

Ixodes
(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 *Ixodes* spp. are common three-host ticks on a range of domestic and wild mammals and birds; most causing irritation and inflammation, some causing toxicoses and paralysis, and many transmitting viral, bacterial and protozoal infectious diseases.

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: *Ixodes* (parasitic on skin of mammals/birds)
Species: various species cause irritation, dermatitis, toxicosis or paralysis in domestic and wild animals, incl. humans

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 tarsi I each bearing a complex sensory pit (Haller's organ). 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 tick 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> (<i>Aponomma</i>)	anterior	rectangular	long	long	ornate	present	present	indistinct	3
	anterior	rectangular	long	long	often ornate	present	absent	absent	3
<i>Rhipicephalus</i> (<i>Boophilus</i>)	anterior	hexagonal	short	medium	some ornate	present	present	present	3
	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 Ixodinae comprises prostriate inornate ticks lacking eyes and festoons, but whose males possess sclerotized ventral plates.

All *Ixodes* spp. are ectoparasitic on small to large mammals or birds as 3-host ticks (larvae, nymphs and adults parasitizing different individual hosts). Ticks are often named after a particular host (e.g. dog tick) but they are generally not strictly host-specific, but rather host-preferential, attempting to feed on many passing animal species. Larvae tend to feed on small hosts (usually rodents, birds), nymphs on mid-sized hosts (rodents, omnivores, birds) and adults on mid-sized to large hosts (carnivores, herbivores). A total of 15 subgenera of *Ixodes* have been recognized on the basis of tick morphology (especially the form of Haller's organ, palps, hypostome, spurs, sternal plates, porose areas), host occurrence and geographic distribution.

Ixodes subgenera	Common hosts	Number of species recorded in each zoogeographic region					
		Nearctic (North America)	Palaearctic (Eurasia)	Ethiopian (Africa)	Neotropical (South America)	Oriental (India, SE Asia)	Australian (Australia, New Guinea)
<i>I. (Ixodes)</i> [= <i>I. (Trichotoixodes)</i>]	mammals, birds, reptiles	14	21	8	24	12	
<i>I. (Pholeoixodes)</i> [= <i>I. (Ixodiopsis)</i>]	mammals, birds	18	21		3		
<i>I. (Afrioxodes)</i>	mammals, birds			42		2	
<i>I. (Partipalpiger)</i>	mammals		1			1	
<i>I. (Exopalpiger)</i>	mammals		1	1	3		4
<i>I. (Endopalpiger)</i>	marsupials, monotremes, rodents						7
<i>I. (Coxioxodes)</i>	monotremes						1
<i>I. (Sternalixodes)</i>	mammals						9
<i>I. (Alloixodes)</i>	rodents				1		
<i>I. (Haemioxodes)</i>	rodents				1		
<i>I. (Eschatocephalus)</i> [= <i>I. (Pomerantzevella)</i>]	bats		3	4		3	3
<i>I. (Lepidioxodes)</i>	bats			1		1	
<i>I. (Ceratixodes)</i>	seabirds	1	1		1	1	1
<i>I. (Multidentatus)</i>	birds	2	1	5	1	1	9
<i>I. (Scaphioxodes)</i>	birds	2	7			1	

The subgenera *Ixodes* (*Ceratixodes*), *I. (Scaphioxodes)* and *I. (Multidentatus)* are common on coastal birds on most continents, *I. (Eschatocephalus)* and *I. (Lepidioxodes)* are found on bats throughout the world, *I. (Alloixodes)* and *I. (Haemioxodes)* are confined to rodents in South America, *I. (Endopalpiger)*, *I. (Coxioxodes)* and *I. (Sternalixodes)* are found on marsupials and monotremes in Australia and New Guinea, *I. (Afrioxodes)* occur mostly on native animals and birds in Africa, several *I. (Exopalpiger)* and *I. (Partipalpiger)* species infest mammals on most continents, except North America, while the most speciose subgenera *I. (Ixodes)* and *I. (Pholeoixodes)* are found on mammals, birds and reptiles throughout the world, except Australia. Various species are notorious as opportunistic ectoparasites of domestic animals and humans (e.g. *I. ricinus* in Europe, *I. ovatus* and *I. persulcatus* in Japan and Russia, *I. scapularis* and *I. pacificus* in North America, and *I. holocyclus* in Australia); some causing tick paralysis in susceptible hosts (e.g. *I. holocyclus*, *I. cornuatus*, *I. rubicundus*), and others transmitting infectious microbial diseases (e.g. *I. ricinus*, *I. pacificus*, *I. scapularis*).

<i>Ixodes</i> species (* = type species for subgenus)	Host range	Clinical signs	Distribution
<i>I. abrocomae</i>	Rodentia: abrocomid (Bennett's chinchilla rat), cricetid (long-haired grass mouse, olive grass mouse, yellow-rumped leaf-eared mouse)		South America
<i>I. (Endopalpiger) acer</i>	Dasyuromorphia: dasyurid (New Guinean quoll); Diprotodontia: petaurid (long-fingered triok); Peramelemorphia: peramelid (striped bandicoot, kalubu bandicoot, Raffray's bandicoot); Rodentia: murid (squirrel-toothed rat)		New Guinea
<i>I. acanthoglossi</i>	Monotremata: tachyglossid (western long-beaked echidna)		New Guinea
<i>I. (Ixodes) acuminatus</i> (syn. <i>I. dorriensmithi</i>) (southern rodent tick)	Rodentia: cricetid (short-tailed field vole, bank vole, Guernsey vole), glirid (garden dormouse), murid (house mouse, yellow-necked mouse, striped field mouse, wood mouse, brown rat); Eulipotyphla: erinaceid (European hedgehog, northern white-breasted hedgehog), soricid (crowned shrew, pygmy shrew, lesser white-toothed shrew), talpid (mole); Carnivora: canid (dog, gray wolf, red fox), felid (cat), mustelid (badger, marten, ferret, least weasel, European mink); Primates: hominid (human); Accipitriformes: accipitrid (common buzzard); Galliformes: phasianid (red partridge); Passeriformes: turdid (common blackbird)	(possible vector for borrelioses)	Europe
<i>I. (Ixodes) acutitarsus</i> (syn. <i>I. gigas, laevis</i>)	Artiodactyla: bovid (cattle, zebu, yak, buffalo, bharal, goral, mithun, sheep, goat, Japanese serow), cervid (dwarf musk deer), suid (pig,		Eurasia

	wild boar); Rodentia: cricetid (vole), murid (house mouse), sciurid (ground squirrel); Eulipotyphla: soricid (shrew); Carnivora: canid (dog), felid (unspecified), ursid (unspecified bears); Primates: hominid (human); Passeriformes: corvid (red-billed blue magpie), timaliid (unspecified)		
<i>I. aequalis</i>	Rodentia: sciurid (California ground squirrel)		North America
<i>I. (Ixodes) affinis</i>	Artiodactyla: bovid (cattle), cervid (white-tailed deer, red brocket, gray brocket); Perissodactyla: equid (horse); Eulipotyphla: soricid (southern short-tailed shrew); Didelphimorphia: didelphid (Virginia opossum, Robinson's mouse opossum); Rodentia: cricetid (woodrat, Peruvian cotton rat, long-whiskered rice rat, cotton mouse), murid (rat, mouse), sciurid (eastern gray squirrel); Carnivora: canid (dog), felid (bobcat, jaguar, cougar, ocelot, Florida panther), procyonid (raccoon, white-nosed coati), ursid (spectacled bear); Primates: hominid (human); Accipitriformes: cathartid (black vulture); Passeriformes: cardinalid (northern cardinal), furnariid (red-billed scythe bill), mimid (brown thrasher), parulid (golden-crowned warbler, white-rimmed warbler), passerellid (white-throated sparrow, saffron-billed sparrow, eastern towhee), thraupid (white-lined tanager, orange-headed tanager), troglodytid (house wren, Carolina wren), turdid (American robin, creamy-bellied thrush, rufous-bellied thrush); Sauria: teiid (unspecified whiptail)	trauma, irritation, dermatitis	Americas
<i>I. (Afrixodes) albignaci</i>	Afrosoricida: tenrecid (Talazac's shrew tenrec); Rodentia: murid (black rat)		Madagascar
<i>I. (Exopalpiger) alluaudi</i>	Eulipotyphla: soricid (greater red musk shrew, Hildegard's shrew, Jackson's shrew); Afrotheria: macroscelid (elephant shrew); Afrosoricida: chrysochlorid (golden mole); Rodentia: bathyergid (Cape mole-rat), murid (four-striped grass mouse, delectable soft-furred mouse, Southern African vlei rat, Grant's gerbil, Lobengula's gerbil), spalacid (mole-rat); Lagomorpha: leporid (hare)		Africa
<i>I. amarali</i>	Didelphimorphia: didelphid (gray short-tailed opossum, pygmy short-tailed opossum, white-eared opossum, northern red-sided opossum, Amazonian red-sided opossum); Rodentia: cricetid (montane grass mouse, hairy-tailed bolo mouse, blackish grass mouse, Atlantic forest climbing mouse, terraced rice rat, large-headed rice rat, black-footed pygmy rice rat, small-eared pygmy rice rat, Brazilian pygmy rice rat, marsh rat), echimyid (hairy Atlantic spiny rat), murid (black rat, brown rat)		South America
<i>I. (Multidentatus) amersoni</i>	Charadriiformes: larid (fairy tern); Pelecaniformes: sulid (red-footed booby); Procellariiformes: procellariid (white-headed petrel)		Pacific Islands, New Zealand
<i>I. ampullaceus</i>	Rodentia: nesomyid (Gambian pouched rat)		Africa
<i>I. (Sternalixodes) anatis</i>	Anseriformes: anatid (mallard, Pacific black duck, giant Canada goose); Apterygiformes: apterygid (North Island brown kiwi, southern brown kiwi); Gruiformes: rallid (buff weka); Carnivora: felid (cat faeces)		Australasia
<i>I. (Exopalpiger) andinus</i>	Rodentia: cricetid (Peruvian vesper mouse, Darwin's leaf-eared mouse?)		South America
<i>I. angulatus incertae sedis</i>	Eulipotyphla: erinaceid (Amur hedgehog)		China
<i>I. (Pholeoixodes) angustus</i>	Eulipotyphla: soricid (common shrew, slender shrew, long-tailed shrew, long-clawed shrew, Olympic shrew, Trowbridge shrew, Laxmann's shrew, Siberian large-toothed shrew, Eurasian least shrew, Eurasian pygmy shrew, wandering shrew, northern short-tailed shrew), talpid (mole, American shrew-mole, hairy-tailed mole); Didelphimorphia: didelphid (common opossum, white-eared opossum); Rodentia: aplodontid (mountain beaver), cricetid (small-toothed harvest mouse, western harvest mouse, zempoaltepec, deer mouse, brush mouse, canyon mouse, pinyon mouse, white-footed mouse, southern plains woodrat, bushy-tailed woodrat, dusky-footed woodrat, Alfaro's rice rat, long-tailed vole, eastern meadow vole, California vole, Guatemalan vole, Townsend's vole, grey red-backed vole, southern red-backed vole, northern red-backed vole, heather vole, montane vole, tundra vole, southern bog lemming),	trauma, irritation, dermatitis (vector for Lyme disease)	North America

	geomyid (gopher, Columbian pocket gopher), heteromyid (pocket mouse, chisel-toothed kangaroo rat), murid (mouse, striped field mouse, large Japanese field mouse, black rat, brown rat, bushy-tailed woodrat), sciurid (American red squirrel, western gray squirrel, solver gray squirrel, soft-haired squirrel, ground squirrel, Columbian ground squirrel, Douglas ground squirrel, northern flying squirrel, white-tailed antelope squirrel, eastern chipmunk, least chipmunk, cliff chipmunk, Siberian chipmunk, Townsend chipmunk, cascades chickadee squirrel, redwood chickaree squirrel), sminthid (long-tailed birch mouse), zapodid (western jumping mouse, woodland jumping mouse, Pacific jumping mouse); Lagomorpha: leporid (black-tailed jackrabbit, cottontail rabbit, snowshoe hare), ochotonid (American pika, alpine pika); Carnivora: canid (dog, gray fox), felid (cat), procyonid (raccoon, ringtail); Chiroptera: vespertilionid (little brown bat); Primates: hominid (human); Passeriformes: emberizid (bunting)		
<i>I. annulatus</i>	Artiodactyla: cervid (white-tailed deer)		North America
<i>I. (Exopalpiger) antechini</i>	Dasyuromorphia: dasyurid (eastern quoll, yellow-footed antechinus, dusky antechinus, brown antechinus, swamp antechinus, fat-tailed dunnart, slender-tailed dunnart); Procellariiformes: procellariid (fairy prion)		Australia
<i>I. (Ixodes) apronophorus</i> (syn. <i>I. apronatus</i> , <i>pari</i>)	Artiodactyla: suid (pig); Rodentia: castorid (Eurasian beaver), cricetid (common vole, bank vole, tundra vole, northern red-backed vole, short-tailed field vole, narrow-headed vole, European water vole, grey dwarf hamster, European hamster, muskrat), dipodid (great jerboa), echimyid (nutria), murid (striped field mouse, yellow-necked mouse, wood mouse, Eurasian harvest mouse, brown rat), sciurid (red squirrel, spotted giant flying squirrel, Siberian chipmunk); Eulipotyphla: soricid (common shrew, Eurasian pygmy shrew, Mediterranean water shrew, Eurasian water shrew); Lagomorpha: leporid (hare), Carnivora: canid (dog, red fox); Primates: hominid (human); Columbiformes: columbid (collared dove); Gruiformes: rallid (spotted crane); Passeriformes: fringillid (brambling), motacillid (white-wagtail), muscicapid (unspecified), parid (great tit), turdid (common blackbird); Serpentes: viperid (unspecified)	(vector for Omsk haemorrhagic fever virus and possibly tularemia, babesiosis, encephalitis virus)	Eurasia
<i>I. aptericola</i>	Apterygiformes: apterygid (southern brown kiwi)		New Zealand
<i>I. apteridis</i>	Apterygiformes: apterygid (North Island brown kiwi, southern brown kiwi)		New Zealand
<i>I. arabukiensis</i>	Carnivora: herpestid (bushy-tailed mongoose)		Africa
<i>I. (Pholeoixodes) arboricola</i> (syn. <i>I. dryadis</i> , <i>passericola</i> , <i>strigicola</i>) (tree-hole tick)	Rodentia: murid (mouse, yellow-necked mouse); Carnivora: canid (dog); Chiroptera: vespertilionid (common noctule); Charadriiformes: burhinid (stone-curlew); Columbiformes: columbid (dove); Falconiformes: falconid (peregrine falcon); Galliformes: phasianid (chicken); Passeriformes: acrocephalid (reed warbler), certhiid (Eurasian treecreeper), corvid (jackdaw), fringillid (European greenfinch, bullfinch), hirundinid (sand martin), muscicapid (European robin, pied flycatcher, spotted flycatcher, collared flycatcher, isabelline wheatear, common redstart, black redstart), parid (great tit, European crested tit, Eurasian blue tit, marsh tit, willow tit, coal tit), passerid (house sparrow, rock sparrow, Eurasian tree sparrow, white-winged snowfinch), phylloscopid (willow warbler), sittid (Eurasian nuthatch), sturnid (common starling), sylviid (Eurasian blackcap), troglodytid (wren), turdid (common blackbird); Piciformes: picid (great spotted woodpecker); Strigiformes: strigid (western barn owl, little owl, tawny owl)	trauma, irritation (possible vector for borreliosis, rickettsioses, encephalitis virus)	Africa, Eurasia, North America
<i>I. (Ixodes) arebiensis</i>	host unknown, collected from vegetation		Africa
<i>I. ariadnae</i>	Chiroptera: vespertilionid (brown long-eared bat, greater mouse-eared bat, lesser mouse-eared bat, pond bat, Alcathe bat, Bechstein's bat, Daubenton's bat, Geoffroy's bat, Natterer's bat)		Europe
<i>I. (Ixodes) arvicolae</i>	Rodentia: cricetid (European water vole), echimyid (nutria), murid (house mouse, wood mouse); Eulipotyphla: soricid (lesser white-		Europe

	toothed shrew)		
<i>I. asanumai</i>	Squamata: lacertid (green grass lizard); scincid (Japanese five-lined skink, Ousima skink); Carnivora: canid (dog)		Japan
<i>I. (Eschatocephalus) audyi</i>	Rodentia: murid (mountain giant Sunda rat)		Asia
<i>I. (Afrixodes) aulacodi</i>	Artiodactyla: bovid (black duiker, Maxwell's duiker, royal antelope, harnessed bushbuck); Eulipotyphla: soricid (Oriental shrew); Rodentia: hystricid (brush-tailed porcupine), murid (Rudd's mouse, gerbil), nesomyid (Gambian pouched rat), thryonomyid (greater cane rat); Carnivora: herpestid (Egyptian mongoose), viverrid (African civet); Galliformes: numidid (helmeted guineafowl); Passeriformes: cisticolid (white-chinned prinia)		Africa
<i>I. (Afrixodes) auriculaelongae</i>	Rodentia: murid (mouse, brush-furred mouse, southern multimammate mouse, black rat); Eulipotyphla: soricid (unspecified shrew)		Africa
<i>I. (Multidentatus) auritulus</i> (syn. <i>I. thoracicus</i>)	Accipitriformes: accipitrid (bald eagle); Apodiformes: apodid (white-throated swift); Charadriiformes: lariid (kelp gull, New Zealand Antarctic tern), scolopacid (South Island snipe, Antipodes snipe, Subantarctic snipe), stercorariid (brown skua, South polar skua); Columbiformes: columbid (ruddy ground dove); Falconiformes: falconid (striated caracara); Galliformes: cracid (horned guan, rusty-margined guan), odontophorid (spotted wood quail), phasianid (ruffed grouse, blue grouse, willow grouse, dusky grouse); Gruiformes: rallid (western weka, Stewart Island weka); Passeriformes: acanthizid (Tasmanian scrubwren), artamid (black currawong), callaeid (South Island saddleback), certhiid (Eurasian treecreeper), conopophagid (rufous gnateater), corvid (American crow, Steller's jay), emberizid (uniform finch, buff-throated warbling finch, black-and-rufous warbling finch, mourning sierra-finch, greenish yellow-finch, double-collared seedeater, slender-billed finch), fringillid (pale-naped brushfinch, slaty brushfinch, purple finch), furnariid (thorn-tailed rayadito, canebrake groundcreeper, blackish cinclodes, buff-winged cinclodes, dark-bellied cinclodes, white-throated treerunner, rufous-capped spinetail, Spix's spinetail, buff-browed foliage-gleaner, white-chinned thistletail, rufous henero, sharp-tailed streamcreeper, freckle-breasted thornbird), icterid (Austral blackbird, long-tailed meadowlark), motacillid (pipit), parulid (white-rimmed warbler, golden-crowned warbler, masked yellowthroat, ovenbird), passerellid (pale-naped brushfinch, slaty brushfinch, volcano junco, Shufeldt's junco, dark-eyed junco, rufous-collared sparrow, savannah sparrow, fox sparrow, Kodiak fox sparrow), passerid (sparrow, song sparrow, rusty song sparrow), petroicid (western yellow robin), rhinocryptid (tapaculo), rhinocryptid (unspecified tapalco), thamnophilid (variable antshrike, rufous-capped antshrike), thraupid (scarlet-bellied mountain tanager, golden-crowned tanager, lacrimose mountain tanager, blue-and-yellow tanager, blue-and-black tanager, black-goggled tanager, blue-capped tanager, diademed tanager, white-sided flowerpiercer, slaty flowerpiercer, uniform finch, gray-throated warbling finch, buff-throated warbling finch, black-and-rufous warbling finch, greenish yellow finch, slender-billed finch, pardusco, mourning sierra finch, golden-billed saltator, double-collared seedeater), troglodytid (house wren, bay wren, timberline wren, moustached wren, bay wren, Santa Marta wren), turdid (black-billed nightingale-thrush, white-necked thrush, creamy-bellied thrush, mountain thrush, Austral thrush, sooty thrush, Andean slaty thrush, rufous-bellied thrush, varied thrush), tyrannid (white-crested elaenia, velvety black tyrant, mottle-cheeked tyrannulet); Pelecaniformes: ardeid (black-crowned night heron), Piciformes: picid (Andean flicker); Procellariiformes: diomedeid (wandering albatross, Atlantic yellow-nosed albatross, black-browed albatross, Gibson's albatross), oceanitid (black-bellied storm petrel, white-faced storm petrel), pelecanoidid (Magellanic diving petrel),	trauma (possible vector for borreliosis)	Americas, Africa, Australia, New Zealand

