmot); Carnivora: canid (dog, wolf, red fox, corsac fox, Karaganka fox, golden jackal, side-striped jackal, black-backed jackal, red fox, bat-eared fox), felid (cat, jungle cat, black-footed cat, African wildcat, caracal, serval, cheetah, leopard, snow leopard, lion), herpestid (Egyptian mongoose), hyaenid (brown hyena, aardwolf), mustelid (Eurasian badger, steppe polecat, marbled polecat, least weasel, ferret), ursid (brown bear), viverrid (African civet, genet); Primates: cercopithecid (vervet monkey), hominid (human); Accipitriformes: accipitrid (short-toed snake-eagle, Wahlberg's eagle, black kite, white-headed vulture), sagittariid (secretary bird); Caprimulgiformes: caprimulgid (European nightjar); Charadriiformes: burhinid (Cape dikkop); Ciconiiformes: ciconiid (Marabou stork); Columbiformes: columbid (dove); Galliformes: phasianid (chicken); Otidiformes: otidid (black bustard, Denham's bustard); Passeriformes: alaudid (crested lark), corvid (rook), sturnid (rosy starling); Piciformes: picid (white-winged woodpecker); Strigiformes: strigid (marsh owl, Eurasian eagle-owl); Struthioniformes: struthionid (ostrich); Sauria: lacertid (Caucasus emerald lizard, multi-ocellated racerunner); Serpentes: viperid (puff adder) (3-host cycle)	(vector for babesiosis, theileriosis, hepatozoonosis, rickettsiosis)	Africa, Eurasia
<i>R. walkerae</i>	Artiodactyla: giraffid (giraffe)		Africa
<i>R. warburtoni</i>	Artiodactyla: bovid (cattle, sheep, goat, gemsbok); Lagomorpha: leporid (scrub hare, Cape hare, Smith's red rock rabbit); Macroscelidea: macroscelidid (rock elephant shrew); Carnivora: canid (dog), felid (African wildcat); Rodentia: murid (Namaqua rock mouse), pedetid (springhare); Primates: hominid (human); Passeriformes: alaudid (lark) (3-host cycle)	irritation, paralysis	Africa

<i>R. zambeziensis</i> (lowveld brown ear tick)	Artiodactyla: bovid (cattle, buffalo, goat, impala, greater kudu, blue wildebeest, klipspringer, steenbok, eland, nyala, bushbuck, common duiker, roan antelope, sable antelope), giraffid (giraffe), suid (bushpig, warthog); Perissodactyla: equid (horse, Burchell's zebra), rhinocerotid (white rhinoceros); Lagomorpha: leporid (scrub hare, Cape hare); Rodentia: hystricid (South African porcupine), pedetid (springhare), sciurid (Smith's bush squirrel); Tubulidentata: orycteropodid (aardvark); Carnivora: canid (dog, hunting dog, black-backed jackal), felid (cat, cheetah, lion, leopard), herpestid (slender mongoose, marsh mongoose, banded mongoose, white-tailed mongoose), hyaenid (brown hyena, spotted hyena), viverrid (African civet); Primates: cercopithecoid (vervet monkey), hominid (human); Galliformes: numidid (helmeted guinea fowl), phasianid (chicken) (3-host cycle)	trauma, irritation, anaemia (plus vectors for theileriosis, ehrlichiosis)	Africa
<i>R. ziemanni</i> (syn. <i>R. cuneatus</i>)	Artiodactyla: bovid (cattle, zebu, buffalo, forest buffalo, sheep, goat, bongo, bushbuck, common duiker, bay duiker, blue duiker, black duiker, zebra duiker, yellow-backed duiker, red-flanked duiker, banded duiker, Maxwell's duiker, grysbok, oribi, giant eland, royal antelope), cervid (water chevrotain), giraffid (okapi), suid (pig, red river hog, warthog); Perissodactyla: rhinocerotid (black rhinoceros); Proboscidea: elephantid (African elephant); Hyracoidea: procaviid (rock hyrax, tree hyrax); Rodentia: hystricid (crested porcupine, tufted-tailed porcupine, African brush-tailed porcupine), thryonomyid (greater cane rat); Carnivora: canid (dog, jackal), felid (leopard, serval), mustelid (otter), viverrid (African civet); Primates: cercopithecoid (baboon), hominid (human)		Africa
<i>R. zumpti</i>	Artiodactyla: bovid (cattle, buffalo, Lichtenstein's hartebeest, steenbok, waterbuck, nyala, oribi, greater kudu, common duiker), suid (bushpig, red river hog, desert warthog); Perissodactyla: equid (plains zebra, Burchell's zebra), rhinocerotid (black rhinoceros); Rodentia: hystricid (Cape porcupine); Carnivora: canid (dog), felid (lion), viverrid (African civet); Primates: hominid (human) (3-host cycle)		Africa