	procellariid (sooty shearwater, flesh-footed shearwater, Buller's shearwater, Hutton's shearwater, grey petrel, soft-plumaged petrel, great-winged petrel, common diving petrel, Kerguelen petrel, fairy prion, broad-billed prion, fulmar prion, Antarctic prion); Psittaciformes: nestorid (South Island kaka), strigopid (kakapo); Sphenisciformes: spheniscid (king penguin, Snares penguin, little penguin, yellow-eyed penguin); Tinamiformes: tinamid (Andean tinamou); Rhynchocephalia: sphenodontid (tuatara); Carnivora: otariid (New Zealand sea lion); Rodentia: cricetid (olive montane mouse, forest small rice rat, Tome's rice rat, meadow vole), sciurid (golden-mantled ground squirrel, yellow-bellied marmot, woodchuck)		
<i>I. (Endopalpiger) australiensis</i>	Artiodactyla: bovid (cattle), suid (pig); Diprotodontia: macropodid (quokka), potoroid (long-nosed potoroo, boodie, woylie); Carnivora: canid (dog); Primates: hominid (human)		Australia
<i>I. (Pholeoixodes) baergi</i>	Passeriformes: hirundinid (cliff swallow); Primates: hominid (human)		North America
<i>I. (Afrinoxodes) bakeri</i>	Eulipotyphla: soricid (swamp musk shrew, forest shrew); Macroscelidea: macroscelidid (elephant shrew); Rodentia: murid (African vlei rat)		Africa
<i>I. (Pholeoixodes) bakonyensis</i>	Carnivora: mustelid (European badger)		Europe
<i>I. (Pholeoixodes) banksi</i>	Rodentia: castorid (American beaver), cricetid (muskrat); Carnivora: mustelid (North American river otter); Primates: hominid (human)	trauma, irritation, dermatitis (plus vector for tularemia)	North America
<i>I. barkeri</i>	Monotremata: tachyglossid (short-beaked echidna)		Australia
<i>I. (Afrinoxodes) bedfordi</i>	Rodentia: murid (African vlei rat, four-striped mouse)		Africa
<i>I. bengalensis</i>	Sauria (varanid (Bengal monitor))		India
<i>I. (Scaphixodes) berlesei</i>	Apodiformes: apodid (Pacific swift); Columbiformes: columbid (rock dove); Falconiformes: falconid (common kestrel, gyrfalcon); Passeriformes: emberizid (unspecified), cariliid (unspecified), corvid (red-billed chough, Daurian jackdaw, western jackdaw), muscapid (blue rock-thrush, northern wheatear, white-winged redstart, black redstart), passerid (unspecified), sturnid (starling), turdid (unspecified)		Paleartic
<i>I. (Ixodes) bequaerti</i>	Passeriformes: emberizid (unspecified), malurid (red-winged fairywren), thraupid (blue-black grassquit), turdid (unspecified thrush); Trogoniformes: trogonid (collared trogon, resplendent quetzal)		Central America
<i>I. bimaculatus</i> (syn. <i>I. hippopotamensis</i> , <i>Hyalomma hippopotamense</i> , <i>Amblyomma hippopotami</i>) (now <i>Cosmiomma hippopotamensis</i>)	Artiodactyla: hippopotamid (hippopotamus)		Africa
<i>I. birmanensis</i>	Testudines: geomyid (Indian black turtle), testudinid (elongated tortoise)		Africa, Asia
<i>I. (Ixodes) bivari</i>	Lagomorpha: leporid (rabbit)		Europe
<i>I. bocatorensis</i>	Lagomorpha: cuniculid (lowland paca); Rodentia: dasyproctid (red-rumped agouti, Central American agouti); Pilosa: bradypodid (pale-throated sloth), cyclopedid (silky anteater), myrmecophagid (southern tamandua); Perissodactyla: tapirid (South American tapir)		South America
<i>I. (Ixodes) boliviensis</i> (syn. <i>I. bicornis</i>)	Artiodactyla: bovid (cattle), cervid (white-tailed deer); Perissodactyla: equid (horse, mule), tapirid (Baird's tapir); Didelphimorphia: didelphid (common opossum); Rodentia: erethizontid (Mexican hairy dwarf porcupine), sciurid (unspecified squirrel); Carnivora: canid (dog, bush dog, fox), felid (cat, jaguar,		Americas

	cougar), procyonid (raccoon, white-nosed coati, South American coati), ursid (spectacled bear); Primates: hominid (human); Galliformes: cracid (great curassow), phasianid (pheasant)		
<i>I. (Afrixodes) brewsterae</i>	Carnivora: felid (unspecified), herpestid (marsh mongoose, Egyptian mongoose)		Africa
<i>I. (Afrixodes) browningi</i>	Rodentia: murid (brush-furred mouse, soft-furred mouse), sciurid (sun squirrel, red-legged sun squirrel, Thomas's rope squirrel)		Africa
<i>I. (Afrixodes) brumpti</i>	Hyracoidea: procaviid (yellow-spotted rock hyrax)		Africa
<i>I. (Ixodes) brunneus</i> (syn. <i>I. bifurcatus</i>)	Accipitriformes: accipitrid (golden eagle); Anseriformes: anamid (greylag goose); Columbiformes: columbid (mourning dove, lemon dove); Galliformes: odontophorid (bobwhite quail), phasianid (turkey); Gruiformes: rallid (corn crane); Piciformes: rhampastid (toucan); Passeriformes: bombycillid (cedar waxwing), cardinalid (black-headed grosbeak, western tanager), corvid (blue jay, coast jay, Eurasian jay, Steller's jay), emberizid (common reed bunting), fringillid (house finch, purple finch, hawfinch, American goldfinch, European greenfinch, brambling), hirundinid (barn swallow, violet-green swallow), icterid (red-winged blackbird, meadowlark, common grackle, purple grackle), laniid (island shrike), mimid (brown thrasher, grey catbird), motacillid (meadow pipit, tree pipit, white-browed wagtail), muscicapid (European robin, whinchat, European stonechat), parid (great tit), parulid (ovenbird), passerellid (dark-eyed junco, slate-coloured junco, field sparrow, white-throated sparrow, golden-crowned sparrow, white-crowned sparrow, song sparrow, fox sparrow, eastern towhee, white-eyed towhee), passerid (house sparrow, chipping sparrow, Eurasian tree sparrow, Italian sparrow), pycnonotid (brown-eared bulbil), regulid (goldcrest), sittid (Eurasian nuthatch), Sturnid (starling), thraupid (masked crimson tanager), troglodytid (winter wren, Carolina wren), turdid (blackbird, red-winged blackbird, eastern bluebird, American robin, true thrush, hermit thrush, song thrush, Andean slaty thrush, ring ouzel); Rheiformes: rheid (greater rhea); Strigiformes: strigid (barred owl); Rodentia: cricetid (marsh rice rat), sciurid (eastern gray squirrel); Carnivora: felid (cat); Microbiotheria: microbiotherid (colocolo opossum); Primates: hominid (human)	lesions, paralysis	Americas
<i>I. calcarhebes</i>	Rodentia: murid (Natal multimammate mouse)		Africa
<i>I. (Scaphixodes) caledonicus</i> (northern bird tick)	Apodiformes: apodid (common swift); Charadriiformes: alcid (Atlantic puffin), larid (black-legged kittiwake); Columbiformes: columbid (dove, pigeon); Falconiformes: falconid (peregrine falcon, gyrfalcon, kestrel); Passeriformes: corvid (jackdaw, hooded crow, common raven), fringillid (crossbill), muscicapid (common redstart, black redstart, blue rock thrush), sturnid (starling); Procellariiformes: procellariid (northern fulmar)		Palaearctic
<i>I. californicus</i>	Artiodactyla: bovid (cattle, goat), cervid (black-tailed deer, elk); Perissodactyla: equid (horse); Lagomorpha: leporid (rabbit, mountain cottontail, hare); Rodentia: caviid (guinea pig), cricetid (long-tailed vole, white-footed mouse), murid (house mouse, rat), sciurid (ground squirrel); Carnivora: canid (dog, American red fox, gray fox), felid (cat); Primates: hominid (human); Galliformes: phasianid (chicken, grouse); Passeriformes: mimid (crissal thrasher); Strigiformes: strigid (burrowing owl); Sauria: anguid (alligator lizard), phrynosomatid (western fence lizard)		North America
<i>I. (Ixodes) candavius</i>	Artiodactyla: bovid (goat)		Australia
<i>I. (Pholeoixodes) canisuga</i> (syn. <i>I. barbarossae</i> , <i>latirostris</i> , <i>melicola</i> , <i>sciuricola</i> , <i>vulpicola</i> , <i>vulpinus</i> , <i>autumnalis vulpis</i>) (dog tick)	Artiodactyla: bovid (sheep), cervid (red deer, muntjac), suid (pig); Perissodactyla: equid (horse, mule); Lagomorpha: leporid (rabbit), ochotonid (Daurian pika); Eulipotyphla: erinaceid (European hedgehog, northern white-breasted hedgehog); Rodentia: sciurid (tarbagan marmot, long-tailed marmot, squirrel, ground squirrel); Carnivora: canid (dog, golden jackal, red fox), felid (cat), herpestid (small Asian mongoose), mustelid (European badger, pine marten, ferret, mink); Passeriformes: corvid (western jackdaw), hirundinid (sand martin), parid (Eurasian blue tit, great tit), passerid (house sparrow, tree sparrow), sittid (Eurasian nuthatch), sturnid (common	trauma, pruritus, dermatitis, alopecia, anaemia (plus vector for babesiosis, theileriosis)	Eurasia

	starling); Strigiformes: strigid (little owl)		
<i>I. (Alloixodes) capromydis*</i>	Rodentia: echimyid (Desmarest's hutia)	trauma	Cuba
<i>I. catarinensis</i>	Carnivora: felid (cat); Didelphimorphia: didelphid (woolly mouse opossum); Rodentia: cricetid (Paraguayan rice rat)		South America
<i>I. (Afrixodes) catherinei</i>	Lagomorpha: leporid (scrub hare)		Africa
<i>I. (Afrixodes) cavipalpus</i>	Artiodactyla: bovid (cattle, sheep, goat, korrigum, klippspringer, waterbuck, reedbuck, steenbok, Kirk's dikdik, steenbok, common duiker, bay duiker, Lichtenstein's hartebeest, Thomson's gazelle); Lagomorpha: leporid (hare); Eulipotyphla: erinacid (South African hedgehog); Carnivora: canid (dog, side-striped jackal), felid (cat, African wildcat, lion, leopard), herpestid (slender mongoose), viverrid (common genet, rusty-spotted genet, African civet, Congo civet); Primates: cercopithecid (yellow baboon, moustached guenon), hominid (human)		Africa
<i>I. (Afrixodes) ceylonensis</i>	Artiodactyla: bovid (cattle); Eulipotyphla: soricid (Asian house shrew); Rodentia: herpestid (ruddy mongoose), murid (black rat, bandicoot rat, Indian bush rat, Blanford's rat, little Indian field mouse), sciurid (jungle palm squirrel); Carnivora: felid (leopard cat, jungle cat), herpestid (ruddy mongoose); Primates: cercopithecid (bonnet macaque); Passeriformes: alaudid (unspecified lark)	(possible vector for Kyasanur Forest disease)	Sri Lanka
<i>I. (Pholeoixodes) chilensis</i>	Chiroptera: vespertilionid (Chilean myotis)		South America
<i>I. chiropterorum</i>	Chiroptera: miniopterid (common bent-wing bat), rhinolophid (greater horseshoe bat), vespertilionid (Natterer's bat)		Europe
<i>I. chordeilis</i>	Caprimulgiformes: caprimulgid (common nighthawk)		North America
<i>I. (Afrixodes) colasbelcouri</i>	Afrosoricida: tenrecid (tailless tenrec); Eulipotyphla: (soricid (shrew); Rodentia: murid (roof rat, black rat), nesomyid (unspecified rat)		Madagascar
<i>I. (Eschatocephalus) collaris</i>	Chiroptera: hipposiderid (Pomona roundleaf bat), rhinolophid (intermediate horseshoe bat)		Asia
<i>I. (Scaphixodes) collocaliae</i>	Apodiformes: apodid (white-rumped swiftlet)		Australasia
<i>I. columnae</i>	Rodentia: cricetid (red-backed vole), murid (large Japanese field mouse, small Japanese field mouse), sciurid (red squirrel, Japanese squirrel, Japanese giant flying squirrel); Lagomorpha: leporid (rabbit); Primates: hominid (human); Galliformes: phasianid (ring-necked pheasant, Swinhoe's pheasant); Piciformes: picid (unspecified woodpecker); Passeriformes: alcippeid (grey-cheeked fulvetta), cettid (yellow-bellied bush warbler), emberizid (black-faced bunting), muscicapid (snowy-browed flycatcher, white-browed bush robin), paradoxornithid (vinous-throated parrotbill), turdid (pale thrush), zosteropid (Taiwan yuhina)		Palaearctic
<i>I. (Pholeoixodes) conepati</i>	Rodentia: sciurid (rock squirrel); Carnivora: mephitid (skunk, hog-nosed skunk), procyonid (ringtail)		North America
<i>I. (Sternalixodes) confusus</i>	Artiodactyla: bovid (cattle); Perissodactyla: equid (horse); Diprotodontia: macropodid (unspecified wallaby); Carnivora: felid (cat); Aves (unspecified)		New Guinea
<i>I. (Pholeoixodes) cookei</i> (syn. <i>I. cruciarius</i>)	Artiodactyla: bovid (cattle, sheep); Didelphimorphia: didelphid (common opossum, Virginia opossum); Eulipotyphla: soricid (masked shrew, American water shrew); Lagomorpha: leporid (eastern cottontail); Rodentia: cricetid (deer mouse, eastern meadow vole), erethizontid (North American porcupine), geomyid (pocket gopher), hystricid (unspecified porcupine), murid (brown rat, field mouse, northern golden mouse), sciurid (groundhog, prairie dog, marmot, pallid yellow-bellied woodchuck, southern woodchuck, rock squirrel, brown ground squirrel, fox squirrel, gray squirrel, thirteen-lined ground squirrel), zapodid (meadow jumping mouse); Carnivora: canid (dog, coyote, American red fox, gray fox), castorid (American beaver), felid (cat, bobcat, cougar), mephitid (striped skunk, spotted skunk, Rio Grande spotted skunk, Florida skunk), mustelid (North American river otter, long-tailed weasel, short-	trauma, irritation, dermatitis (vector for Powassan encephalitis, tularemia, spotted fever, borreliosis (Lyme disease), filarioid nematode (<i>Ackertia marmotae</i>))	Americas

	tailed weasel, least weasel, ferret, American mink, European mink, American badger, fisher, marten, stoat), phocid (unspecified seal), procyonid (common raccoon, eastern raccoon, ringtail), viverrid (civet); Primates: hominid (human); Strigiformes: strigid (snowy owl); Passeriformes: emberizid (unspecified bunting), turdid (American robin)		
<i>I. (Ixodes) cooleyi</i>	Rodentia: ctenomyid (tuco-tuco)		South America
<i>I. (Ixodes) copei</i>	Passeriformes: mimid (northern mockingbird), turdid (white-eyed thrush)		Central America
<i>I. (Sternalixodes) cordifer*</i>	Dasyuromorphia: dasyurid (unspecified); Diprotodontia: petaurid (striped possum), phalangerid (southern common cuscus, northern common cuscus, white cuscus, Sulawesi bear cuscus), macropodid (unspecified wallaby); Rodentia: murid (Pacific rat, marmoset xanthurus rat); Primates: tarsiid (Dian's tarsier, Lariang tarsier); Gruiformes: rallid (unspecified rail); Passeriformes: acanthazid (unspecified peep-warbler, unspecified scrub-wren), cnemophilid (silken satinbird, velvet satinbird), locustellid (malia, chestnut-backed bush warbler), meliphagid (unspecified honeyeater), muscicapid (rufous-throated flycatcher), oriolid (pitohui), pachycephalid (unspecified whistler), paradisaeid (short-tailed paradigalla), petroicid (Australasian robin), rhipidurid (unspecified fantail), turdid (unspecified bubbling thrush), zosteropid (white-eye)	trauma	Australasia
<i>I. coreensis</i>	Carnivora: canid (Korean raccoon dog)		Asia
<i>I. (Exopalpiger) cornuae</i>	Galliformes (unspecified quail)		South America
<i>I. (Sternalixodes) cornuatus</i> (Tasmanian paralysis tick, southern paralysis tick)	Artiodactyla: bovid (cattle, sheep); Diprotodontia: macropodid (common wallaroo, Tasmania pademelon, kangaroo, wallaby), phalangerid (common brushtail possum), phascolarctid (koala), potoroid (Tasmania bettong), vombatid (common wombat); Peramelemorphia: peramelid (southern brown bandicoot, eastern barred bandicoot); Rodentia: murid (black rat, bush rat, swamp rat, house mouse); Carnivora: canid (dog), felid (cat); Primates: hominid (human); Passeriformes: acanthizid (Tasmanian scrubwren), artamid (black currawong, grey butcherbird), pachycephalid (grey shrike-thrush)	trauma, toxicosis, paralysis	Australia
<i>I. (Afrixodes) corwini</i>	Carnivora: canid (dog), felid (cat), herpestid (common slender mongoose, Cape gray mongoose), mustelid (African clawless otter), viverrid (common genet, Cape genet)		Africa
<i>I. (Ixodes) cuernavacensis</i>	Apodiformes: apodid (white-naped swift)		North America
<i>I. (Afrixodes) cumulatimpunctatus*</i>	Artiodactyla: bovid (royal antelope, harnessed bushbuck, bongo, oribi, bay duiker, black duiker, zebra duiker, Maxwell's duiker), suid (red river hog), tragulid (water chevrotain); Eulipotyphla: soricid (unspecified shrew); Pholidota: manid (African black-bellied pangolin); Hyracoidea: procaviid (western tree hyrax); Rodentia: hystricid (African brush-tailed porcupine), murid (typical striped grass mouse, delectable soft-furred mouse, rusty-bellied brush-furred rat, marsh rat, Indian gerbil), nesomyid (Gambian pouched rat), sciurid (fire-footed rope squirrel), thryomomyid (greater cane rat); Carnivora: felid (leopard), herpestid (marsh mongoose, common kusimanse), viverrid (African civet); Primates: cercopithecoid (Diana monkey), hominid (chimpanzee); Cuculiformes: cuculid (Senegal coucal); Galliformes: numidid (plumed guineafowl, black guineafowl), Passeriformes: turdid (Fraser's rufous thrush)	trauma, irritation	Africa
<i>I. (Pholeoixodes) dampfi</i>	Rodentia: geomyid (pocket gopher)		North America
<i>I. (Pholeoixodes) danyi</i>	Carnivora: canid (fox)		Europe
<i>I. (Ixodes) daveyi</i>	Artiodactyla: bovid (buffalo); Proboscidea: elephantid (elephant); Hyracoidea: procaviid (hyrax); Columbiformes: columbid (lemon dove); Musophagiformes: musophagid (purple-crested turaco, Rwenzori turaco); Passeriformes: cisticolid (croaking cisticola),		Africa

	ploceid (red-billed quelea), turdid (olive thrush)		
<i>I. (Afrixodes) dawesi</i>	Afrosoricida: potamogalid (giant otter shrew, Ruwenzori otter shrew), tenrecid (tenrec)		Africa
<i>I. (Sternalixodes) dendrolagi</i>	Diprotodontia: macropodid (Matchie's tree-kangaroo)		New Guinea
<i>I. (Ixodes) dentatus</i>	Artiodactyla: bovid (sheep); Didelphimorphia: didelphid (opossum); Lagomorpha: leporid (eastern cottontail, New England cottontail, European rabbit, swamp rabbit, snowshoe hare); Rodentia: cricetid (muskrat, meadow vole, deer mouse, white-footed mouse), murid (golden harvest mouse, brown rat, cotton rat), sciurid (American red squirrel, Douglas squirrel, groundhog); Carnivora: procyonid (common raccoon); Primates: hominid (human); Galliformes: odontophorid (bobwhite quail); Passeriformes: cardinalid (northern cardinal), corvid (blue jay), icterid (common grackle), mimid (brown thrasher), parid (tufted titmouse), passerellid (song sparrow, swamp sparrow, fox sparrow, field sparrow, white-throated sparrow, white-crowned sparrow, dark-eyed junco, eastern towhee), passerid (house sparrow), troglodytid (Carolina wren), turdid (hermit thrush, Swainson's thrush)	trauma, irritation, dermatitis (vector for Lyme disease, Connecticut virus, spotted fever, tularemia)	North America
<i>I. (Ixodes) dicei</i>	Lagomorpha: leporid (Dice's cottontail)		Costa Rica
<i>I. didelphis</i>	Didelphimorphia: didelphid (brown four-eyed opossum, white-eared opossum, Brazilian opossum); Rodentia: caviid (guinea pig), murid (mouse)		South America
<i>I. diversicoxalis</i>	Rodentia: cricetid (social vole), murid (house mouse, wood mouse); Eulipotyphla: soricid (greater white-toothed shrew)		Central Asia
<i>I. (Ixodes) diversifossus</i>	Artiodactyla: bovid (cattle); Lagomorpha: leporid (hare, mountain cottontail, jack rabbit, black-tailed jack rabbit, Washington jack rabbit); Rodentia: cricetid (woodrat), sciurid (Townsend's chipmunk); Carnivora: procyonid (common raccoon); Galliformes: odontophorid (bobwhite quail); Passeriformes: passerellid (fox sparrow)		North America
<i>I. (Afrixodes) djaronensis</i>	Carnivora: viverrid (large spotted genet, mongoose)		Africa
<i>I. (Ixodes) domerguei</i>	Passeriformes: ploceid (nelicourvi weaver), vangid (common newtonia)		Madagascar
<i>I. donarthuri</i>	Artiodactyla: bovid (common duiker, southern reedbeek)		Africa
<i>I. downsi</i>	Chiroptera: phyllostomid (Geoffroy's tailless bat); Caprimulgiformes: steatornithid (oilbird)		Central America
<i>I. (Afrixodes) drakensbergensis</i>	Artiodactyla: bovid (cattle, goat, eland)		Africa
<i>I. (Ixodes) eadsi</i>	Rodentia: heteromyid (Mexican spiny pocket mouse), cricetid (white-footed mouse, hispid cotton rat), murid (house mouse, fulvous harvest mouse), sciurid (chipmunk); Eulipotyphla: soricid (shrew)		North America
<i>I. eastoni</i>	Rodentia: cricetid (southern red-backed vole, long-tailed vole, eastern meadow vole, bushy-tailed woodrat, eastern deer mouse), dipodid (unspecified), sciurid (least chipmunk), zapodid (meadow jumping mouse); Eulipotyphla: soricid (common shrew)		North America
<i>I. (Multidentatus) eichorni</i> (syn. <i>I. mindanensis</i>)	Coraciiformes: alcedinid (kingfisher); Galliformes: phasianid (red junglefowl); Passeriformes: turdid (Norfolk thrush); Primates: hominid (human)		Australasia
<i>I. eidmanni</i>	Rodentia: nesomyid (Gambian pouched rat)		Africa
<i>I. eldaricus</i>	Rodentia: cricetid (grey dwarf hamster), murid (Cairo spiny mouse, house mouse, wood mouse, field mouse, mouse-like hamster, Persian jird, short-tailed bandicoot rat); Eulipotyphla: soricid (bicolored shrew); Carnivora: canid (red fox), felid (jungle cat); Chiroptera: rhinolophid (horseshoe bat); Charadriiformes: larid (gull); Galliformes: phasianid (common partridge, rock partridge, grey partridge, chukar partridge); Passeriformes: alaudid (lark), cettid (Cetti's warbler), corvid (crow), emberizid (red-headed bunting), fringillid (finch), locustellid (common grasshopper warbler), motacillid (tree pipit, tawny pipit), muscicapid (common redstart, Eversmann's redstart, European robin), passerid (house		Central Asia

	sparrow, saxaul sparrow), prunellid (dunnock), sittid (nuthatch), sturnid (common starling), sylviid (whitethroat), turdid (common blackbird, song thrush, black-throated thrush); Strigiformes: strigid (owl)		
<i>I. (Afrixodes) elongatus</i>	Macroscelidea: macroscelidid (short-snouted elephant shrew); Rodentia: murid (black rat, southern multimammate mouse, Natal multimammate mouse, red veld rat, creek rat); Eulipotyphla: soricid (shrew)		Africa
<i>I. (Multidentatus) eudyptidis</i> (syn. <i>I. intermedius</i> , <i>I. neumanni</i> , <i>I. praecoxalis</i>)	Anseriformes: anatid (unspecified duck); Charadriiformes: larid (silver gull, kelp gull, red-billed gull, black-backed gull, whiskered tern, black-fronted tern, Antarctic tern, Caspian tern), Pelecaniformes: threskiornithid (royal spoonbill); Procellariiformes: diomedeid (northern royal albatross, northern Buller's albatross, Chatham albatross), pelecanoidid (common diving petrel), procellariid (white-headed petrel, soft-plumaged petrel, Cook's petrel, Providence petrel, fairy prion); Sphenisciformes: spheniscid (yellow-eyed penguin, little penguin, Fiordland penguin); Suliformes: phalacrocoracid (great cormorant, spotted shag), sulid (northern gannet, Australasian gannet); Strigiformes: tytonid (Tasmanian masked owl); Rodentia: murid (mouse)		Australia, New Zealand
<i>I. euplecti</i>	Passeriformes: cisticolid (rattling cisticola, croaking cisticola), fringillid (yellow-fronted canary), malaconotid (black-crowned tchagra), motacillid (tree pipit), muscicapid (northern wheatear), ploceid (yellow-mantled widowbird, yellow bishop, yellow-crowned bishop, black bishop, black-winged red bishop, Baglafaecht weaver), pycnonotid (yellow-throated leaflove), turdid (African thrush, Abyssinian ground thrush)		Africa
<i>I. (Afrixodes) evansi</i>	Artiodactyla: bovid (harnessed bushbuck)		Africa
<i>I. exaratus</i>	Chiroptera: vespertilionid (parti-coloured bat, western barbastelle)		Europe
<i>I. exilipes</i>	Sauria: lacertid (ocellated lizard)		Africa
<i>I. (Exopalpiger) feicalis</i>	Dasyuromorphia: dasyurid (yellow-footed antechinus, dusky antechinus, brown antechinus, fawn antechinus, fat-tailed dunnart, slender-tailed dunnart, tiger quoll, western quoll, eastern quoll, Tasmanian devil), myrmecobiid (numbat); Peramelemorphia: peramelid (northern brown bandicoot, southern brown bandicoot, long-nosed bandicoot); Diprotodontia: macropodid (unspecified wallaby), phalangerid (brushtail possum), potoroid (unspecified); Rodentia: murid (mouse, black rat, bush rat, dusky field rat, pale field rat, , Australian swamp rat, fawn-footed mosaic-tailed rat); Perissodactyla: equid (horse); Carnivora: canid (dog), felid (cat); Primates: hominid (human)		Australia
<i>I. (Ixodes) festai</i> (syn. <i>I. thompsoni</i>)	Eulipotyphla: erinaceid (European hedgehog); Lagomorpha: leporid (European rabbit); Rodentia: glirid (garden dormouse, Maghreb garden dormouse), murid (black rat, wood mouse, Algerian mouse, Barbary striped grass mouse, North African gerbil), sciurid (red squirrel); Carnivora: canid (red fox), mustelid (common weasel); Galliformes: phasianid (chukar, Barbary partridge); Passeriformes: turdid (blackbird, thrush); Strigiformes: strigid (little owl); Sauria: agamid (Bibron's agama), lacertid (sand lizard, Algerian sand racer), scincid (ocellated skink, Algerian skink)		Africa
<i>I. (Pholeoixodes) filippovae</i> (syn. <i>I. crenulatus</i> p.p.)	Rodentia: sciurid (marmots)		Eurasia
<i>I. (Ixodes) fossulatus</i>	Artiodactyla: bovid (cattle); Carnivora: canid (dog)		Asia, South America
<i>I. frequens</i>	Artiodactyla: bovid (cattle); Perissodactyla: equid (horse); Primates: hominid (human)		Japan
<i>I. (Ixodes) frontalis</i> (syn. <i>I. pallipes</i> , <i>I. pari</i> , <i>I. sturni</i>)	Accipitriformes: accipitrid (Harris's hawk); Anseriformes: anatid (greylag goose); Charadriiformes: haematopodid (unspecified oystercatcher); Columbiformes: columbid (unspecified dove); Falconiformes: falconid (common kestrel); Galliformes: phasianid (common quail); Gruiformes: rallid (corncrake, water rail);	(possible vector for arboviruses, borrelioses, anaplasmosis)	Palaearctic

	<p>Passeriformes: acrocephalid (Eurasian reed warbler, great reed warbler), alaudid (woodlark), certhiid (treecreeper), cettid (Cetti's warbler), corvid (Eurasian magpie, Eurasian jay, Steller's jay, rook), emberizid (pine bunting, common reed bunting, yellowhammer), fringillid (European goldfinch, European greenfinch, chaffinch, hawfinch, brambling, bullfinch, linnet, redpoll, black rosy finch), laniid (red-backed shrike, brown shrike), locustellid (Savi's warbler), motacillid (tree pipit, meadow pipit, white wagtail), muscicapid (European robin, common redstart, black redstart, spotted flycatcher, red-breasted flycatcher, whinchat, European stonechat, common nightingale, thrush nightingale, bluethroat), parid (great tit, long-tailed tit, marsh tit, willow tit, coal tit, blue tit), passerid (house sparrow, tree sparrow, rock sparrow), phylloscopid (willow warbler, chiffchaff), prunellid (dunnock), reguliid (goldcrest), remizid (Eurasian penduline tit), sittid (Eurasian nuthatch), sturnid (starling), sylviid (barred warbler, Eurasian blackcap, Sardinian warbler, common whitethroat, lesser whitethroat), thraupid (masked crimson tanager), troglodytid (Eurasian wren), turdid (common blackbird, fieldfare, redwing, ring ouzel, song thrush, isabelline wheatear, hermit thrush); Piciformes: picid (great spotted woodpecker); Strigiformes: strigid (unspecified owl); Carnivora: mustelid (badger, marten); Primates: hominid (human)</p>		
<i>I. (Ixodes) fuscipes</i> (syn. <i>I. aragaoi</i>)	<p>Artiodactyla: bovid (cattle), cervid (brown brocket, little red brocket); Perissodactyla: equid (horse); Didelphimorphia: didelphid (short-tailed opossum, northern three-striped opossum, yellow-sided opossum, big lutrine opossum); Pilosa: myrmecophagid (southern tamandua); Rodentia: cricetid (Azara's grass mouse, Parana grass mouse, black-footed pygmy rice rat, lesser Wilfred's mouse), cuniculid (paca), dasyproctid (red-rumped agouti), sciurid (Brazilian squirrel); Carnivora: canid (dog), felid (cougar, ocelot); Passeriformes: furnariid (freckle-breasted thornbird, buff-browed foliage-gleaner, black-billed scythe bill, lesser woodcreeper), parulid (white-browed warbler, golden-crowned warbler), thamnophilid (dusky-tailed antbird), thraupid (ruby-crowned tanager, black-goggled tanager), turdid (white-necked thrush, rufous-bellied thrush)</p>		South America
<i>I. fuscomaculatus</i>	Serpentes: boid (common boa)		South America
<i>I. (Afrixodes) fynbosensis</i>	Rodentia: murid (four-striped grass mouse); Eulipotyphla: soricid (shrew); Carnivora: canid (dog)		Africa
<i>I. (Ixodes) galapagoensis</i>	Rodentia: cricetid (Galapagos rice rat)		Galapagos Islands
<i>I. garhwalicus</i>	Artiodactyla: bovid (sheep)		India
<i>I. (Exopalpiger) ghilarovi</i>	Rodentia: cricetid (grey dwarf hamster, European snow vole, Caucasian snow vole, Daghestan pine vole), murid (yellow-necked mouse); Eulipotyphla: soricid (Radde's shrew)		Russia
<i>I. (Ixodes) gibbosus</i>	Artiodactyla: bovid (cattle, sheep, goat), camelid (camel); Perissodactyla: equid (horse); Eulipotyphla: erinaceid (hedgehog); Lagomorpha: leporid (hare); Carnivora: canid (dog); Primates: hominid (human); Passeriformes: turdid (blackbird)		Palaearctic
<i>I. (Endopalpiger) giluwensis</i>	Rodentia: murid (eastern white-eared giant rat, squirrel-toothed rat, Rothschild's woolly rat)		New Guinea
<i>I. globulosus</i>	Rodentia: hystricid (staple-tailed porcupine)		Asia
<i>I. (Exopalpiger) goliath</i>	Rodentia: murid (eastern white-eared giant rat)		New Guinea
<i>I. (Ixodes) granulatus</i>	Rodentia: cricetid (Mexican deer mouse, Chapman's rice rat), murid (house mouse, striped field mouse, pencil-tailed tree mouse, black rat, greater bandicoot rat, mountain spiny rat, Bartel's spiny rat, Rajah spiny rat, Whitehead's spiny rat, Annandale's rat, ricefield rat, unicoloured rice rat, grey tree rat, dark-tailed tree rat, long-tailed giant rat, Edward's long-tailed giant rat, Polynesian rat, yellow-breasted rat, mountain giant Sunda rat, Muller's giant Sunda rat, Malaysian wood rat, Manipur white-toothed rat, Bartel's rat, Musschenbroek's Sulawesi maxomys, Hoffman's Sulawesi rat),		Eurasia