Parasite morphology: *Rhipicephalus* spp. (including *Boophilus* spp.) form 4 different types of morphological stages during their development: eggs; larvae; nymphs; and adults. Eggs are small orange-brown ovoid stages measuring around 0.4 mm in diameter. Larvae have ovate flattened bodies measuring 0.5-0.6 mm long. They are covered by toughened cuticles that are usually pale cream-brown in colour with a slightly darker posterior portion. They have conspicuous anterior heads (capitulum) with pointy palps flanking the central protruding mouthparts. The posterior sac-like body (idiosoma) has a hard chitinized plate (scutum) covering the antero-dorsal surface. Larvae are characterized by the possession of 3 pairs of long pale legs attached to the anterior ventral idiosoma, but they lack respiratory openings (stigmata) and tracheae. Nymphs have dorso-ventrally flattened bodies that are oval-elliptical in dorsal profile and measure 1.0-1.4 mm in length. They have a conspicuous orange-brown to red-brown dorsal scutum and the posterior idiosoma is usually cream-grey, sometimes with white patches. The anterior capitulum is visible and contains a pair of pointy palps projecting forwards. Nymphs typically have 8 long pale legs tipped with claws, and they possess a pair of lateral respiratory stigmata surrounded by oval plates. Adult ticks have ovate-pyriform bodies that are tapered anteriorly, flattened ventrally but convex dorsally (capable of marked distention during engorgement). Unfed ticks range in length from 2-6 mm, but engorged females may swell up to 8-20 mm long (members of the subgenus *R. (Boophilus)* are typically smaller, ranging from 2-3 mm long when unfed and 6-12 mm when engorged). Adults range in colour from creamy-brown to reddish-brown in colour, and they often darken to grey or brown-black after feeding. They have 2 conspicuous body tagma: a small anterior capitulum (head) visible from above (whereas that of argasids is ventral and not visible) and a larger saccular idiosoma (body). The capitulum comprises the basis capitulum (integumental ring encircling mouthparts) and the gnathosoma (feeding structures with palps, chelicerae and hypostome). The basis capitulum is hexagonal (not triangular, rectangular or pentagonal) and has distinct lateral projections (rounded in the subgenus *R. (Boophilus)*). Female ticks also have clusters of small pores (porose areas) on the dorsal surfaces (involved in waterproofing eggs during oviposition). The mouthparts project forwards and are short being similar in length to the basis capitulum. The palps are sensory structures that move laterally and do not enter the skin when feeding. They are short, often wider than long, and their segments may contain dorsal and lateral ridges (especially in the subgenus *R. (Boophilus)*). The chelicerae are tubular dentate structures that move horizontally to cut flesh forming small pools of blood. The barbed hypostome is inserted into the blood pool to facilitate feeding as well as to aid attachment. A food canal is formed by apposition of the dorsal chelicerae and ventral hypostome allowing blood to be ingested and saliva to be injected. The alimentary tract contains a muscular pharynx (with pharyngeal valve), tubular oesophagus (short tube), large saccular midgut (ventriculus) with lateral diverticula (caeca), short intestine (with excretory Malpighian tubules) leading to the posterior rectal sac. The anus is located ventrally near the midbody and

contains a posterior (metastriate) anal groove, which is difficult to see in members of the subgenus *R. (Boophilus)* (in comparison, the genus *Ixodes* has an anterior (prostriate) anal groove). The idiosoma is covered by a hard waxy cuticle with a distinct sclerotized dorsal plate (scutum). The scutum almost completely covers males (= conscutum) but is confined to a smaller anterior circular-pyiform shield in females. The cuticle may also contain ridges and/or depressions depending on tick species (members of the subgenus *R. (Boophilus)* have 3 longitudinal grooves) as well as tiny surface folds, small punctuations (pores) and numerous setae. The scutum of most *Rhipicephalus* spp. is inornate (without coloured patterns), except for several species (*R. dux*, *humeralis*, *maculatus*, *pulchellus*) which have lighter and darker patches. A pair of simple convex or flat eyes are present on the lateral margins of the scutum, but are difficult to observe in some species. The posterior margin of the idiosoma also bears a series of grooves or indentations (known as festoons) which are present in all species, except those belonging to the subgenus *R. (Boophilus)*. The ventral idiosoma gives rise to 4 pairs of pale cream-yellow legs (without distinct pale rings) which are unequal in size, the second pair being the shortest and the fourth pair being the longest. The legs are well developed and consist of 6 segments (coxae, trochanter, femur, patella (genu), tibia, and tarsus) terminating in a pair of claws with a pad-like pulvillus (pulvillus absent or rudimentary in argasids). A distinctive feature of *Rhipicephalus* spp. is the presence of a pair of large external spurs on coxae I which impart a forked appearance (argasid coxae without spurs). In addition, tarsi IV have ventral hooks, and tarsi I have a dorsal sensory apparatus (Haller's organ) used to detect temperature, chemical and tactile stimuli. Adults possess a pair of respiratory openings with stigmatal plates located behind coxae IV, the plates bearing comma-shaped tail-like protrusions (in comparison, argasids have small stigmata located between coxae III). Adults display considerable sexual dimorphism, including differences in body size (females being larger, especially when engorged), in dorsal scutum size (males being covered, but not females), the presence of ventral plates (in males only) and the presence of specialized porose areas on the basis capitulum (on females only). Females have a single saccular ovary with paired oviducts joined to a common uterus (with accessory glands) opening to a bipartite vagina (cervical region acting as receptaculum seminis to store spermatophores, and vestibular region prolapsing during oviposition). The genital opening (gonopore) is located on the ventral midbody and is U- or V-shaped with marginal folds and an anterior sclerotized flap (genital apron). During oviposition, eggs pass through a special gland (Gene's organ) located near the gnathosoma-ideosoma junction which helps waterproof eggs. Males have pairs of flat sclerotized ventral plates (adanal and accessory plates) located either side of the subterminal anus (absent in the genera *Aponomma*, *Dermacentor*, *Haemaphysalis*, and *Bothriocroton*, but more extensive in the genus *Ixodes*). Adult males have paired tubular testes joined to a common vas deferens (with a multilobed accessory gland) leading to the ejaculatory duct. The gonopore is situated ventrally around the midbody and has an anterior genital apron. Males produce packets of spermatids (spermatophores) which are transferred to the genital operculum of females.