	<p>sciurid (gray-bellied squirrel, black-striped squirrel, gray squirrel, plantain squirrel, Anderson's squirrel, Low's squirrel, Pallas's squirrel, Prevost's squirrel, three-striped ground squirrel, Bornean mountain ground squirrel, northern palm squirrel, Javanese flying squirrel, least pygmy squirrel, giant squirrel, shrew-faced squirrel, Asian red-cheeked squirrel, slender squirrel); Eulipotyphla: erinaceid (short-tailed gymnure), soricid (moonrat, Malayan shrew, Oriental shrew); Scandentia: ptilocercid (pen-tailed treeshrew), tupaiid (common treeshrew, northern treeshrew, mountain treeshrew, Sumatran treeshrew, Bornean smooth-tailed treeshrew, Horsfield's treeshrew); Carnivora: felid (tiger), herpestid (mongoose); Primates: hominid (human); Sauria: scincid (little brown skink); Passeriformes: corvid (red-billed blue magpie), emberizid (black-faced bunting), sittid (Eurasian nuthatch), sylviid (unspecified warbler), timaliid (unspecified babbler), turdid (blackbird, pale thrush)</p>		
<i>I. gregsoni</i>	Carnivora: felid (cat), mustelid (mink, fisher, American marten)		North America
<i>I. (Ixodes) guatemalensis</i>	Rodentia: cricetid (big deer mouse), sciurid (red-bellied squirrel, Mexican gray squirrel); Eulipotyphla: soricid (Goodwin's broad-clawed shrew); Carnivora: mustelid (long-tailed weasel)		Central America
<i>I. (Ixodes) guernseyensis</i>	Rodentia: cricetid (bank vole)		Europe
<i>I. (Scaphixodes) gussevi</i>	Passeriformes: passerid (rock sparrow)		Central Asia
<i>I. happinus</i>	Artiodactyla: bovid (cattle)		Japan
<i>I. hayashii</i>	Carnivora: canid (dog)		Japan
<i>I. (Pholeioxodes) hearlei</i>	Rodentia: sciurid (pine squirrel, Streater's red squirrel, fox squirrel, golden-mantled ground squirrel, Tahoe chipmunk); Carnivora: procyonid (common raccoon)		North America
<i>I. heathi</i>	Diprotodontia: burramyid (mountain pygmy possum)		Australia
<i>I. (Afrixodes) heinrichi</i>	Passeriformes: macrosphenid (moustached grass warbler)		Africa
<i>I. (Pholeioxodes) hexagonus*</i> (syn. <i>I. erinaceus</i> , <i>reduvius</i> , <i>sexpunctatus</i> , <i>crenulatus p.p.</i>) (hedgehog tick)	<p>Artiodactyla: bovid (cattle, sheep, argali, goat, oryx), suid (pig, wild boar); Perissodactyla: equid (horse, donkey); Didelphimorphia: didelphid (opossum); Eulipotyphla: erinaceid (European hedgehog, northern white-breasted hedgehog, long-eared hedgehog), soricid (common shrew, pygmy shrew), talpid (European mole); Lagomorpha: leporid (European rabbit, mountain hare, desert hare, tolai hare, European hare, Chinese hare), ochotonid (Daurian pika); Rodentia: cricetid (grey dwarf hamster, European hamster, Chinese hamster, winter white dwarf hamster, northern mole vole, common vole, narrow-headed vole), dipodid (great jerboa, Mongolian five-toed jerboa), echimyid (coypu), geomyid (pocket gopher), glirid (garden dormouse, hazel dormouse, European edible dormouse), heterocephalid (mole rat), hystricid (crested porcupine), murid (house mouse, wood mouse, Eurasian harvest mouse, brown rat, black rat, short-tailed bandicoot rat, great gerbil), sciurid (red squirrel, eastern grey squirrel, little ground squirrel, golden-mantled ground squirrel, speckled ground squirrel, thirteen-lined ground squirrel, relict ground squirrel, Altai marmot, European ground squirrel, Daurian ground squirrel, long-tailed marmot, gray marmot, Bobak marmot, Menzbier's marmot, Tarbagan marmot, groundhog), sminthid (southern birch mouse, Tien Shan birch mouse); Carnivora: canid (dog, common raccoon dog, jackal, red fox, corsac fox), felid (cat, wildcat, ocelot), herpestid (Egyptian mongoose), mephitid (striped skunk), mustelid (European badger, Eurasian otter, stoat, least weasel, ferret, European polecat, steppe polecat, marbled polecat, European mink, beech marten, stone marten, European pine marten); Primates: hominid (human); Charadriiformes: charadriid (golden plover, European golden plover), scolopacid (ruff); Columbiformes: columbid (rock dove, common wood pigeon), Coraciiformes: coraciid (European roller), meropid (European bee-eater), Falconiformes: falconid (common kestrel, lesser kestrel);</p>	<p>trauma, pruritus, dermatitis (plus vector for borreliosis, babesiosis, theileriosis, Russian encephalitis virus)</p>	Eurasia, Africa, North America

	Galliformes: phasianid (common quail, grey partridge, rock partridge, chukar partridge); Gruiformes: rallid (corncrake); Passeriformes: acrocephalid (sedge warbler), alaudid (Eurasian skylark), corvid (red-billed chough), emberizid (rock bunting, yellowhammer), fringillid (common linnet, common chaffinch), hirundinid (sand martin), motacillid (tawny pipit, meadow pipit, pied wagtail), muscicapid (European robin, Siberian blue robin, collared flycatcher, pied flycatcher, isabelline wheatear, northern wheatear, common redstart, African stonechat), parid (great tit, Eurasian blue tit), passerid (house sparrow, rock sparrow, Eurasian tree sparrow), phylloscopid (common chiffchaff, willow warbler), prunellid (dunnock), regulid (common firecrest), sittid (western rock nuthatch), sturnid (common starling, rosy starling), sylviid (Eurasian blackcap, common whitethroat), troglodytid (Eurasian wren), turdid (common blackbird, song thrush, fieldfare); Strigiformes: strigid (little owl, swamp owl)		
<i>I. (Ixodes) himalayensis</i>	Rodentia: murid (mouse); Eulipotyphla: soricid (shrew)		India
<i>I. (Sternalixodes) hirsti</i> (Hirst's marsupial tick)	Diprotodontia: macropodid (western grey kangaroo, eastern grey kangaroo, red-necked wallaby, brush-tailed rock wallaby, red-necked pademelon, swamp wallaby), potoroid (brush-tailed bettong, long-nosed potoroo), petaurid (common ringtail possum, eastern ringtail possum), phalangerid (common brushtail possum, short-eared brushtail possum, Tasmanian brush-tailed possum), phascolarctid (koala); Carnivora: canid (dog), felid (cat); Rodentia: murid (bush rat, black rat); Passeriformes: acanthizid (striated thornbill, brown thornbill, white-bowed scrubwren), meliphagid (New Holland honeyeater, crescent honeyeater, tawny-crowned honeyeater, brown-headed honeyeater), muscicapid (scarlet robin), pardalotid (spotted pardalote)		Australia
<i>I. (Pholeoixodes) holdenriedi</i>	Rodentia: geomyid (Botta's pocket gopher)		North America
<i>I. (Sternalixodes) holocyclus</i> (Australian paralysis tick, eastern paralysis tick)	Artiodactyla: bovid (cattle, sheep, goat), camelid (camel), cervid (deer), suid (pig); Perissodactyla: equid (horse); Dasyuromorphia: dasyurid (yellow-footed antechinus, tiger quoll, brush-tailed phascogale, slender-tailed dunnart); Peramelemorphia: peramelid (northern brown bandicoot, southern brown bandicoot, long-nosed bandicoot); Diprotodontia: macropodid (black-striped wallaby, red-necked wallaby, Godman's rock-wallaby, brush-tailed rock-wallaby, swamp wallaby, red-legged pademelon, red kangaroo, Lumholtz's tree kangaroo), petaurid (striped possum, sugar glider), phalangerid (short-eared possum, common brushtail possum); phascolarctid (koala), potoroid (rufous rat-kangaroo, northern bettong), vombatid (wombat); Monotremata: tachyglossid (short-beaked echidna); Lagomorpha: leporid (rabbit); Rodentia: caviid (guinea pig), murid (house mouse, brown rat, black rat, cane-field rat, dusky field rat, pale field rat, bush rat, rakali, fawn-footed mosaic-tailed rat, Papua grassland mosaic-tailed rat, giant white-tailed rat, naked-tail rat), sciurid (red squirrel, red-tailed squirrel); Carnivora: canid (dog, dingo), felid (cat); Chiroptera: pteropodid (spectacled flying-fox), vespertilionid (little bat); Primates: hominid (human); Anseriformes: anatid (duck); Cuculiformes: cuculid (unspecified cuckoo); Galliformes: phasianid (chicken, turkey); Psittaciformes: psittaculid (crimson rosella); Passeriformes: acanthizid (yellow-throated scrubwren, white-browed scrubwren), artamid (pied butcherbird, Australian magpie, Lord Howe currawong), corvid (Australian raven), meliphagid (unspecified honeyeater), pittid (noisy pitta), ptilonorhynchid (bowerbird); Psittaciformes: psittacid (crimson rosella)	trauma, toxicosis, paralysis (plus vector for Q fever, Queensland tick typhus)	Eastern Australia
<i>I. (Ixodes) hoogstraali</i>	Rodentia: murid (king jird)		Arabia
<i>I. (Scaphixodes) howelli</i>	Passeriformes: hirundinid (cliff swallow), fringillid (gray-crowned rosy finch); Falconiformes: falconid (prairie falcon)		North America

<i>I. (Ixodes) hyatti</i> (syn. <i>I. ochotonarius</i>)	Lagomorpha: ochotonid (Royle's pika, Moupin pika); Rodentia: murid (mouse)		Nepal, Pakistan
<i>I. (Endopalpiger) hydromyidis</i>	Rodentia: murid (rakali, sooty beaver-rat, bush rat, black rat)		Australia
<i>I. imperfectus</i>	Didelphimorphia: didelphid (Chaco fat-tailed opossum)		South America
<i>I. inopinatus</i>	Artiodactyla: bovid (cattle, sheep); Carnivora: canid (red fox); Serpentes: lamprophiid (Cape sand snake), Sauria: lacertid (Algerian sand racer), varanid (mangrove monitor)		Eurasia, Africa
<i>I. (Ceraticodes) jacksoni</i>	Suliformes: phalacrocoracid (spotted shag)	trauma	Australasia
<i>I. japonensis</i>	Artiodactyla: bovid (cattle, sheep), cervid (barking deer, Indian muntjac); Perissodactyla: equid (mule); Eulipotyphla: erinaceid (European hedgehog), soricid (greater white-toothed shrew), talpid (Japanese mole); Lagomorpha: leporid (rabbit, mountain hare); Scandentia: tupaiid (common treeshrew); Rodentia: cricetid (Bedford's red-backed vole, Japanese grass vole, red vole), heteromyid (California pocket mouse), murid (brown rat, Japanese house mouse, small Japanese field mouse, large Japanese field mouse), sciurid (ground squirrel); Carnivora: canid (dog, common raccoon dog), felid (cat), mustelid (Japanese weasel), ursid (giant panda); Primates: hominid (human)		Asia
<i>I. (Ixodes) jellisoni</i>	Rodentia: cricetid (canyon mouse), geomyid (pocket gopher), heteromyid (long-tailed pocket mouse, California pocket mouse, agile kangaroo rat, California kangaroo rat), sciurid (ground squirrel); Carnivora: canid (dog), felid (cat); Primates: hominid (human)		North America
<i>I. (Exopalpiger) jonesae</i>	Rodentia: cricetid (soft-furred Oldfield mouse, forest small rice rat); Paucituberculata: caenolestid (Tate's shrew opossum)		South America
<i>I. juvenis</i>	Sauria: leiocephalid (unspecified iguana/curlytail)		South America
<i>I. (Pholeoixodes) kaiseri</i>	Carnivora: canid (red fox, desert fox), felid (jungle cat, African wildcat), hyaenid (striped hyena), mustelid (European badger); Eulipotyphla: erinaceid (European hedgehog); Rodentia: hystricid (Indian crested porcupine)		Eurasia, Africa
<i>I. (Pholeoixodes) kangdingensis</i>	Carnivora: mustelid (Siberian weasel)		China
<i>I. (Ixodes) kashmiricus</i>	Artiodactyla: bovid (cattle, sheep, goat); Rodentia: murid (house mouse, Turkestan rat), sciurid (flying squirrel); Carnivora: canid (dog); Primates: hominid (human); Sauria: agamid (rock agama)		Eurasia
<i>I. (Ixodes) kazakstani</i>	Artiodactyla: bovid (cattle); Eulipotyphla: soricid (long-tailed shrew); Lagomorpha: leporid (Tolai hare); Rodentia: cricetid (common vole, European snow vole, grey dwarf hamster), glirid (forest dormouse), murid (house mouse, wood mouse, midday jird, Tamarisk jird, great gerbil), sminthid (birch mouse); Primates: hominid (human); Galliformes: phasianid (rock partridge, ring-necked pheasant)		Central Asia
<i>I. kelloggi</i>	Passeriformes: corvid (Steller's jay), turdid (unspecified thrush)		North America
<i>I. kempii</i>	Rodentia: sciurid (red-bellied tree squirrel)		India
<i>I. (Multidentatus) kerguelensis</i>	Procellariiformes: diomedeid (wandering albatross), oceanitid (white-faced storm petrel), procellariid (grey petrel, soft-plumaged petrel, white-chinned petrel, Kerguelen petrel, Providence petrel, broad-billed prion, fairy prion, Antarctic prion, sooty shearwater, short-tailed shearwater, flesh-footed shearwater, common diving petrel, South Georgia diving petrel); Sphenisciformes: spheniscid (unspecified penguin); Psittaciformes: strigopid (kakapo)		Australia, New Zealand
<i>I. (Pholeoixodes) kingi</i> (syn. <i>I. pratti</i>) (rotund tick)	Rodentia: cricetid (desert woodrat, bushy-tailed woodrat, western harvest mouse, northern grasshopper mouse, southern grasshopper mouse, canyon mouse, pinyon mouse, cactus mouse, deer mouse, montane vole, sagebrush vole), geomyid (northern pocket gopher, Botta's pocket gopher, Mazama pocket gopher, Wyoming pocket gopher), heteromyid (little pocket mouse, long-tailed pocket mouse, Oregon pocket mouse, Great Basin pocket mouse, dark kangaroo mouse, chisel-toothed kangaroo rat, Merriam's kangaroo rat, Ord's kangaroo rat, Richardson's kangaroo rat), sciurid (black-tailed	trauma, irritation, dermatitis (possible vector for tularemia)	North America

	prairie dog, white-tailed prairie dog, Mexican prairie dog, Utah prairie dog, Gunninson's prairie dog, woodchuck, rock squirrel, Richardson's red squirrel, golden-mantled ground squirrel, Columbian ground squirrel, Wyoming ground squirrel, Richardson's ground squirrel, Townsend's ground squirrel, Uinta ground squirrel, white-tailed antelope squirrel, least chipmunk, cliff chipmunk, yellow-bellied marmot, pallid yellow-bellied woodchuck); Lagomorpha: leporid (cottontail, desert cottontail, mountain cottontail, rabbit, black-tailed jackrabbit), ochotonid (American pika); Carnivora: canid (dog, wolf, coyote, red fox, kit fox), felid (cat, bobcat), mephitid (striped skunk, western spotted skunk, eastern spotted skunk, hog-nosed skunk), mustelid (American badger, California badger, mink, black-footed ferret, long-tailed weasel), procyonid (common raccoon, ringtail); Serpentes: colubrid (striped whipsnake)		
<i>I. (Multidentatus) kohlsi</i>	Charadriiformes: larid (greater crested tern, fairy tern); Sphenisciformes: spheniscid (little penguin); Suliformes: phalacrocoracid (black-faced cormorant), sulid (Australasian gannet); Procellariiformes: procellariid (short-tailed shearwater); Primates: hominid (human)		Australia
<i>I. (Lepidixodes) kopsteini*</i> (syn. <i>I. paradoxus</i>) (Kopstein's bat tick)	Chiroptera: emballonurid (Theobald's tomb bat), molossid (white-striped free-tailed bat, northern free-tailed bat, little free-tailed bat, wrinkle-lipped free-tailed bat, Malayan free-tailed bat, Angolan free-tailed bat, hairless bat), vespertilionid (long-eared bat)	trauma, irritation	Africa, Asia, Australia
<i>I. (Ixodes) kuntzi</i>	Rodentia: murid (black rat, Coxing's white-bellied rat, Oldfield white-bellied rat, Taiwan field mouse), sciurid (Pallas's squirrel, Swinhoe's striped squirrel, red giant flying squirrel, red-and-white giant flying squirrel, Taiwan flying squirrel); Passeriformes: muscicapid (unspecified flycatcher), sittid (Eurasian nuthatch), timaliid (unspecified babbler), turdid (unspecified thrush)		Taiwan
<i>I. (Pholeoixodes) lagodechiensis</i>	Strigiformes: strigid (tawny owl)		Central Asia
<i>I. lagotis</i>	Rodentia: chinchillid (plains viscacha, northern viscacha)		South America
<i>I. (Ixodes) laguri</i>	Rodentia: cricetid (common vole, social vole, narrow-headed vole, bank vole, European water vole, European snow vole, European pine vole, Major's pine vole, golden hamster, grey dwarf hamster, Evermann's hamster, Ciscaucasian hamster, European hamster, Turkish hamster, steppe lemming), glirid (European edible dormouse), murid (house mouse, wood mouse, mound-building mouse, striped field mouse, Black Sea field mouse, Ural field mouse, Eurasian harvest mouse, great gerbil, Mongolian gerbil, Tristram's jird, brown rat, water rat), sciurid (yellow ground squirrel, speckled ground squirrel, little ground squirrel, red-cheeked ground squirrel, European ground squirrel, bobak marmot), smynthid (northern birch mouse, southern birch mouse); Eulipotyphla: erinaceid (long-eared hedgehog, European hedgehog), soricid (lesser white-toothed shrew); Lagomorpha: leporid (European hare), ochotonid (steppe pika); Carnivora: canid (dog, red fox), felid (cat), mustelid (steppe polecat, marbled polecat, European polecat, least weasel, European pine marten); Primates: hominid (human); Passeriformes: alaudid (Eurasian skylark)		Europe
<i>I. laridis</i>	Charadriiformes: larid (white-fronted tern, Caspian tern, silver gull, kelp gull); Pelecaniformes: threskiornithid (royal spoonbill); Procellariiformes: diomedeid (northern royal albatross, northern Buller's albatross, Chatham albatross), procellariid (white-headed petrel); Suliformes: phalacrocoracid (great cormorant, spotted shag, Otago shag), sulid (Australasian gannet)	lesions, possibly paralysis	Australia, New Zealand
<i>I. (Ixodes) lasallei</i>	Rodentia: cuniculid (lowland paca), dasyproctid (black agouti, red-rumped agouti, Central American agouti); Didelphimorphia: didelphid (woolly mouse opossum); Carnivora: felid (ocelot)		South America
<i>I. (Afrinoxodes) latus</i>	Artiodactyla: bovid (cattle); Rodentia: sciurid (black-and-red bush squirrel); Hyracoidea: procaviid (hyrax)		Africa
<i>I. (Multidentatus)</i>	Anseriformes: anatid (Hawaiian duck); Charadriiformes: larid (sooty	trauma	Pacific Islands