Site of infection: All motile developmental stages (larvae, nymphs, adults) are ectoparasitic on vertebrate hosts, with each successive stage usually found on a different host. Most species have 3-host life-cycles, although a few have 2-host life-cycles and all members of the subgenus *R. (Boophilus)* have one-host life-cycles. Infestations are generally found on multiple host species (broad euryxenous or stenoxenous host ranges), although different tick species tend to have host preferences for particular mammalian, avian and/or reptilian hosts. Infestations have been reported on mammals belonging to 55 families in 16 orders (including ungulates, insectivores, rodents, bats, carnivores, marsupials and primates), birds belonging to 22 passerine families and 28 non-passerine families in 20 orders (including water birds, terrestrial birds, forest birds, and some birds of prey), reptiles belonging to 4 lizard families, 4 snake families, one tortoise family and one crocodile family, and amphibians belonging to one toad family. While all ectoparasitic stages may migrate around the host body, some demonstrate preferred attachment/feeding sites (tissue tropism), particularly for areas of the body that are difficult for the host to groom. In heavy infestations, however, ticks can be found more widely distributed over the body. Larval stages seem to preferentially feed on softer skin found on the forelegs, thighs and flanks of their hosts, while nymphs and adults feed mainly around the belly, shoulders, neck, and when present, the ears, escutcheon, base of the tail, and between the toes.

Pathogenesis: Light infestations may be asymptomatic or subclinical, but heavier infestations may cause mild to severe disease with cutaneous lesions and systemic effects on their hosts. The severity of disease is dependent on numerous factors, including differences in tick pathogenicity (species/strain variations), host susceptibility (physiological and immunological status), the stage, duration and intensity of infestations, and the presence of concomitant infections. *Rhipicephalus* larvae, nymphs and adults are all obligate haematophagous parasites that use their mouthparts to cut into dermal tissues producing pools of blood which are ingested (feeding process known as telmophagy). All stages attach firmly to the skin of their hosts, usually creating a sterile abscess where they feed on lymph and whole blood. The volume of blood ingested by individual feeding stages may be small (< 1 ml), but engorging females may take up significantly more (up to 10 ml per tick). Heavy infestations therefore may cause enough blood loss to manifest as anaemia with prolonged infestations leading to jaundice. Infestations cause focal tissue trauma resulting in cutaneous lesions with irritation, inflammation, erythema, oedema, pruritus, necrosis and haemorrhages as well as haematoma and granuloma formation. During feeding, ticks inject saliva containing many vaso-active compounds, including those with analgesic, anticoagulant, vasodilatory, inflammatory, antigenic and even toxic properties. The glue or cement they use for attachment also contains compounds which stimulate inflammation and granuloma formation. Individual hosts may also suffer allergic or hypersensitivity reactions to foreign compounds, which leads to further inflammation and more severe lesions. Secretions from some tick species (e.g. *R. evertsi*) may also disrupt metabolic processes leading to liver damage and toxemia, especially in young animals. Metabolic parameters affected include reductions in serum iron, cholesterol, phospholipids, albumin, alkaline phosphatase and amylase, as well as elevations in serum urea-nitrogen and gamma-globulins. Infested animals may develop fever with increases in water intake, urinary volume and faecal volume (both water and dry matter content). Infestations in livestock often cause their

hosts considerable biting-stress (tick worry) leading to reduced productivity due to inefficient feeding with anorexia, poor growth with reduced weight gain or weight loss, and lowered milk production in dairy animals. Granulomatous skin lesions also damage hides resulting in reduced market value. The course of infestations is greatly influenced by both innate and acquired immune responses. Naive (previously unexposed) cattle often develop heavy infestations but then gradually acquire protective immunity (resistance) over several months which helps them survive repeated exposures. Tropical breeds of *Bos indicus* cattle develop greater resistance than European or British breeds of *Bos taurus* cattle. Paradoxically, cattle have also been shown to develop transient immunosuppression that favours tick survival and transmission. Experimental studies have shown that compounds in tick saliva (particularly prostaglandins) may inhibit both cellular and humoral host responses, as evidenced by depleted numbers of T and B lymphocytes in peripheral blood and reduced antibody responses. These enigmatic and complex interactions are prime examples of the ongoing evolutionary arm race between parasite pathogenicity and host immunity. Epidemiological and experimental studies have shown that many *Rhipicephalus* spp. act as efficient vectors for the transmission of various infectious microbial diseases. The ticks may act as mechanical vectors where microbes are passively transported between hosts, but many also act as biological vectors where microbial stages undergo amplification (growth and multiplication) in ticks, The microbes invariably undergo trans-stadial transmission (transfer between different metamorphic stages) and some even exhibit trans-ovarian transmission (vertical transfer from female adult ticks to eggs). Transmission may occur during feeding (via the injection of salivary secretions), during fluid regulation (via the regurgitation of excess gut fluids back into bite sites) or during waste elimination (via the excretion of materials from the hindgut and/or Malpighian tubules). *Rhipicephalus* spp. may transmit haemoprotozoan parasites causing theileriosis (East Coast fever) and babesiosis (tick fever), rickettsial bacteria causing anaplasmosis, rickettsiosis (spotted fever), ehrlichiosis, spirochaetes causing borreliosis (relapsing fever, Lyme disease), proteobacteria causing coxiellosis (Q fever) and orthonairoviruses causing Nairobi sheep disease. In particular, the species *R. sanguineus* (brown dog tick) acts as a vector for canine babesiosis caused by *Babesia canis* resulting in haemolytic anaemia and jaundice in dogs. Species belonging to the subgenus *R. (Boophilus)* (commonly known as blue ticks) are important vectors for bovine babesiosis (tick fever) caused by *Babesia bigemina* and *B. bovis* resulting in significant morbidity and mortality in cattle populations in tropical and subtropical regions.

Developmental cycle and mode of transmission: *Rhipicephalus* spp. undergo incomplete (hemimetabolous) metamorphosis whereby eggs hatch larvae that moult to nymphs and then adult ticks. Each developmental stage feeds once to repletion on blood from vertebrate hosts, usually a succession of 3 different hosts (sometimes 2), but those in the subgenus *R. (Boophilus)* only use one-host. Those with 3-host life-cycles drop off the host after feeding and moult to the next developmental stage in the external environment. The duration of the off-host stages varies considerably and are heavily influenced by prevailing environmental conditions (particularly temperature and relative humidity). Gravid female ticks lay large batches of eggs (hundreds to thousands) in moist shaded areas in soil and vegetation where they hatch in 14-42 days, although this may take up to 145 days when conditions are unfavourable (cold and dry). The emergent 6-legged larvae (known as seed ticks, grass ticks, or pepper ticks) take several days to harden and then ascend vegetation to quest for hosts (sedentary ambush strategy rather than actively hunting/pursuing hosts). They are able to sense various chemical, temperature and tactile stimuli associated with passing hosts and they actively wave their forelegs in the air when triggered by host odours (exhaled carbon dioxide, urinary ammonia), body heat, and vibrations (sound and movement). In suitable moist conditions, larvae may quest for hosts for between 20-240 days. They infest passing animals by crawling onto the skin where they probe for suitable feeding sites. Most species have preferred hosts, often small terrestrial vertebrates (mammals, birds and reptiles), and they are reluctant to feed on unusual hosts (as evidenced by protracted probing, taking small sample meals, dropping off and seeking alternative hosts). When hosts are suitable, the larvae attach to the skin and feed on blood over several days. When replete they drop off the host into the surrounding environment to digest their bloodmeals and moult into nymphs after 2-3 weeks. Like all ixodid ticks, they only form one nymphal instar (in contrast to argasid ticks which form between 2-7 nymphal instars). Nymphs also ascend vegetation to quest for hosts, many species showing some preferences for small mammals (particularly rodents) and birds. They are able to seek hosts for several days to months depending on environmental conditions. Having located a host, they crawl onto the skin, attach and feed on blood for several days. When replete, they drop off their hosts into the external environment to digest their bloodmeals and moult into adult ticks after 1-2 weeks. The adults wait for suitable conditions and then ascend vegetation to quest over several days to months for passing hosts, often larger vertebrates (including domestic and companion animals). Once attached, adults feed on blood for longer periods of time (one week or more) and are able to grow new cuticle to accommodate their larger bloodmeals. Ticks mature after feeding and usually mate on their hosts, with males seeking attached females to inseminate with spermatophores. Fertilized females then engorge on host blood, increasing markedly in size to become up to 100-120 times their pre-feeding weight. Once engorged, the females drop off into the immediate environment and soon begin to lay large batches of eggs (cumulatively totally 2,000-10,000) over several weeks before dying. Oviposition may be delayed for several weeks under adverse cold/dry environmental conditions, and some species are even thought to undergo developmental diapause in cold climates. The whole life-cycle of 3-host *Rhipicephalus* spp. may be completed in as little as 2 months under ideal conditions, so there are often several generations per year in tropical and subtropical regions. However, in temperate regions with well-defined wet and dry seasons, many species only have one generation per year. In colder regions, developmental stages may only be able to feed over summer months so there may be only one complete generation every 2-3 years. Members of the subgenus *R. (Boophilus)* have one-host life cycles that may be completed in 2-3 months in tropical regions and 6-9 months in subtropical to temperate regions. All developmental stages occur on the same host, with larvae and nymphs feeding for several days before moulting around one week later, and adults feeding for longer periods before mating. Males take small meals and may mate several times, even living detached from hosts for several months in cold conditions. There are even several reports of adult males feeding on haemolymph from female ticks. Fertilized females engorge with blood and drop off their hosts into the surrounding environment. They continue development for several days to weeks and then lay egg batches over 2-44