<i>I. laysanensis</i> *	tern, greater crested tern, brown noddy), scolopacid (ruddy turnstone); Passeriformes: drepanidid (Hawaiian honeycreeper), fringillid (finch), sturnid (starling); Phaethontiformes: phaethontid (red-tailed tropicbird); Procellariiformes: diomedeid (black-footed albatross, Laysan albatross), procellariid (wedge-tailed shearwater); Suliformes: fregatid (great frigatebird), sulid (red-footed booby, masked booby); Primates: hominid (human)		
<i>I. (Afrixodes) lemuris</i>	Primates: cheirogaleid (unspecified mouse lemur), lemurid (red-fronted lemur); Rodentia: murid (unspecified rodent)		Madagascar
<i>I. (Afrixodes) lewisi</i>	Artiodactyla: bovid (cattle, buffalo, sheep, common eland, harnessed bushbuck, common duiker, red forest duiker, Kirk's dik-dik, bongo), giraffid (giraffe); Hyracoidea: procaviid (hyrax); Carnivora: canid (dog), felid (unspecified)		Africa
<i>I. lindbergi</i>	Primates: hominid (human)		Himalayas
<i>I. lisphilus</i>	Rodentia: sciurid (Japanese squirrel)		Japan
<i>I. (Pholeoixodes) lividus</i> (syn. <i>I. hirundinicola</i> , <i>plumbeus</i>)	Coraciiformes: alcedinid (kingfisher), meropid (bee-eater); Passeriformes: alaudid (Eurasian skylark), hirundinid (common house martin, sand martin), muscicapid (redstart), parid (tit), passerid (Eurasian tree sparrow), sturnid (common starling), turdid (common blackbird); Rodentia: murid (wood mouse); Carnivora: canid (dog); Chiroptera: vespertilionid (common pipistrelle)	anaemia (possible vector for rickettsiosis, borreliosis, encephalitis virus, West Nile virus)	Palaearctic
<i>I. longiscutatus</i>	Artiodactyla: bovid (cattle); Perissodactyla: equid (horse); Rodentia: caviid (montane guinea pig, Brazilian guinea pig), cricetid (Altiplano grass mouse, dark bolo mouse, yellow pygmy rice rat, black-footed pygmy rice rat, long-nosed hociudo, Waterhouse's swamp rat)		South America
<i>I. (Ixodes) loricatus</i> (syn. <i>I. coxaefurcatus</i>)	Didelphimorphia: didelphid (common opossum, big-eared opossum, white-eared opossum, agile gracile opossum, big lutrine opossum, water opossum, brown four-eyed opossum, gray-and-black four-eyed opossum, gray four-eyed opossum, southeastern four-eyed opossum, yellow-sided opossum, red-sided short-tailed opossum, long-nosed short-tailed opossum, northern three-striped opossum, woolly mouse opossum, Linnaeus's mouse opossum); Cingulata: dasypodid (nine-banded armadillo); Rodentia: caviid (guinea pig), cricetid (Azara's grass mouse, vesper mouse, Cariri climbing mouse, unspecified cane mouse, russet rice rat, terraced rice rat, large-headed rice rat, yellow pygmy rice rat, black-footed pygmy rice rat, web-footed marsh rat, Argentine swamp rat, Waterhouse's swamp rat, red hociudo, long-nosed hociudo), cuniculid (lowland paca), murid (house, black rat, brown rat); Carnivora: procyonid (South American coati); Primates: atelid (Geoffroy's spider monkey)		South America
<i>I. (Afrixodes) loveridgi</i>	Rodentia: nesomyid (southern giant pouched rat)		Africa
<i>I. (Ixodes) luciae</i>	Artiodactyla: cervid (brown brocket); Didelphimorphia: didelphid (common opossum, white-eared opossum, big lutrine opossum, brown-eared woolly opossum, bare-tailed woolly opossum, woolly mouse opossum, white-bellied woolly mouse opossum, Mexican mouse opossum, Linnaeus's mouse opossum, Robinson's mouse opossum, Tschudi's slender opossum, brown four-eyed opossum, northern red-sided opossum, southern red-sided opossum, Anderson's four-eyed opossum, gray four-eyed opossum, grayish mouse opossum, buff-bellied fat-tailed mouse opossum, Cinderella fat-tailed mouse opossum); Eulipotyphla: soricid (shrew); Rodentia: cricetid (vesper mouse, Sumichrast's vesper rat, western Amazonian oryzomys, unicolorized rice rat, bicolorized arboreal rice rat, small-eared pygmy rice rat, marsh rice rat, Yungas rice rat, Pittier's crab-eating rat, cotton rat, short-tailed cane mouse), cuniculid (lowland paca), echimyid (spiny rat); Carnivora: canid (dog)		Africa, South America
<i>I. (Ixodes) lunatus</i>	Rodentia: murid (black rat), nesomyid (lowland red forest rat, white-bellied nesomys); Afrosoricida: tenrecid (tenrec, greater hedgehog tenrec, Dobson's shrew tenrec)		Madagascar

<i>I. (Endopalpiger) luxuriosus*</i>	Dasyuromorphia: dasyurid (New Guinean quoll); Peramelemorphia: peramelid (white-lipped bandicoot, striped bandicoot, Raffray's bandicoot); Diprotodontia: macropodid (tree kangaroo, small dorcopsis, pademelon), petaurid (long-fingered triok), phalangerid (Stein's cuscus), pseudocheirid (coppery ringtail possum); Monotremata: tachyglossid (echidna); Rodentia: murid (Rothschild's woolly rat, eastern white-eared giant rat, black-tailed mosaic-tailed rat, mountain mosaic-tailed rat, giant white-tailed rat, moss forest rat, Stein's rat)	trauma	Australasia
<i>I. (Afrixodes) macfarlanei</i>	Artiodactyla: bovid (yellow-backed duiker); Carnivora: viverrid (Cape genet)		Africa
<i>I. (Ixodes) malayensis</i>	Scandentia: tupaiid (common treeshrew)		Asia
<i>I. (Pholeoixodes) marmotae</i>	Rodentia: cricetid (bushy-tailed woodrat, deer mouse), erethizontid (North American porcupine), sciurid (woodchuck, yellow-bellied marmot, golden-mantled ground squirrel, Columbian ground squirrel, Richardson's ground squirrel, Uinta ground squirrel); Passeriformes: hirundinid (sand martin)		North America
<i>I. (Pholeoixodes) marxi</i>	Artiodactyla: bovid (unspecified); Lagomorpha: leporid (black-tailed jackrabbit, snowshoe hare); Eulipotyphla: soricid (shrew); Rodentia: cricetid (vole, deer mouse, white-footed mouse), sciurid (eastern chipmunk, least chipmunk, eastern grey squirrel, American red squirrel, northern flying squirrel); Carnivora: canid (dog, fox), felid (cat), mustelid (weasel), procyonid (raccoon); Primates: hominid (human); Passeriformes (unspecified)	(vector for Powassan virus)	North America
<i>I. maskelli</i>	Procellariiformes: diomedeid (wandering albatross)		New Zealand
<i>I. maslovi</i>	host unknown, collected from vegetation		Russia
<i>I. (Afrixodes) matopi</i>	Artiodactyla: bovid (goat, klipspringer); Hyracoidea: procaviid (rock hyrax, yellow-spotted rock hyrax); Lagomorpha: leporid (red rock hare)		Africa
<i>I. megathyreus</i>	Carnivora: canid (dog); Eulipotyphla: erinaceid (European hedgehog)		Europe
<i>I. mellinus</i>	Carnivora: mustelid (European badger)		Europe
<i>I. (Ixodes) mexicanus</i>	Passeriformes: emberizid (unspecified bunting), passerellid (yellow-eyed junco), troglodytid (spotted wren, cactus wren)		North America
<i>I. (Afrixodes) microgalei</i>	Afrosoricida: tenrecid (pygmy shrew tenrec, shrew-toothed shrew tenrec, Dobson's shrew tenrec)		Madagascar
<i>I. (Ixodes) minor</i> (syn. <i>I. bishoppi</i>)	Rodentia: cricetid (woodrat, hispid cotton rat, eastern rice rat, Boquete rice rat, Mexican deer mouse, Florida mouse, vesper mouse), murid (house mouse, rat), sciurid (woodchuck, eastern gray squirrel); Lagomorpha: leporid (eastern cottontail); Carnivora: mephitid (eastern spotted skunk); Passeriformes: passerellid (eastern towhee), troglodytid (house wren), turdid (ruddy-capped nightingale-thrush)		Americas
<i>I. (Afrixodes) minutae</i>	Rodentia: murid (southern multimammate mouse)		Africa
<i>I. (Endopalpiger) mirzai</i>	Dasyuromorphia: dasyurid (three-striped dasyure); Peramelemorphia: peramelid (striped bandicoot); Galliformes: megapodid (wattled brush turkey)		New Guinea
<i>I. (Scaphixodes) mitchelli</i>	Galliformes: phasianid (Himalayan monal, snow partridge)		Nepal
<i>I. (Ixodes) monospinosus</i>	Artiodactyla: bovid (unspecified), cervid (deer); Rodentia: cricetid (vole), murid (mouse); Eulipotyphla: talpid (mole); Carnivora: ursid (bear); Primates: hominid (human)		Palaearctic
<i>I. (Ixodes) montoyanus</i>	Artiodactyla: cervid (northern pudu, brocket deer); Carnivora: procyonid (western mountain coati)		South America
<i>I. (Afrixodes) moreli</i>	Artiodactyla: bovid (harnessed bushbuck, bay duiker, black duiker, red-flanked duiker, zebra duiker, Maxwell's duiker, royal antelope, suni); Rodentia: thryonomyid (greater cane rat); Carnivora: felid (leopard), nandiniid (African palm civet), viverrid (African civet)		Africa
<i>I. moscharius</i>	Artiodactyla: moschid (dwarf musk deer)		China
<i>I. (Ixodes) moschiferi</i> (syn. <i>I. rangtangensis</i>)	Artiodactyla: moschid (Siberian musk deer, alpine musk deer, dwarf musk deer)		Nepal, China

<i>I. mossambicensis</i>	Rodentia: thryonomyid (greater cane rat)		Africa
<i>I. (Afrixodes) muniensis</i>	Artiodactyla: bovid (goat, bushbuck, bay duiker, blue duiker, black duiker, black-fronted duiker, red-flanked duiker, Maxwell's duiker, harnessed bushbuck, royal antelope, forest antelope, Bate's dwarf antelope, bongo), giraffid (giraffe), suid (pig, red river hog); Hyracoidea: procaviid (western tree hyrax); Rodentia: murid (Rudd's mouse), nesomyid (Gambian pouched rat), sciurid (Gambian sun squirrel), thryonomyid (greater cane rat); Carnivora: canid (dog), felid (cat, leopard), herpestid (common kusimanse), viverrid (African civet); Primates: hominid (human)		Africa
<i>I. (Ixodes) muris</i> (mouse tick)	Artiodactyla: cervid (white-tailed deer); Rodentia: cricetid (eastern meadow vole, montane vole, meadow mouse, muskrat, deer mouse, white-footed mouse), murid (mouse, brown rat), sciurid (eastern gray squirrel, eastern chipmunk), zapodid (meadow jumping mouse, woodland jumping mouse); Eulipotyphla: soricid (common shrew, long-tailed shrew, northern short-tailed shrew, Arctic shrew, Say's least shrew, American water shrew); Lagomorpha: leporid (eastern cottontail, Mearn's cottontail); Carnivora: canid (dog, American red fox), felid (cat), mephitid (striped skunk), procyonid (raccoon); Primates: hominid (human); Charadriiformes: larid (gull), scolopacid (sandpiper); Galliformes: odontophorid (bobwhite), phasianid (fowl); Passeriformes: corvid (blue jay), emberizid (bunting), icterid (blackbird), mimid (gray catbird, brown thrasher), parulid (yellowthroat, northern waterthrush, mourning warbler, black-and-white warbler, blue-winged warbler, Tennessee warbler), passerellid (song sparrow, swamp sparrow, white-throated sparrow, eastern towhee), troglodytid (house wren, Carolina wren), turdid (Swainson's thrush, American robin, veery)	trauma, irritation, dermatitis (plus vector for theileriosis, babesiosis)	North America
<i>I. (Multidentatus) murreleti</i>	Charadriiformes: alcid (Scripp's murrelet, Guadalupe murrelet)		North America
<i>I. myospalacis</i>	Rodentia: spalacid (Chinese zokor)		China
<i>I. (Afrixodes) myotomys</i>	Carnivora: felid (cat, caracal); Rodentia: murid (bush vlei rat, bush Karoo rat)		Africa
<i>I. (Sternalixodes) myrmecobii</i>	Dasyuromorphia: myrmecobiid (numbat); Diprotodontia: potoroid (woylie); Perissodactyla: equid (horse); Carnivora: canid (dog), felid (cat); Primates: hominid (human)		Australia
<i>I. (Afrixodes) nairobiensis</i>	Artiodactyla: bovid (unspecified), suid (desert warthog); Eulipotyphla: soricid (white-toothed shrew); Rodentia: murid (black rat, East African creek rat, rock rat, grass rat, Creel groove-toothed swamp rat, tropical vlei rat, Abyssinian grass rat, Namaqua rock rat, typical striped grass mouse, southern multimammate mouse, Natal multimammate mouse); Carnivora: canid (dog), herpestid (mongoose), viverrid (African civet)		Africa
<i>I. (Afrixodes) nchisiensis</i>	Rodentia: murid (Abyssinian grass rat); Eulipotyphla: soricid (Oriental shrew); Macroscelidea: macroscelidid (four-toed elephant shrew)		Africa
<i>I. (Ixodes) nectomys</i>	Rodentia: cricetid (western Amazonian nectomys)		South America
<i>I. (Ixodes) neotomae</i>	Rodentia: cricetid (dusky-footed woodrat, desert woodrat, muskrat, deer mouse), heteromyid (kangaroo rat); Lagomorpha: leporid (brush rabbit, volcano rabbit, black-tailed jackrabbit, desert cottontail, La Jolla jackrabbit, hare); Carnivora: canid (dog, gray fox)		North America
<i>I. (Afrixodes) neitzi</i>	Artiodactyla: bovid (mountain reedbeek, impala)		Africa
<i>I. (Afrixodes) nesomys</i>	Rodentia: nesomyid (pouched rat)		Africa
<i>I. neuquenensis</i>	Microbiotheria: microbiotheriid (monito del monte (little bush monkey), Panchos's monito del monte)		South America
<i>I. nicolasi</i>	Artiodactyla: bovid (cattle)		Africa
<i>I. (Ixodes) nipponensis</i>	Artiodactyla: bovid (cattle, goat), cervid (water deer, Siberian roe deer), suid (boar); Perissodactyla: equid (horse); Eulipotyphla: soricid (Asian house shrew, lesser Ryuka shrew), talpid (Ussuri mole); Lagomorpha: leporid (mountain hare, Japanese hare); Rodentia: cricetid (deer mouse), murid (mouse, black rat, Ryuku	(possible vector for anaplasmosis, borreliosis)	Asia

	mouse), sciurid (Siberian chipmunk); Carnivora: canid (dog, raccoon dog), felid (cat, leopard cat), mustelid (Asian badger, Siberian weasel), ursid (bear); Primates: hominid (human); Passeriformes: emberizid (black-faced bunting), motacillid (wagtail, Pechora pipit), phylloscopid (dusky warbler), sylviid (babbler), turdid (eyebrowed thrush, pale thrush); Sauria: lacertid (Amur grass lizard, mountain grass lizard), scincid (Tsushima ground skink)		
<i>I. (Ixodes) nitens</i>	Rodentia: murid (Maclear's rat)		Christmas Island
<i>I. nodulipes</i>	Chiroptera: vespertilionid (parti-coloured bat, western barbastelle)		Europe
<i>I. (Pholeoixodes) nuttalli</i>	Rodentia: chinchillid (southern viscacha, northern viscacha)		South America
<i>I. (Ixodes) nuttallianus</i> (syn. <i>I. muntiaci</i> , <i>ricinoides</i>)	Artiodactyla: bovid (cattle, yak, goral, buffalo, sheep, serow, goat), cervid (swamp deer, Indian muntjac), moschid (musk deer); Carnivora: canid (dog)		Eurasia
<i>I. (Ixodes) occultus</i>	Rodentia: cricetid (unspecified hamster), murid (great gerbil, midday jird, Libyan jird, house mouse), sciurid (yellow ground squirrel); Eulipotyphla: soricid (lesser white-toothed shrew, piebald shrew); Carnivora: mustelid (least weasel, mountain weasel, marbled polecat); Serpentes: viperid (Amur viper)		Central Asia
<i>I. (Pholeoixodes) ochotonae</i>	Lagomorpha: ochotonid (American pika); Rodentia: cricetid (bushy-tailed woodrat, deer mouse, canyon mouse, pinyon mouse, red-backed vole, meadow vole, heather vole), geomyid (northern pocket gopher), sciurid (cliff chipmunk, pine squirrel, golden-mantled ground squirrel, Uinta ground squirrel, white-tailed antelope squirrel); Carnivora: canid (gray fox)		Americas
<i>I. ochotonarius</i>	Lagomorpha: ochotonid (Moupin pika)		China
<i>I. (Afrixodes) okapiae</i>	Artiodactyla: giraffid (okapi)		Africa
<i>I. (Afrixodes) oldi</i>	Artiodactyla: bovid (cattle, black duiker); Eulipotyphla: soricid (Oriental shrew); Pholidota: manid (long-tailed pangolin); Macroscelidea: macroscelidid (elephant shrew); Rodentia: heterocephalid (mole rat), murid (forest rat, sub-Saharan pygmy mouse), nesomyid (Gambian pouched rat), sciurid (grey squirrel, African bush squirrel); Carnivora: canid (dog), felid (cat, leopard), herpestid (marsh mongoose, long-haired mongoose, Egyptian mongoose), viverrid (common genet, rusty-spotted genet, African civet); Primates: cercopithecid (mona monkey, spot-nosed monkey)		Africa
<i>I. orbiculatus</i>	Rodentia: sciurid (fox squirrel)		North America
<i>I. (Coxixodes) ornithorhynchi*</i> (platypus tick)	Monotremata: ornithorhynchid (platypus)	trauma	Australia
<i>I. (Partipalpiger) ovatus*</i>	Artiodactyla: bovid (cattle, zebu, zhum, buffalo, sheep, goat, goral, serow), cervid (Indian muntjac, chital, tufted deer, dwarf musk deer, alpine musk deer); Perissodactyla: equid (horse); Rodentia: cricetid (Royle's high mountain vole), murid (house mouse, little Himalayan rat, chestnut rat); Lagomorpha: leporid (Japanese hare, mountain hare), ochotonid (Royle's pika); Eulipotyphla: soricid (house shrew, brown-toothed shrew, Sikkim large-clawed shrew), talpid (mole); Scandentia: tupaiid (treeshrew); Carnivora: canid (dog, red dog, golden jackal), felid (wildcat, leopard cat), mustelid (Siberian weasel), ursid (giant panda), viverrid (Asian palm civet); Primates: hominid (human); Galliformes: phasianid (kalij pheasant); Passeriformes: emberizid (bunting)	trauma, irritation, dermatitis (plus vector for theileriosis, borreliosis)	Asia, Japan
<i>I. ozarkus</i>	Artiodactyla: cervid (deer); Carnivora: canid (dog), procyonid (raccoon); Primates: hominid (human)		North America
<i>I. (Ixodes) pacificus</i> (western black-legged tick)	Artiodactyla: bovid (cattle, sheep, goat), cervid (Columbian black-tailed deer); Perissodactyla: equid (horse, mule); Lagomorpha: leporid (cottontail, jackrabbit, snowshoe hare); Didelphimorphia: didelphid (Virginia opossum); Eulipotyphla: soricid (vagrant shrew), talpid (North American mole, northern broad-footed mole, coast mole); Rodentia: cricetid (dusky-footed woodrat, desert woodrat, deer mouse, brush mouse, canyon mouse, cactus mouse, pinyon	trauma, irritation, tick paralysis (vector for borreliosis (incl. Lyme disease),	North America

	mouse, western harvest mouse, California vole), heteromyid (long-tailed pocket mouse, California pocket mouse, Great Basin pocket mouse), murid (mouse, rat), sciurid (cliff chipmunk, northern flying squirrel, western gray squirrel, pine squirrel, Douglas's squirrel, chickaree, California ground squirrel), zapodid (jumping mouse); Carnivora: canid (dog, wolf, coyote, gray fox), felid (cat, wildcat, bobcat, cougar), mustelid (American mink, long-tailed weasel), procyonid (raccoon); Primates: hominid (human); Galliformes: phasianid (California quail, grouse); Passeriformes: corvid (California scrub jay, magpie), emberizid (unspecified bunting), passerellid (rufous-crowned sparrow, chipping sparrow, golden-crowned sparrow, dark-eyed junco), troglodytid (unspecified wren); Sauria: anguid (northern alligator lizard, southern alligator lizard), phrynosomatid (blue-bellied lizard, sagebrush lizard, Great Basin fence lizard), teiid (whiptail lizard); Serpentes: colubrid (north-western garter snake)	tularemia, <i>Babesia</i> -like organisms, spotted fever, anaplasmosis, ehrlichiosis, encephalitis)	
<i>I. (Multidentatus) paranaensis</i>	Apodiformes: apodid (biscutate swift, sooty swift, great dusky swift, white-collared swift)		South America
<i>I. (Ixodes) pararicinus</i>	Artiodactyla: bovid (cattle), cervid (brown brocket), tayassuid (collared peccary); Perissodactyla: equid (horse); Didelphimorphia: didelphid (sepia short-tailed opossum, buff-bellied fat-tailed mouse opossum); Rodentia: cricetid (large vesper mouse, fecund vesper mouse, destructive pygmy rice rat); Carnivora: canid (dog); Chiroptera: phyllostomid (common vampire bat); Passeriformes: corvid (plush-crested jay), emberizid (saffron-billed sparrow, rufous-collared sparrow, stripe-headed brush-finch, yellow-striped brush-finch, red pileated finch), furnariid (buff-browed foliage-gleaner), parulid (brown-capped whitestart, two-banded warbler), passerellid (saffron-billed sparrow, white-browed brushfinch, yellow-striped brushfinch), thraupid (red pileated finch), troglodytid (house wren), turdid (creamy-bellied thrush, rufous-bellied thrush, Andean slaty thrush)		South America
<i>I. parvirostris</i>	Suliformes: phalacrocoracid (pelagic cormorant)		Japan
<i>I. (Ixodes) pavlovskyi</i> (incl. subspp. <i>pavlovskyi</i> , <i>occidentalis</i>)	Artiodactyla: bovid (cattle); Eulipotyphla: erinaceid (hedgehog), soricid (common shrew, bicolored shrew); Lagomorpha: leporid (rabbit), ochotonid (pika); Rodentia: cricetid (common vole, grey red-backed vole, northern red-backed vole), murid (striped field mouse, wood mouse, house mouse), sciurid (Siberian chipmunk), sminthid (Altai birch mouse); Carnivora: canid (dog), procyonid (raccoon); Primates: hominid (human); Anseriformes: anatid (unspecified duck); Columbiformes: columbid (blue hill pigeon); Galliformes: phasianid (hazel grouse, western capercaillie); Gruiformes: rallid (corn crane); Passeriformes: corvid (carrion crow), emberizid (yellowhammer, pine bunting), fringillid (European goldfinch, common rosefinch), motacillid (tree pipit), muscicapid (common redstart), sturnid (common starling), sylviid (common whitethroat), turdid (fieldfare)	trauma (vector for tick-borne encephalitis, Kemerovo virus, Lyme disease)	Eurasia
<i>I. (Multidentatus) percavatus</i>	Charadriiformes: alcid (puffin), larid (herring gull); Procellariiformes: diomedeid (Atlantic yellow-nosed albatross), oceanitid (black-bellied storm petrel), procellariid (short-tailed shearwater, blue petrel, common diving petrel, South Georgia diving petrel); Sphenisciformes: spheniscid (little penguin); Passeriformes: turdid (Tristan thrush)		islands in Atlantic and Indian oceans
<i>I. (Ixodes) peromysci</i>	Rodentia: cricetid (eastern deer mouse), murid (mouse); Sauria: anguid (glass lizard)		North America
<i>I. (Ixodes) persulcatus</i> (taiga tick)	Artiodactyla: bovid (cattle, sheep, argali, goat), camelid (camel), cervid (elk, red deer, roe deer, sika deer, Manchurian wapiti, moose), moschid (Siberian musk deer), suid (pig); Perissodactyla: equid (horse); Lagomorpha: leporid (rabbit, desert hare, mountain hare, Tolai hare, Manchurian hare), ochotonid (alpine pika, northern pika, large-eared pika); Eulipotyphla: erinaceid (European hedgehog, Amur hedgehog), soricid (common shrew, long-clawed shrew, greater white-toothed shrew, lesser white-toothed shrew,	trauma (vector for babesiosis, theileriosis, anaplasmosis, borreliosis (incl. Lyme disease), ehrlichiosis,	Eurasia

	<p>Siberian large-toothed shrew, Arctic shrew, Eurasian water shrew, Eurasian least shrew, pygmy shrew, Eurasian pygmy shrew, Pacific shrew, Laxmann's shrew, Ussuri shrew), talpid (European mole, Ussuri mole); Rodentia: cricetid (muskrat, common vole, bank vole, reed vole, tundra vole, narrow-headed vole, Japanese grass vole, Maximowicz's vole, short-tailed field vole, grey red-backed vole, northern red-backed vole, silver mountain vole, European pine vole, European water vole, Tien Shan forest vole, northern mole vole, grey dwarf hamster, European hamster, Chinese striped hamster, giant rat-headed hamster, wood lemming, steppe lemming), glirid (forest dormouse), murid (house mouse, striped field mouse, Eurasian harvest mouse, small Japanese field mouse, large Japanese field mouse, yellow-necked mouse, wood mouse, black rat, brown rat, great gerbil), sciurid (Siberian chipmunk, gray marmot, red squirrel, Siberian flying squirrel), sminthid (northern birch mouse, long-tailed birch mouse, Altai birch mouse, Tianshan birch mouse); Carnivora: canid (dog, wolf, dhole, common raccoon dog, red fox), felid (cat, Eurasian lynx, leopard, snow leopard, tiger), mustelid (European badger, yellow-throated marten, pine marten, steppe polecat, stoat, least weasel, Siberian weasel), ursid (brown bear); Primates: hominid (human); Accipitriformes: accipitrid (besra, Eurasian sparrowhawk, common buzzard, hen harrier, Montagu's harrier); Bucerotiformes: upupid (Eurasian hoopoe); Charadriiformes: scolopacid (Eurasian woodcock, Swinhoe's snipe, green sandpiper); Columbiformes: columbid (hill pigeon, common wood pigeon, European turtle dove, Oriental turtle dove); Cuculiformes: cuculid (common cuckoo, Himalayan cuckoo, Malaysian hawk-cuckoo); Falconiformes: falconid (common kestrel); Galliformes: phasianid (chicken, common quail, hazel grouse, black grouse, wood grouse, rock partridge, chukar partridge, green pheasant, western capercaillie); Gruiformes: rallid (corn crane, wood hen); Passeriformes: acrocephalid (great reed warbler, thick-billed warbler, Blyth's reed warbler, Oriental reed warbler, marsh warbler), alaudid (Eurasian skylark), campephagid (rosy minivet), cardinalid (scarlet grosbeak), cettid (Asian stubtail), corvid (azure-winged magpie, Eurasian magpie, hooded crow, western jackdaw, Eurasian jay, Siberian jay, spotted nutcracker), emberizid (yellow-breasted bunting, meadow bunting, chestnut bunting, black-faced bunting, yellow-throated bunting, white-capped bunting, chestnut-eared bunting, pine bunting, rustic bunting, common reed bunting, Tristram's bunting, yellowhammer), fringillid (brambling, bullfinch, chaffinch, hawfinch, European goldfinch, common rosefinch, Siberian long-tailed rosefinch, common redpoll, red crossbill), hirundinid (sand martin), icterid (meadowlark), laniid (red-backed shrike, brown shrike, great grey shrike, tiger shrike), locustellid (river warbler, lanceolated warbler, common grasshopper warbler, Gray's grasshopper warbler, Pallas's grasshopper warbler), motacillid (tree pipit, olive-backed pipit, white wagtail, grey wagtail, western yellow wagtail), muscicapid (red-flanked bluetail, black-headed chat, Siberian rubythroat, rufous-tailed robin, Siberian blue robin, spotted flycatcher, blue-and-white flycatcher, grey streaked flycatcher, Asian brown flycatcher, Mugimaki flycatcher, Burmese paradise flycatcher, common nightingale, thrush nightingale, common redstart, Daurian redstart, European robin, bluethroat, northern wheatear, whinchat, African stonechat), parid (great tit, marsh tit, black-capped chickadee), passerid (house sparrow, tree sparrow), phylloscopid (dusky warbler, willow warbler, wood warbler, Arctic warbler, common chiffchaff), prunellid (mountain accentor, dunnoek), regulid (goldcrest), sittid (Eurasian nuthatch), sturnid (common starling, white-cheeked starling, Daurian starling), sylviid (common whitethroat, lesser whitethroat, garden warbler), troglodytid (Eurasian wren), turdid (common blackbird, song thrush, black-throated thrush, red-throated</p>	<p>tick-borne encephalitis, Omsk haemorrhagic fever, Russian spring-summer viral encephalitis)</p>	
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	thrush, fieldfare, Amami ground thrush, grey-backed thrush, little thrush, Naumann's thrush, Siberian thrush, eyebrowed thrush, pale thrush, mistle thrush); Piciformes: picid (black woodpecker, great spotted woodpecker, lesser spotted woodpecker, white-backed woodpecker, grey-headed woodpecker, hairy woodpecker, Eurasian three-toed woodpecker, Eurasian wryneck); Strigiformes: strigid (short-eared owl); Suliformes: phalacrocoracid (great cormorant); Sauria: lacertid (sand lizard, viviparous lizard)		
<i>I. (Ixodes) petauristae</i> (syn. <i>I. kerri</i>)	Artiodactyla: cervid (chital), tragulid (Indian spotted chevrotain); Eulipotyphla: soricid (Asian house shrew); Rodentia: hystricid (Indian crested porcupine), murid (black rat, Blanford's rat), sciurid (Indian giant squirrel, Indian giant flying squirrel); Carnivora: canid (dhole), felid (leopard); Primates: hominid (human)		India, Sri Lanka
<i>I. phascolomys</i>	Diprotodontia: vombatid (common wombat)		Australia
<i>I. (Scaphixodes) philipi</i>	Procellariiformes: hydrobatid (band-rumped storm petrel), procellariid (streaked shearwater)		Japan
<i>I. (Afrixodes) pilosus</i> (russet tick, bush tick)	Artiodactyla: bovid (cattle, buffalo, sheep, goat, roan antelope, impala, harnessed bushbuck, waterbuck, southern reedbuck, grey rhebok, steinbock, grysbok, Lichtenstein's hartebeest, gwape, nyala, suni, oribi, klipspringer, common duiker, blue duiker, red forest duiker, Thomson's gazelle), suid (pig, warthog); Perissodactyla: equid (horse, donkey, mule); Eulipotyphla: erinaceid (South African hedgehog); Macroscelidea: macroscelidid (elephant shrew); Lagomorpha: leporid (scrub hare, Natal red rock hare); Rodentia: sciurid (squirrel); Carnivora: canid (dog, black-backed jackal, bat-eared fox), felid (cat, caracal, serval, African wildcat, leopard, lion), viverrid (civet); Chiroptera: rhinolophid (Geoffroy's horseshoe bat); Primates: hominid (human); Passeriformes: cisticolid (Levaillant's cisticola), ploceid (yellow-crowned bishop)	trauma, irritation, dermatitis, anaemia, paralysis	South Africa
<i>I. (Endopalpiger) planiscutatus</i>	Rodentia: murid (moss-forest rat)		New Guinea
<i>I. (Ixodes) pomerantzi</i>	Lagomorpha: leporid (common tapeti, eastern cottontail, Chiapas cottontail, Dice's cottontail)		South America
<i>I. (Pholeioxodes) pomerantzevi</i>	Rodentia: cricetid (reed vole, grey red-backed vole, northern red-backed vole), murid (striped field mouse, large Japanese field mouse, brown rat), sciurid (Siberian chipmunk); Eulipotyphla: erinaceid (European hedgehog, Amur hedgehog), soricid (common shrew, Siberian chipmunk); Carnivora: canid (dog, red fox)		Russia
<i>I. pospelovae</i>	Chiroptera: miniopterid (common bentwing bat), vespertilionid (lesser mouse-eared bat)		Europe
<i>I. praematurus</i>	Passeriformes: timaliid (babbler), turdid (ground thrush), zosteropid (white-eye)		Timor
<i>I. (Exopalpiger) priscicollaris*</i>	Dasyuromorphia: dasyurid (unspecified phascogale)	trauma, irritation	New Guinea
<i>I. (Afrixodes) procaviae</i>	Hyracoidea: procaviid (southern tree hyrax, rock hyrax); Artiodactyla: suid (warthog)		Africa
<i>I. prokopjevi</i>	Eulipotyphla: erinaceid (Daurian hedgehog)		Eurasia
<i>I. pseudorasus</i>	Artiodactyla: bovid (cattle, buffalo, royal antelope, pygmy antelope, harnessed bushbuck, black-fronted duiker, suni, bongo), giraffid (okapi), suid (red river hog); Hyracoidea: procaviid (tree hyrax); Rodentia: nesomyid (Gambian pouched rat); Carnivora: canid (dog), felid (leopard, lion), herpestid (mongoose), viverrid (genet, African civet); Primates hominid (human); Cuculiformes: cuculid (white-browed coucal)		Africa
<i>I. pterodromae</i>	Procellariiformes: diomedeid (wandering albatross), procellariid (soft-plumaged petrel, Kerguelen petrel, common diving petrel, Antarctic prion, short-tailed shearwater, flesh-footed shearwater, sooty shearwater); Sphenisciformes: spheniscid (penguin); Carnivora: felid (cat)		Africa, Australia
<i>I. punctulatus</i>	Artiodactyla: cervid (roe deer)		Europe
<i>I. (Afrixodes) radfordi</i>	Rodentia: murid (black rat)		India
<i>I. (Afrixodes) rageaui</i>	Primates: cercopithecoid (grivet, moustached guenon, blue monkey),		Africa

	hominid (human)		
<i>I. (Afrixodes) randrianasoloi</i>	Afrosoricida: tenrecid (tenrec); Rodentia: murid (black rat)		Africa
<i>I. (Afrixodes) rasmus</i>	Artiodactyla: bovid (cattle, buffalo, sheep, goat, royal antelope, brown antelope, Bate's dwarf antelope, blue duiker, red forest duiker, black duiker, black-fronted duiker, white-bellied duiker, yellow-backed duiker, Maxwell's duiker, bushbuck, impala, suni, bongo), cervid (African water chevrotain), giraffid (okapi), suid (pig, bushpig, red river hog, desert warthog); Macroscelidea: macroscelidid (giant elephant shrew); Eulipotyphla: soricid (bicolored shrew, African giant shrew, Cretan shrew); Hyracoidea: procaviid (southern tree hyrax, western tree hyrax); Pholidota: manid (tree pangolin); Lagomorpha: leporid (African savanna hare); Rodentia: hystricid (African brush-tailed porcupine), murid (black rat, gray brush-furred rat, yellow-spotted brush-furred rat, groove-toothed rat, Creek groove-toothed swamp rat, Abyssinian grass rat, African grass rat, Guinean grass rat, African marsh rat, tropical vlei rat, house mouse, pygmy mouse, typical striped grass mouse, Peter's striped mouse, Temminck's mouse, Guinea multimammate mouse, gracile tateril, slender gerbil), nesomyid (Gambian pouched rat, Emin's pouched rat, giant forest rat), spalacid (Rwanda African mole-rat), thryonomyid (greater cane rat); Carnivora: canid (dog), felid (leopard, serval), herpestid (Cape genet, slender mongoose, marsh mongoose, large gray mongoose, white mongoose, Egyptian mongoose, common kusimanse), viverrid (African civet, African palm civet); Primates: cercopithecid (grey-cheeked mangabey, red-tailed monkey, moustached guenon, greater spot-nosed monkey, western red colobus, olive baboon), hominid (chimpanzee, human); Cuculiformes: cuculid (unspecified cuckoo); Galliformes: numidid (plumed guinea fowl, black guinea fowl), phasianid (double-spurred spurfowl); Passeriformes: turdid (Fraser's rufous thrush)	trauma, irritation	Africa
<i>I. (Ixodes) redikorzevi</i> (syn. <i>I. transcaucasicus hystrix</i>)	Eulipotyphla: erinaceid (long-eared hedgehog, European hedgehog, southern white-breasted hedgehog, northern white-breasted hedgehog, Syrian long-eared hedgehog), soricid (common shrew, bicolored shrew, greater white-toothed shrew, lesser white-toothed shrew, piebald shrew, Eurasian water shrew, Radde's shrew), talpid (blind mole); Lagomorpha: leporid (Cape hare, European hare, tolai hare), ochotonid (Afghan pika); Rodentia: cricetid (grey dwarf hamster, European hamster, steppe lemming, common vole, montane water vole, short-tailed field vole, Gunther's vole, Robert's snow vole, social vole, Major's pine vole), glirid (forest dormouse), murid (house mouse, hillock mouse, European mouse, striped field mouse, steppe field mouse, eastern broad-toothed field mouse, Black Sea field mouse, wood mouse, Cairo spiny mouse, Ural field mouse, Eurasian harvest mouse, black rat, brown rat, Turkestan rat, African grass rat, short-tailed bandicoot rat, Libyan jird, Persian jird, Shaw's jird, Tamarisk jird, Tristram's jird, great gerbil), sciurid (European ground squirrel, little ground squirrel, long-clawed ground squirrel, Caucasian squirrel), spalacid (Middle East blind mole-rat); Carnivora: canid (dog, red fox, golden jackal), mustelid (marbled polecat, steppe polecat, least weasel, ferret, European badger), sciurid (marmot); Chiroptera: vespertilionid (unspecified bat); Primates: hominid (human); Anseriformes: anatid (red-breasted merganser); Charadriiformes: charadriid (European golden plover); Columbiformes: columbid (rock dove); Coraciiformes: coraciid (European roller); Galliformes: phasianid (common quail, rock partridge, mountain partridge, Daurian partridge, ring-necked pheasant); Gruiformes: rallid (water rail); Otidiformes: otidid (great bustard); Passeriformes: alaudid (crested lark, Calandra lark), corvid (jay, Eurasian magpie), emberizid (common reed bunting, corn bunting, rock bunting), fringillid (hawfinch), laniid (shrike), motacillid (tawny pipit, meadow pipit), muscicapid (thrush nightingale, European robin, northern wheatear, western black-eared	irritation, allergy, toxemia	Central Asia