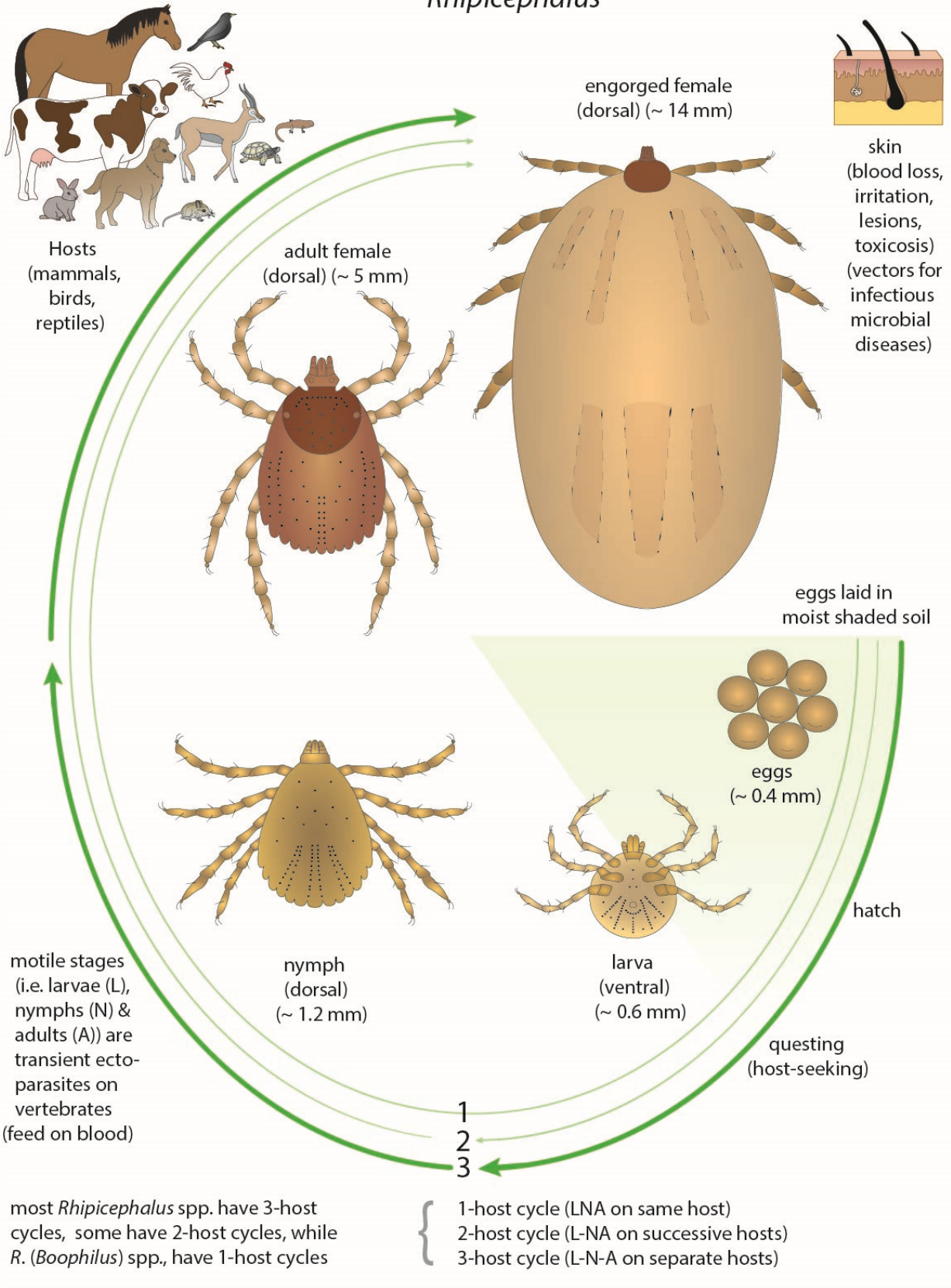
days. Most *Rhipicephalus* spp. show patchy aggregated distributions on livestock within and between farms in endemic regions, because female ticks oviposit large numbers of eggs in small areas leading to focal pasture contamination. All off-host developmental stages require moisture and shade to survive, so tick populations are usually greater on unimproved pastures with tussocky grasses and small bushes rather than on improved pastures. Infestations also abound on pastures with high stocking densities as more hosts come into contact with ticks and supply blood for their nutritional requirements.

Differential diagnosis: It is difficult to diagnose infestations on the basis of symptomatology as other aetiological agents may cause similar skin lesions (especially other ectoparasites) and a range of diseases may involve haematological and biochemical perturbations manifest as anaemia, jaundice, toxicosis, anorexia and loss of condition. Infestations are generally diagnosed by the direct detection of ticks feeding on hosts. Specimens may be carefully removed using tweezers or special tick removal tools for microscopic examination. Samples may also be frozen or fixed in alcohol for subsequent molecular analyses (proteins or DNA). Engorged female ticks may be collected for acaricide resistance testing in egg hatch or larval development assays, and should be stored and transported in small bottles with moist wadding and ventilation holes small enough to prevent any hatched larvae from escaping. Ticks may be collected from pastures and surrounding environs using blanket drags or dry ice traps. Specimens may be identified to genus by their unique morphological characteristics, and there are dichotomous taxonomic keys which include most common species (although some identifications may be difficult due to pleomorphic variation between species, strains, stages and even regions). More recently, molecular biological techniques have been used to characterize species and infer phylogenetic relationships following the polymerase chain reaction (PCR) amplification of nuclear (18S and 28S ribosomal RNA, internal transcribed spacers 1 and 2) and mitochondrial (12S and 16S ribosomal RNA, cytochrome c oxidase subunit I, nicotinamide adenine dinucleotide dehydrogenase subunit 5) gene sequences.

Treatment and control: Incidental infestations on humans are usually treated by removing the offending ticks and providing symptomatic relief (analgesics, anti-pruritics, anti-histamines, anti-inflammatories, disinfectants and possibly antibiotics to prevent secondary bacterial infections in open wounds). Ticks should be gently removed using curved tweezers or special tick removal devices (tick twists, loops/lassos, keys or V-shaped tools) taking care not to squeeze or break them (to avoid forcing gut content and saliva into the wound or leaving behind fragments which exacerbate inflammation). If the tick mouthparts break off and remain in the wound, clinicians should endeavour to remove them surgically. Some success in encouraging ticks to drop off has been reported by applying freezing agents or pyrethroid acaricides directly to their backs, but damaged or dying ticks may also release compounds back into the host. People at risk may deter tick attack by using personal repellents (such as diethyltoluamide (DEET), permethrin, picaridin, eucalyptus oil) on their skin or clothing, wearing heavier clothing (boots, socks, light-coloured trousers and long-sleeved shirts with gathered or tucked cuffs), and avoiding bushy habitats. Livestock and companion animals are best treated (both therapeutically and prophylactically) with topical or systemic acaricides, which are available in a range of dips, baths, sprays, showers, emulsions, dusts, pour-ons, spot-ons, collars, impregnated eartags/taillags, injections, drenches and tablets, some even being applied using self-treatment devices (rubbing posts/rollers, medicated supplementary feeds). Animals have been treated effectively using a range of acaricidal chemicals; including arsenical preparations, organochlorines (dichloro-diphenyl-trichloroethane (DDT), lindane), organophosphates (dioxathion, fenchlorphos), organophosphonates (chlorfenvinphos, dichlorvos, tetrachlorvinphos, trichlorfon), monothiophosphates (chlorpyrifos, coumaphos, cythioate, diazinon, fenthion, propetamphos), dithiophosphates (malathion, phosmet), carbamates (carbaryl), pyrethroids (permethrin, flumethrin, deltamethrin, decamethrin, cypermethrin, cyprothrin), formamidines (amitraz), macrocyclic lactones (ivermectin, selamectin), phenylpyrazoles (fipronil), chloronicotynils (imidacloprid), isoxazolines (afoxolaner, fluralaner) as well as some natural products (rotenone) and some insect growth regulators or chitin synthesis inhibitors (methoprene, pyriproxyfen). Careful attention should be paid to drug contraindications as some formulations are toxic or cause detrimental side-effects in certain animal species. While good results have been obtained with single treatments for ticks with one-host life-cycles, treating ticks with 2-host or 3-host cycles is more difficult as they require periodic re-treatment to negate re-infestation, although slow-release formulations or those with long-lasting residual activity may help reduce treatment frequency. The incorrect or over-usage of acaricides has led to the rapid development and spread of drug resistance, particularly against arsenical compounds, organochlorines, organophosphates, pyrethroids, formamidines and some macrocyclic lactones. Strategies to combat resistance include periodically cycling between acaricide groups, using co-formulations (cocktails), avoiding under-dosing, and regularly testing for resistance (using *in situ* or *in vitro* egg hatch, larval development or adult immersion tests). While resistance testing may be tedious and time-consuming, studies have begun to develop more rapid immunoassays or molecular screening tests. Producers are encouraged to adopt integrated tick management programmes involving health surveillance (screening, quarantine), strategic treatment (often to prevent a “spring rise”), animal management (avoid overstocking, culling, restricting movements), environmental control (cleaning holding facilities, applying residual acaricides), grazing management (pasture rotation, pasture spelling/resting, stabling, clearing vegetation), and controlling wildlife reservoirs (interrupt/divert migration routes, hunting, fencing, trapping, medicated supplementary feeds). A range of computerized prediction models have also been developed to assist producers, based on multiple biotic factors, including climate (temperature, moisture, rainfall, photoperiod), location (latitude, longitude, elevation), vegetation type and structure, land use and animal husbandry. Epidemiological and experimental studies have shown that certain breeds of cattle have an innate genetic resistance to tick infestations. Indigenous *Bos indicus* breeds (Zebu, Brahman, Nelore, Mulla, Iruga Red) are more resistant than introduced *Bos taurus* beef and dairy breeds (Hereford, Shorthorn, Simmental, Angus and Holstein-Friesian), and indigenous African *Bos taurus* breeds (N'dama, Sanga) are also resistant to ticks. Some tick-resistant breeds also seem to acquire better protective immunity to tick-borne diseases if exposed to them at an early age. Many successful programmes have been developed to produce tick-resistant

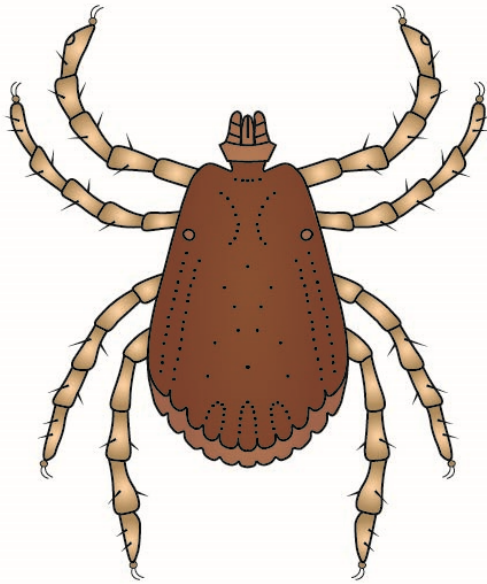
cattle by cross-breeding, selecting resistant individuals and culling heavily-infested individuals. However, repeated culling of susceptible individuals or those with waning resistance appear to be necessary to maintain herd resistance over time. The nutrition status of the hosts may also influence the degree of resistance exhibited. Cattle given lucerne as a supplementary feed were more resistant to ticks than animals grazing only on native grasses, and their better nutrition allowed them to counter the effects of any developing anaemia. Variable successes have been reported in the control and prevention of tick infestations using vaccines derived from various tick extracts, notably concealed gut antigens (BM86 and BM95 from *R. microplus*, BA86 from *R. annulatus*) but also including some salivary gland proteins (64TRP from *R. appendiculatus*) and other metabolic extracts (serpins from *R. appendiculatus*). Studies on biological control have explored the impact of various parasites, pests and predators on tick populations, including grooming birds (oxpeckers), pathogenic nematodes (*Steinernema* and *Heterorhabditis*), entomopathogenic fungi (*Beauveria* and *Metarhizium*), parasitic wasps and pasture manipulation using tropical legumes.