	wheatear, variable wheatear, African stonechat), parid (great tit), passerid (house sparrow, rock sparrow), phylloscopid (common chiffchaff, greenish warbler), sturnid (common starling), turdid (common blackbird, black-throated thrush, red-throated thrush, Siberian thrush, song thrush, fieldfare); Pteroclitiformes: pteroclid (black-bellied sandgrouse); Strigiformes: strigid (short-eared owl); Sauria: anguid (European glass lizard), lacertid (sand lizard, European green lizard, Balkan wall lizard); Serpentes: colubrid (steppe rat snake), viperid (Siberian pit viper); Testudines: emydid (unspecified tortoise)		
<i>I. (Afrixodes) rhabdomysae</i>	Rodentia: murid (four-striped grass mouse), nesomyid (pouched rat); Eulipotyphla: soricid (unspecified shrew); Macroscelidea: macroscelidid (elephant shrew)		Africa
<i>I. (Ixodes) ricinus*</i> (syn. <i>I. fodiens</i> , <i>fuscus</i> , <i>lacertae</i> , <i>nigricans</i> , <i>pustularum</i> , <i>rufus</i> , <i>sciuri</i> , <i>variegatus</i>) (castor bean tick, sheep tick, common European tick)	Artiodactyla: bovid (cattle, zebu, water buffalo, European bison, sheep, mouflon, goat, mountain goat, Bezoar ibex, chamois, oryx), camelid (camel), cervid (red deer, maral, roe deer, sika deer, fallow deer, muntjac, water deer, black-tailed deer, white-tailed deer, brocket deer, moose), suid (pig, wild boar); Perissodactyla: equid (horse, donkey, mule); Lagomorpha: leporid (European rabbit, brush rabbit, eastern cottontail, mountain cottontail, black-tailed jackrabbit, Colorado desert jackrabbit, European hare, mountain hare, blue hare, brown hare); Eulipotyphla: erinaceid (northern white-breasted hedgehog, southern white-breasted hedgehog, long-eared hedgehog, European hedgehog), soricid (common shrew, bicolored shrew, Laxmann's shrew, Radde's shrew, Eurasian water shrew, Mediterranean water shrew, alpine shrew, pygmy shrew, Eurasian pygmy shrew, lesser white-toothed shrew, greater white-toothed shrew), talpid (European mole, broad-footed mole); Didelphimorphia: didelphid (Virginia opossum, large American opossum); Rodentia: cricetid (common vole, bank vole, short-tailed field vole, tundra vole, social vole, European water vole, European snow vole, alpine pine vole, European pine vole, Major's pine vole, Tatra pine vole, grey dwarf hamster, European hamster, Eversmann's hamster, cotton mouse, white-footed mouse, Oldfield mouse, steppe lemming, muskrat, big-eared woodrat, swamp rice rat), dipodid (great jerboa, William's jerboa), echimyid (coyupu), glirid (dormouse, garden dormouse, hazel dormouse, forest dormouse, European edible dormouse), heteromyid (spiny pocket mouse), murid (black rat, brown rat, house mouse, meadow mouse, striped field mouse, Ural field mouse, Black Sea field mouse, yellow-necked mouse, Eurasian harvest mouse, wood mouse), sciurid (red squirrel, eastern gray squirrel, western grey squirrel, Siberian chipmunk, Caucasian squirrel, Siskiyou chipmunk, little ground squirrel, speckled ground squirrel, European ground squirrel, California ground squirrel), smynthid (northern birch mouse), spalacid (lesser blind mole-rat); Carnivora: canid (dog, raccoon dog, wolf, timber wolf, coyote, Arctic fox, red fox, gray fox), castorid (Eurasian beaver), felid (cat, wildcat, bobcat, Florida bobcat, cougar, puma, jaguar, leopard, ocelot), mephitid (striped skunk), mustelid (European badger, European pine marten, stone marten, beech marten, least weasel, stoat, European polecat, steppe polecat, ferret, otter, European mink), procyonid (raccoon), ursid (brown bear), viverrid (common genet); Chiroptera: rhinolophid (lesser horseshoe bat, greater horseshoe bat), vespertilionid (whiskered bat); Primates: hominid (human); Accipitriformes: accipitrid (common buzzard, European honey buzzard, red kite, black kite, Eurasian sparrowhawk, northern goshawk, golden eagle, lesser spotted eagle); Anseriformes: anatid (mallard, duck, greylag goose, common pochard, red-crested pochard); Apodiformes: apodid (common swift); Bucerotiformes: upupid (Eurasian hoopoe); Caprimulgiformes: caprimulgid (Eurasian nightjar); Charadriiformes: charadriid (northern lapwing, European golden plover), larid (common gull, black-headed gull), scolopacid	trauma, anaemia, paralysis (plus vectors for babesiosis, theileriosis, anaplasmosis, Q-fever, ehrlichiosis, louping-ill virus, rickettsial fever, staphylococcal pyaemia, borreliosis (incl. Lyme disease), tick-borne encephalitis, spring-summer encephalitis)	Eurasia, Africa, Australia

	<p>(Eurasian curlew, Eurasian woodcock, common snipe, ruff); Ciconiiformes: ciconiid (white stork); Columbiformes: columbid (stock dove, rock dove, Eurasian collared dove, European turtle dove, common wood pigeon); Cuculiformes: cuculid (common cuckoo); Falconiformes: falconid (common kestrel, saker falcon, merlin, Eurasian hobby); Galliformes: phasianid (chicken, turkey, rock partridge, grey partridge, red grouse, black grouse, hazel grouse, common quail, common pheasant, ring-necked pheasant, western capercaillie, black francolin, willow ptarmigan); Gruiformes: gruoid (crane), rallid (rail, Eurasian coot, corn crake, spotted crake); Passeriformes: acrocephalid (marsh warbler, sedge warbler, icterine warbler, great reed warbler, Eurasian reed warbler), aegithalid (long-tailed tit), alaudid (woodlark, Eurasian skylark, crested lark), bombycillid (Bohemian waxwing), cardinalid (cardinal), certhiid (Eurasian treecreeper), corvid (common raven, carrion crow, hooded crow, rook, western jackdaw, Eurasian jay, Crimean jay, Eurasian magpie, spotted nutcracker), emberizid (rock bunting, corn bunting, Ortolan bunting, yellowhammer), fringillid (canary, European goldfinch, European greenfinch, Eurasian bullfinch, hawfinch, common chaffinch, brambling, common linnets, redpoll, red crossbill, Eurasian siskin), hirundinid (barn swallow, sand martin, house martin), laniid (red-backed shrike, brown shrike), locustellid (river warbler, grasshopper warbler), motacillid (meadow pipit, water pipit, tree pipit, tawny pipit, Pechora pipit, grey wagtail, pied wagtail, white wagtail, western yellow wagtail, eastern yellow wagtail), muscipid (common nightingale, thrush nightingale, northern wheatear, pied wheatear, fieldfare, European robin, common redstart, black redstart, whinchat, African stonechat, pied flycatcher, spotted flycatcher, collared flycatcher, bluethroat), oriolid (Eurasian golden oriole), parid (European crested tit, great tit, willow tit, Eurasian blue tit, coal tit, marsh tit, black-capped chickadee), passerellid (towhee), passerid (house sparrow, Spanish sparrow, Eurasian tree sparrow), phylloscopid (common chiffchaff, willow warbler, wood warbler, greenish warbler), prunellid (dunnock), regulid (goldcrest, common firecrest), sittid (Eurasian nuthatch), sturnid (common starling), sturnid (common starling), sylviid (Eurasian blackcap, garden warbler, common whitethroat, lesser whitethroat, barred warbler, Sardinian warbler), thraupid (Diuca finch), troglodytid (Eurasian wren), turdid (common blackbird, true thrush, Austral thrush, redwing, ring ouzel, song thrush, mistle thrush, fieldfare), tyrannid (grey shrike-tyrant); Piciformes: picid (Eurasian wryneck, European green woodpecker, great spotted woodpecker, middle spotted woodpecker, lesser spotted woodpecker, Eurasian three-toed woodpecker); Podicipediformes: podicipedid (grebe); Strigiformes: strigid (long-eared owl, short-eared owl, tawny owl, swamp owl, barn owl, Eurasian eagle-owl, burrowing owl); Sauria: anguid (southern alligator lizard), crotaphytid (collared lizard), lacertid (sand lizard, Algerian sand racer, rock lizard, viviparous lizard, European green lizard, ocellated lizard, common wall lizard, Italian wall lizard, Crimean wall lizard, Madeiran wall lizard, Caucasus emerald lizard), phrynosomatid (western fence lizard), scincid (red-headed skink); Serpentes: colubrid (four-lined snake, grass snake, smooth snake, spotted whip snake), viperid (meadow viper, steppe viper); Testudines: testudinid (Greek tortoise)</p>		
<i>I. (Multidentatus) rothschildi</i> (syn. <i>I. diomedea</i>)	Charadriiformes: alcid (guillemot, Atlantic puffin), larid (European herring gull); Procellariiformes: diomedeid (yellow-nosed albatross), procellariid (Manx shearwater); Suliformes: phalacrocoracid (European shag)		Americas
<i>I. (Ixodes) rotundatus</i>	Rodentia: spalacid (unspecified mole-rat); Artiodactyla: bovid (bushbuck)		Africa
<i>I. (Afrixodes) rubicundus</i>	Artiodactyla: bovid (cattle, sheep, goat, springbok, grysbok, bontebok, grey rhebok, steenbok, eland, mountain reedbuck, Grant's	trauma, toxicosis,	South Africa

(Karoo paralysis tick)	gazelle, antelope), camelid (camel), cervid (deer), suid (pig); Perissodactyla: equid (horse); Lagomorpha: leporid (Natal red rock hare, Smith's red rock hare, scrub hare, Cape hare, red rock rabbit); Macroscelidea: macroscelidid (rock elephant shrew, Cape elephant shrew); Hyracoidea: procaviid (hyrax); Rodentia: murid (Namaqua rock rat), nesomyid (pouched rat); Carnivora: canid (dog, red jackal, black-backed jackal), felid (cat, black-footed cat, South African wildcat, caracal), hyaenid (aardwolf); Passeriformes: alaudid (lark), ploceid (weaver)	paralysis	
<i>I. (Pholeoixodes) rubidis</i>	Didelphimorphia: didelphid (unspecified opossum); Rodentia: myocastorid (coyup); Carnivora: canid (gray fox), mephitid (striped hog-nosed skunk), mustelid (tayra, long-tailed weasel), procyonid (raccoon, ringtail, northern olingo, ring-tailed coati)		North America
<i>I. (Pholeoixodes) rugicollis</i> (syn. <i>I. cornutus</i>)	Carnivora: canid (dog, red fox), felid (cat), mustelid (stoat, marten, beech marten, European polecat, European pine marten)		Central Asia
<i>I. (Pholeoixodes) rugosus</i>	Rodentia: cricetid (dusky-footed woodrat), sciurid (squirrel); Didelphimorphia: didelphid (opossum); Carnivora: canid (dog, coyote, gray fox), felid (bobcat), mephitid (striped skunk, western spotted skunk, California spotted skunk), mustelid (long-tailed weasel), procyonid (raccoon)		North America
<i>I. (Ixodes) sachalinensis</i>	Lagomorpha: leporid (mountain hare)		Russia
<i>I. (Ixodes) scapularis</i> (syn. <i>I. dammini</i>) (black-legged tick, shoulder tick, deer tick)	Artiodactyla: bovid (cattle, American bison, sheep, goat), camelid (camel), cervid (white-tailed deer, elk), suid (pig), tayassuid (collared peccary); Perissodactyla: equid (horse, mule); Didelphimorphia: didelphid (common opossum, Virginia opossum); Eulipotyphla: soricid (northern short-tailed shrew); Rodentia: cricetid (white-footed mouse, deer mouse, harvest mouse, Oldfield mouse, hispid cotton rat, pack rat, muskrat, marsh rice rat, eastern meadow vole, beach vole), erethizontid (porcupine), murid (mouse, brown rat, rice rat), sciurid (eastern chipmunk, eastern gray squirrel, red squirrel, fox squirrel, woodchuck); Lagomorpha: leporid (marsh rabbit, eastern cottontail, white-sided jackrabbit, hare); Carnivora: canid (dog, wolf, coyote, red fox, American red fox, gray fox), felid (cat, bobcat, Florida bobcat, Florida panther, ocelot), mephitid (striped skunk, eastern spotted skunk), mustelid (fisher, New York weasel), procyonid (raccoon); Chiroptera: vespertilionid (big brown bat); Primates: hominid (human); Accipitriformes: accipitrid (red-tailed hawk); Columbiformes: columbid (mourning dove); Galliformes: odontophorid (northern bobwhite), phasianid (chicken, ruffed grouse, quail, turkey); Gruiformes: gruid (sandhill crane); Passeriformes: corvid (blue jay, raven), fringillid (rose-breasted grosbeak, American goldfinch), icterid (brown-headed cowbird, common grackle), mimid (gray catbird, brown thrasher), muscicapid (common redstart), oriolid (Baltimore oriole), parulid (common yellowthroat, myrtle warbler, ovenbird), passerellid (song sparrow, swamp sparrow, white-throated sparrow, eastern towhee, junco), sturnid (common starling), turdid (American robin, hermit thrush); Sauria: anguid (eastern glass lizard), phrynosomatid (eastern fence lizard), scincid (little brown skink, broadhead skink, common five-lined skink); Testudines: emydid (unspecified tortoise)	trauma, irritation (vector for babesiosis, theileriosis, borreliosis (incl. Lyme disease), human granulocytic ehrlichiosis, anaplasmosis, tularemia, spotted fever, Powassan virus)	North America
<i>I. (Afrioxodes) schillingsi</i>	Rodentia: cricetid (white-footed mouse), murid (black rat, crested rat), sciurid (unspecified squirrel); Hyracoidea: procaviid (hyrax); Primates: cercopithecid (Samango monkey, king colobus, mantled guereza, moustached guenon), galagid (brown greater galago), hominid (human)		Africa
<i>I. (Ixodes) schulzei</i>	Rodentia: cricetid (montane grass mouse, russet rice rat, scaly-footed water rat, yellow pygmy rice rat, black-footed pygmy rice rat); Passeriformes: muscicapid (Kalahari scrub robin)		South America, Africa
<i>I. (Pholeoixodes) sculptus</i>	Artiodactyla: bovid (sheep, goat), cervid (white-tailed deer); Perissodactyla: equid (horse); Lagomorpha: leporid (Mearn's cottontail, white-tailed jackrabbit, hare), ochotonid (American pika);		

	Eulipotyphla: talpid (eastern mole); Didelphimorphia: didelphid (opossum); Rodentia: cricetid (dusky-footed woodrat, deer mouse, white-footed mouse, long-tailed vole, montane vole, western heather vole), dipodid (San Bernardino kangaroo rat), geomyid (brown pocket gopher, plains pocket gopher, northern pocket gopher, Botta's pocket gopher, Illinois pocket gopher), heteromyid (little pocket mouse), murid (mouse), sciurid (Merriam's chipmunk, black-tailed prairie dog, white-tailed prairie dog, Gunninson's prairie dog, Utah prairie dog, rock squirrel, golden-mantled ground squirrel, spotted ground squirrel, striped ground squirrel, thirteen-lined ground squirrel, Belding ground squirrel, California ground squirrel, Colorado ground squirrel, Columbian ground squirrel, Franklin's ground squirrel, Richardson's ground squirrel, Uinta ground squirrel, Wyoming ground squirrel, white-tailed antelope squirrel, yellow-bellied marmot), zapodid (western jumping mouse); Carnivora: canid (dog, red fox, gray fox), felid (cat, wildcat), mephitid (eastern spotted skunk, western spotted skunk, striped skunk), mustelid (American badger, long-tailed weasel), procyonid (raccoon), viverrid (civet); Primates: hominid (human); Galliformes: odontophorid (quail); Passeriformes: corvid (blue jay), turdid (thrush)		
<i>I. scuticrenatus</i>	Didelphimorphia: didelphid (opossum)		North America
<i>I. (Scaphixodes) semenovi</i>	Falconiformes: falconid (common kestrel); Passeriformes: corvid (red-billed chough), hirundinid (common house martin), passerid (white-winged snowfinch), prunellid (alpine accentor)		Central Asia
<i>I. (Haemixodes) serrafreirei</i>	Rodentia (unspecified species)		South America
<i>I. shahi</i>	Lagomorpha: ochotonid (Royle's pika); Rodentia: murid (house mouse)		Nepal
<i>I. shinchikuensis</i>	Carnivora: canid (dog)		Taiwan
<i>I. (Partipalpiger) siamensis</i>	Rodentia: murid (Gairdner's shrewmouse); Eulipotyphla: soricid (Chinese mole shrew)		Asia
<i>I. sigalasi</i>	Charadriiformes: charadriid (northern lapwing); Passeriformes: turdid (blackbird)		Europe
<i>I. sigelos</i>	Rodentia: abrocomid (Bennett's chinchilla rat), cricetid (long-haired grass mouse, olive grass mouse, highland grass mouse, Spegazzini's grass mouse, drylands vesper mouse, Andean long-clawed mouse, western Patagonian laucha, Patagonian chinchilla mouse, southern big-eared mouse, yellow-rumped leaf-eared mouse, long-tailed pygmy rice rat, bunny rat), murid (brown rat), octodontid (Chilean rock rat, common degu)		South America
<i>I. (Scaphixodes) signatus</i> (syn. <i>I. arcticus</i>)	Charadriiformes: alcid (common murre), larid (black-tailed gull); Passeriformes: fringillid (mountain finch), turdid (Siberian thrush); Procellariiformes: procellariid (northern fulmar); Suliformes: phalacrocoracid (great cormorant, pelagic cormorant, Brandt's cormorant); Carnivora: otariid (northern fur seal)		Americas, Europe
<i>I. (Ixodes) silvanus</i>	Passeriformes: furnariid (sooty-fronted spinetail, buff-browed foliage-gleaner), parulid (two-banded warbler), passerellid (yellow-striped brushfinch, rufous-collared sparrow), thraupid (orange-headed tanager), tityrid (crested becard), turdid (rufous-bellied thrush, Andean slaty thrush)		South America
<i>I. (Eschatocephalus) simplex</i> (syn. <i>I. chiropterum</i>)	Chiroptera: miniopterid (common bentwing bat, little bentwing bat, Natal long-fingered bat), rhinolophid (greater horseshoe bat, smaller horseshoe bat, eloquent horseshoe bat, Geoffroy's horseshoe bat), vespertilionid (greater mouse-eared bat, eastern long-fingered bat, Alcahoie bat, Cape hairy bat, common pipistrelle, unspecified vesper bat); Afrosoricida: potamogalid (giant otter shrew); Rodentia: murid (mouse)	(possible vector for chiropteran piroplasmosis)	Australia, Eurasia, Africa
<i>I. (Ixodes) sinaloa</i>	Rodentia: cricetid (marsh rice rat, long-tailed rice rat, Alfaro's rice rat, Coues's rice rat, Sumichrast's harvest mouse, Mexican deer mouse), heteromyid (painted spiny pocket mouse, Salvin's spiny pocket mouse); Didelphimorphia: didelphid (grayish mouse opossum)		North America