Rhipicephalus



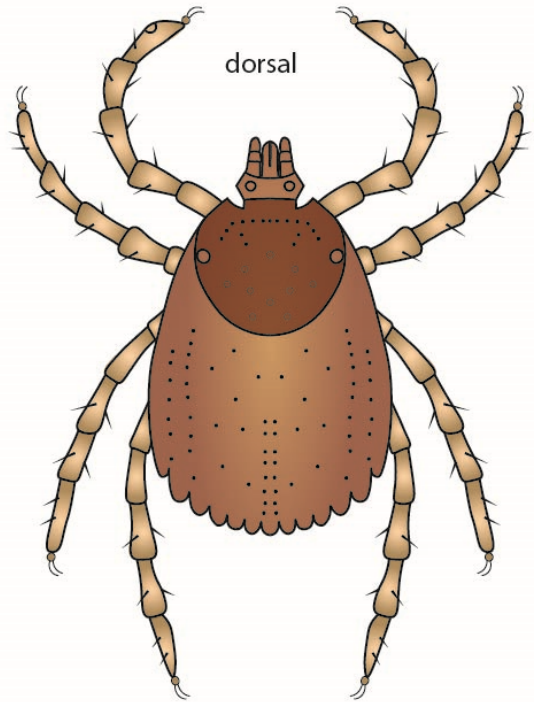
Rhipicephalus

dorsal



male (~ 4 mm)

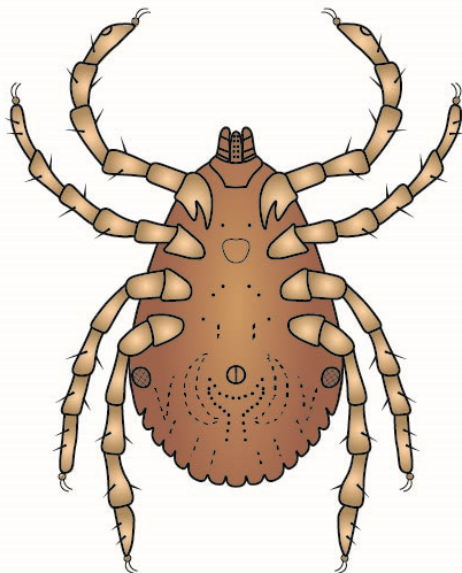
dorsal



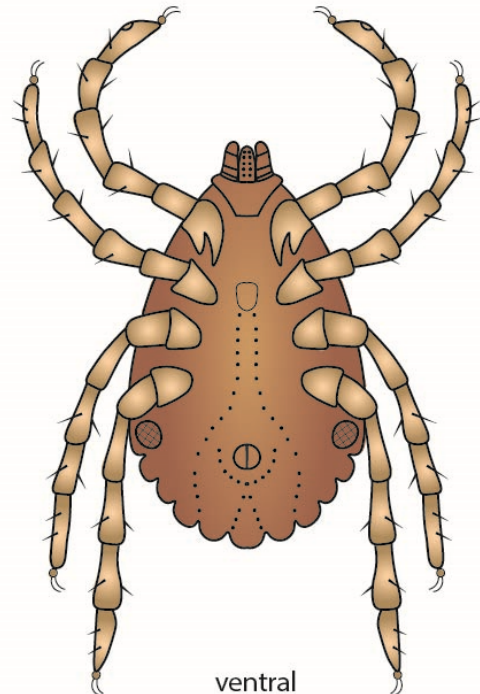
female (~ 5 mm)

adult ticks

ventral

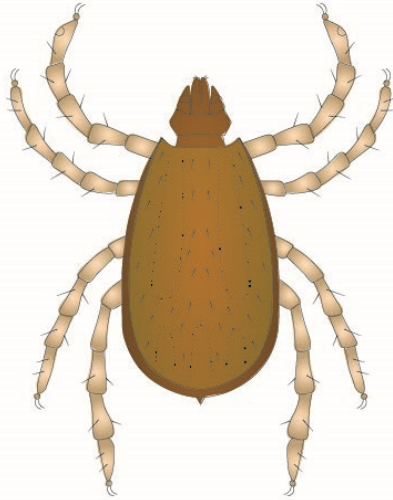


ventral



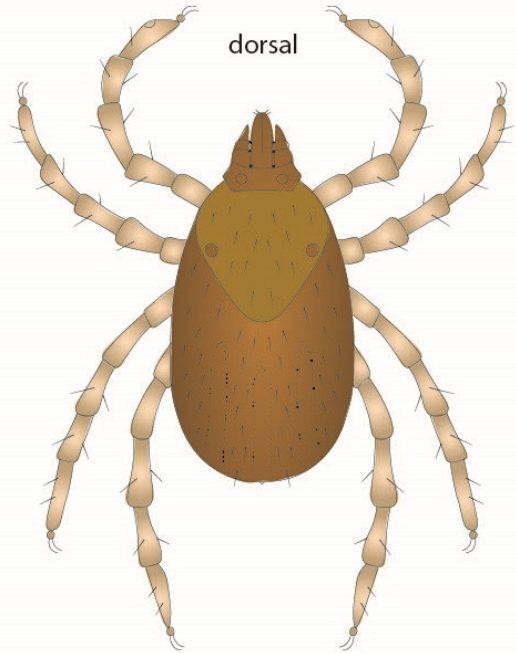
Rhipicephalus (Boophilus)

dorsal



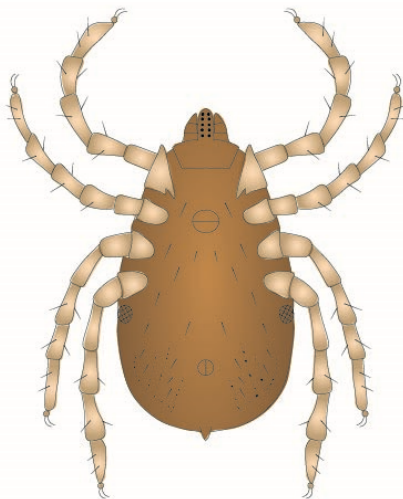
male (~ 4 mm)

dorsal

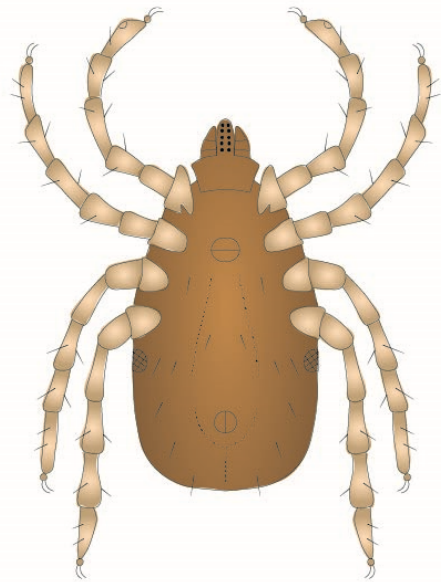


female (~ 5 mm)

adult ticks



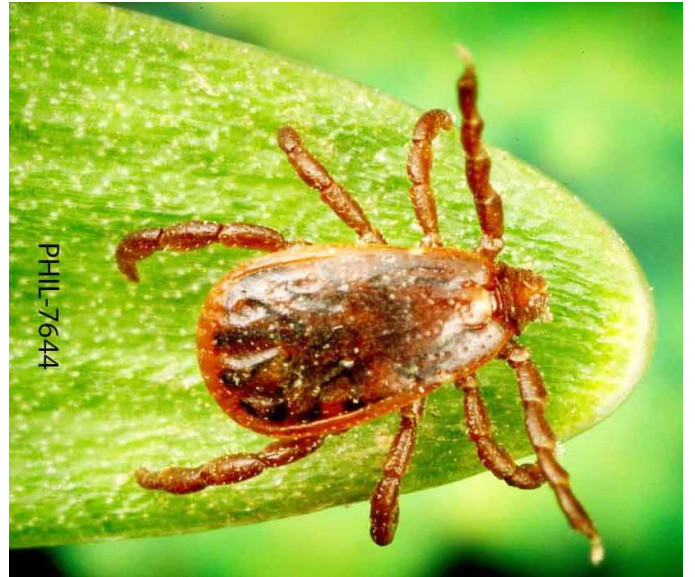
ventral



ventral



Rhipicephalus adults



Rhipicephalus adult



Rhipicephalus larva



Rhipicephalus adult



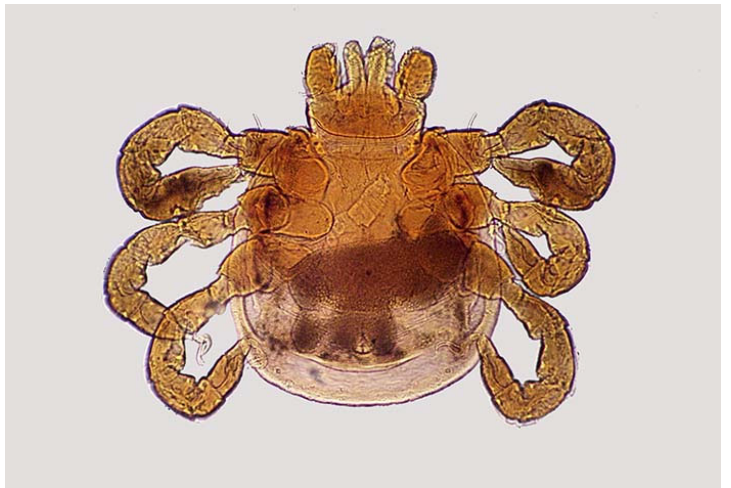
Rhipicephalus (Boophilus) adults



Rhipicephalus (Boophilus) eggs and larva



Rhipicephalus (Boophilus) larvae



Rhipicephalus (Boophilus) larva