<i>I. sinensis</i>	Artiodactyla: bovid (cattle, buffalo, sheep), cervid (white-tailed deer); Lagomorpha: leporid (hare); Rodentia: murid (mouse); Carnivora: canid (dog), felid (cat, leopard); Primates: hominid (human); Galliformes: phasianid (fowl)	(possible vector for rickettsioses)	China
<i>I. (Afrixodes) soarimalalae</i>	Afrosoricida: tenrecid (Cowman's shrew tenrec)		Madagascar
<i>I. (Pholeoixodes) soricis</i>	Eulipotyphla: soricid (common shrew, vagrant shrew, dusky shrew, northern montane shrew, Trowbridge's shrew), talpid (shrew-mole, broad-footed mole, Townsend's mole); Rodentia: cricetid (gray-tailed vole, Townsend's vole, North American deer mouse), geomyid (northern pocket gopher); Primates: hominid (human)		North America
<i>I. (Eschatocephalus) spiculae</i>	Chiroptera: (unspecified bat)		Africa
<i>I. (Afrixodes) spinae</i>	Hyracoidea: procaviid (rock hyrax); Rodentia: not specified; Passeriformes: fringillid (unspecified finch), motacillid (tree pipit), ploceid (southern red bishop)		Africa
<i>I. (Ixodes) spinicoxalis</i>	Rodentia: murid (red tree rat, white-bellied rat, narrow-tailed white-bellied rat), sciurid (black-striped squirrel); Scandentia: tupaiid (Horsfield's treeshrew); Eulipotyphla: soricid (Oriental shrew); Carnivora: mephitid (Sunda stink badger), mustelid (yellow-throated marten, Malayan glutton), viverrid (Asian palm civet); Passeriformes: muscicapid (flycatcher), pittid (pitta)		Indonesia
<i>I. (Ixodes) spinipalpis</i>	Rodentia: cricetid (bushy-tailed woodrat, dusky-footed woodrat, desert woodrat, Mexican woodrat, deer mouse, cactus mouse, pinyon mouse, western harvest mouse, groove-toothed harvest mouse, northern grasshopper mouse, California vole), heteromyid (little pocket mouse, long-tailed pocket mouse, Merriam's kangaroo rat), murid (rat), sciurid (ground squirrel, pine squirrel, Douglas's squirrel, chipmunk); Eulipotyphla: soricid (common shrew, vagrant shrew); Lagomorpha: leporid (volcano rabbit, brush rabbit, jackrabbit, cottontail, hare), ochotonid (American pika); Carnivora: canid (dog), mustelid (weasel); Primates: hominid (human); Passeriformes: corvid (Florida scrub jay, Eurasian magpie), emberizid (bunting), mimid (gray catbird), parulid (orange-crowned warbler), passerellid (song sparrow, golden-crowned sparrow, Lincoln's sparrow, eastern towhee, dark-eyed junco), troglodytid (wren), turdid (hermit thrush, varied thrush)		North America
<i>I. spinosus</i>	Rodentia: cuniculid (lowland paca), dasyproctid (agouti, green acouchi)		South America
<i>I. (Endopalpiger) steini</i>	Dasyuromorphia: dasyurid (speckled dasyure)		New Guinea
<i>I. (Endopalpiger) stellae</i>	Dasyuromorphia: dasyurid (New Guinea quoll); Peramelemorphia: peramelid (striped bandicoot)		New Guinea
<i>I. (Ixodes) stilesi</i> (syn. <i>I. elegans</i>)	Artiodactyla: cervid (pudu); Rodentia: cricetid (long-tailed pygmy rice rat)		South America
<i>I. sturni</i>	Passeriformes: sturnid (common starling)		Europe
<i>I. (Pholeoixodes) stromi</i>	Rodentia: cricetid (common vole, bank vole, silver mountain vole, timber vole, narrow-headed vole, grey red-backed vole, gray dwarf hamster), murid (wood mouse, Turkestan rat); Eulipotyphla: soricid (unspecified shrew); Lagomorpha: ochotonid (large-eared pika); Carnivora: mustelid (unspecified weasel); Passeriformes: emberizid (red-headed bunting), muscicapid (white-winged redstart)		Central Asia
<i>I. (Pholeoixodes) subterraneus</i>	Columbiformes: columbid (European turtle dove); Coraciiformes: coraciid (European roller); Falconiformes: falconid (lesser kestrel); Galliformes: phasianid (fowl); Passeriformes: alaudid (crested lark), corvid (Eurasian magpie), fringillid (European goldfinch), passerid (house sparrow, Eurasian tree sparrow), sturnid (common starling, rosy starling, turdid (red-throated thrush); Strigiformes: strigid (owl)		Palaearctic
<i>I. succineus</i>	fossil (amber)		Europe
<i>I. sulcatus</i>	Passeriformes: alaudid (brown lark), emberizid (yellowhammer), fringillid (bullfinch), sittid (Eurasian nuthatch)		Europe
<i>I. (Pholeoixodes) taglei</i>	Artiodactyla: cervid (pudu)		South America

<i>I. taiwanensis</i>	Artiodactyla: cervid (sambar deer), suid (wild boar); Carnivora: canid (dog), felid (cat)		Asia
<i>I. (Ixodes) tampaui</i>	Rodentia: sciurid (Deppe's squirrel)		North America
<i>I. (Ixodes) tancitarium</i>	Rodentia: cricetid (groove-toothed harvest mouse, unspecified deer mouse)		North America
<i>I. (Ixodes) tanuki</i>	Artiodactyla: cervid (sika deer); Rodentia: cricetid (grey red-backed vole, Smith's vole), murid (large Japanese field mouse); Carnivora: canid (Japanese raccoon dog), felid (cat), mustelid (mountain weasel, Siberian weasel, yellow-throated marten, Japanese badger), procyonid (raccoon)		Eurasia
<i>I. (Ixodes) tapirus</i>	Perissodactyla: tapirid (mountain tapir, Baird's tapir)		South America
<i>I. (Endopalpiger) tasmani</i> (common marsupial tick)	Dasyuromorphia: dasyurid (agile antechinus, yellow-footed antechinus, dusky antechinus, Tasmanian dusky antechinus, western quoll, tiger quoll, brush-tailed phascogale, white-footed dunnart, common dunnart, Tasmanian devil); Diprotodontia: burramyid (Tasmanian pygmy possum, lesser pygmy possum); macropodid (red-necked wallaby, Pearson Island rock-wallaby, Tasmanian pademelon, red-legged pademelon), petaurid (Leadbeater's possum), phalangerid (short-eared brushtail possum, Tasmanian brushtail possum, common brushtail possum), phascolarctid (koala), potoroid (eastern bettong, long-nosed potoroo), pseudocheirid (greater glider, yellow-bellied glider, sugar glider, green ringtail possum, common ringtail possum), vombatid (common wombat); Peramelemorphia: peramelid (northern brown bandicoot, southern brown bandicoot, eastern barred bandicoot, long-nosed bandicoot); Monotremata: tachyglossid (short-beaked echidna); Lagomorpha: leporid (European rabbit); Rodentia: murid (broad-toothed rat, giant white-tailed rat, fawn-footed melomys, rakali, long-tailed mouse, canefield rat, dusky field rat, bush rat, swamp rat, brown rat, black rat, white-footed rabbit-rat); Perissodactyla: equid (horse); Carnivora: canid (dog), felid (cat); Primates: hominid (human)		Australia
<i>I. (Ixodes) tatei</i>	Carnivora: canid (red fox)		Middle-East
<i>I. (Scaphixodes) tauricus</i>	Suliformes: phalacrocoracid (European shag)		Central Asia
<i>I. (Ixodes) tecpanensis</i>	Rodentia: geomyid (giant pocket gopher)		Central America
<i>I. tenuirostris</i>	Rodentia: cricetid (common vole, bank vole, red-backed vole, field vole, short-tailed field vole, water vole, European water vole), murid (house mouse, wood mouse, Eurasian harvest mouse, brown rat); Eulipotyphla: soricid (common shrew, Eurasian pygmy shrew), talpid (European mole); Galliformes: phasianid (pheasant)		Europe
<i>I. tertiarium</i>	fossil		North America
<i>I. (Pholeoixodes) texanus</i>	Didelphimorphia: didelphid (common opossum, Virginia opossum); Lagomorpha: leporid (eastern cottontail, hare); Rodentia: cricetid (vole), murid (rat), sciurid (fox squirrel, pine squirrel, tree squirrel, eastern gray squirrel, American red squirrel, California gray squirrel, Richardson's Columbian squirrel, golden-mantled ground squirrel, yellow-bellied marmot, pallid yellow-bellied marmot, Tahoe chipmunk, southern woodchuck); Carnivora: canid (dog, gray fox, kit fox), felid (cat, bobcat), mephitid (striped skunk, western spotted skunk), mustelid (American badger, long-tailed weasel, short-tailed weasel, Arizona weasel, mink, new marten, fisher, stoat, American mink), procyonid (raccoon, ringtail, cacomistle), viverrid (civet); Primates: hominid (human)	trauma, irritation, dermatitis (vector for babesiosis, spotted fever)	North America
<i>I. (Ixodes) theileriae</i>	Passeriformes: hirundinid (barn swallow), platysteirid (Cape batis), ploceid (red-billed quelea, Cape weaver), sturnid (wattled starling), turdid (olive thrush)		Africa
<i>I. theodori</i>	Primates: hominid (human)		Israel
<i>I. (Afrinoxodes) thomasae</i>	Artiodactyla: bovid (suni); Eulipotyphla: soricid (shrew); Rodentia: murid (Abyssinian grass rat, tropical vlei rat, mouse, Natal multimammate mouse); Cuculiformes: cuculid (coucal); Passeriformes: malaconotid (black-crowned tchagra), ploceid (weaver)		Africa

<i>I. (Ixodes) tiptoni</i>	Rodentia: sciurid (red-tailed squirrel)		Central America
<i>I. (Ixodes) tovari</i>	Artiodactyla: bovid (cattle, goat); Lagomorpha: leporid (black-tailed jackrabbit, desert cottontail, hare); Rodentia: heteromyid (Ord's kangaroo rat); Passeriformes: emberizid (unspecified bunting), icterid (western meadowlark), passerellid (black-throated sparrow)		North America
<i>I. (Afrixodes) transvaalensis</i>	Rodentia: murid (Namaqua rock rat)		Africa
<i>I. (Exopalpiger) trianguliceps</i> (syn. <i>I. nivalis</i> , <i>Endopalpiger heroldi</i>)	Eulipotyphla: erinaceid (European hedgehog), soricid (common shrew, Eurasian pygmy shrew, Eurasian least shrew, alpine shrew, Arctic shrew, Caucasian shrew, Laxmann's shrew, Taiga shrew, Eurasian water shrew, Etruscan shrew, Mediterranean water shrew, lesser white-toothed shrew, Siberian large-toothed shrew, Caucasian pygmy shrew), talpid (European mole, Altai mole); Rodentia: cricetid (common vole, bank vole, meadow vole, tundra vole, social vole, short-tailed field vole, silvery mountain vole, grey red-backed vole, northern red-backed vole, narrow-headed vole, European water vole, European snow vole, alpine pine vole, European pine vole, Major's pine vole, Tatra pine vole, long-clawed mole vole, grey dwarf hamster, European hamster, wood lemming), echimyid (nutria), glirid (forest dormouse, hazel dormouse), murid (black rat, brown rat, Turkestan rat, water rat, house mouse, striped field mouse, Ural field mouse, forest mouse, wood mouse, yellow-necked mouse, Eurasian harvest mouse), sciurid (red squirrel, grey squirrel, Siberian chipmunk), smynthid (northern birch mouse); Lagomorpha: leporid (rabbit, hare); Perissodactyla: equid (horse); Carnivora: canid (fox), mustelid (least weasel, mottled polecat); Chiroptera: vespertilionid (big brown bat); Primates: hominid (human); Galliformes: phasianid (fowl); Passeriformes: corvid (crow), emberizid (yellowhammer), fringillid (finch); motacillid (tree pipit), turdid (blackbird); Piciformes: picid (great spotted woodpecker); Strigiformes: strigid (tawny owl); Sauria: lacertid (sand lizard, viviparous lizard)	trauma, irritation (vector for anaplasmosis, and possibly borreliosis)	Europe
<i>I. (Sternalixodes) trichosuri</i> (possum tick)	Diprotodontia: macropodid (unspecified), phalangerid (common brushtail possum, Tasmanian brushtail possum), potoroid (eastern bettong); Peramelemorphia: peramelid (southern brown bandicoot); Rodentia: murid (black rat, bush rat, Australian swamp rat); Passeriformes: acanthizid (Tasmanian scrubwren)		Australia
<i>I. (Ixodes) tropicalis</i>	Rodentia: cricetid (golden Oldfield mouse, Tome's rice rat), echimyid (Bolivian bamboo rat); Didelphimorphia: didelphid (common opossum)		South America
<i>I. (Ixodes) turdus</i>	Rodentia: murid (large Japanese field mouse); Eulipotyphla: erinaceid (European hedgehog); Primates: hominid (human); Galliformes: phasianid (Chinese bamboo partridge); Strigiformes: strigid (owl); Passeriformes: cisticolid (singing cisticola, plain prinia), cettid (Korean bush warbler), emberizid (meadow bunting, yellow-throated bunting, black-faced bunting, Tristram's bunting), fringillid (hawfinch, brambling), motacillid (olive-backed pipit), muscicapid (red-flanked bluetail), pycnonotid (brown-eared bulbul), phylloscopid (western crowned warbler, dusky warbler), turdid (common blackbird, true thrush, song thrush, brown-headed thrush, grey-backed thrush, eyebrowed thrush, pale thrush, scaly thrush)		Palaearctic
<i>I. (Afrixodes) ugandanus</i>	Artiodactyla: bovid (harnessed bushbuck, yellow-backed duiker, Maxwell's duiker); Hyracoidea: procaviid (yellow-spotted rock hyrax); Rodentia: nesomyid (Gambian pouched rat), thryonomyid (greater cane rat); Carnivora: herpestid (slender mongoose, large grey mongoose), viverrid (rusty-spotted genet, civet); Primates: cercopithecoid (moustached guenon), lorisid (potto); Cuculiformes: cuculid (white-browed coucal)		Africa
<i>I. (Afrixodes) uilenbergi</i>	Afrosoricida: tenrecid (mole-like rice tenrec, highland streaked tenrec, shrew-toothed shrew tenrec, Dobson's shrew tenrec)		Madagascar
<i>I. (Afrixodes) uncus</i>	Afrosoricida: tenrecid (shrew-toothed shrew tenrec, Dobson's shrew tenrec)		Madagascar

<i>I. (Scaphixodes) unicavatus*</i> (cormorant tick)	Charadriiformes: alcid (puffin); Falconiformes: falconid (gyrfalcon); Passeriformes: motacillid (European rock pipit, water pipit); Procellariiformes: diomedeid (wandering albatross); Siluriformes: phalacrocoracid (great cormorant, black cormorant, European shag)	trauma	Europe
<i>I. (Ceratixodes) uriae*</i> (syn. <i>I. borealis</i> , <i>fimbriatus</i> , <i>hirsutis</i> , <i>putus</i>) (seabird tick)	Anseriformes: anatid (Campbell teal); Charadriiformes: alcid (common murre, thick-billed murre, razorbill, large-billed guillemot, black guillemot, Atlantic puffin), chionid (black-faced sheathbill), haematopodid (blackish oystercatcher), larid (black-legged kittiwake, herring gull, kelp gull, glaucous gull, glaucous-winged gull, black-backed southern gull, dolphin gull, Antarctic tern), scolopacid (curlew), stercorarid (great skua, brown skua); Passeriformes: fringillid (crossbill), hirundinid (sand martin), muscicapid (wheatear), sturnid (starling); Procellariiformes: diomedeid (wandering albatross, Antipodean albatross, Atlantic yellow-nosed albatross, Buller's albatross, Campbell albatross, Gibson's albatross, Salvin's albatross, southern royal albatross, northern royal albatross, grey-headed albatross, black-browed albatross, shy albatross, white-capped albatross, light-mantled albatross, sooty albatross), hydrobatid (northern storm petrel), procellariid (southern giant petrel, northern giant petrel, white-headed petrel, grey petrel, diving petrel, Kerguelen petrel, Cape petrel, Antarctic prion, fairy prion, sooty shearwater, Hutton's shearwater, Mank's shearwater, northern fulmar); Sphenisciformes: spheniscid (little penguin, yellow-eyed penguin, chinstrap penguin, king penguin, Adelie penguin, gentoo penguin, Magellanic penguin, Fiordland penguin, eastern rockhopper penguin, southern rockhopper penguin, macaroni penguin, snares penguin, crested penguin, erect-crested penguin, royal penguin); Suliformes: phalacrocoracid (black-faced cormorant, neotropic cormorant, spotted shag, rock shag, New Zealand king shag, Imperial shag, Auckland shag, Campbell shag, Kerguelen shag, Macquarie shag, Otago shag), sulid (booby, Australasian gannet, northern gannet); Carnivora: mustelid (otter); Rodentia: murid (rat, mouse); Primates: hominid (human)	trauma, irritation (plus vector for borreliosis, possibly arboviruses, reoviruses, bunyaviruses and flaviviruses)	circumpolar
<i>I. (Haemixodes) uruguayensis*</i>	Rodentia: cricetid (yellow pygmy rice rat, Waterhouse's swamp rat, grass mouse)	trauma	South America
<i>I. (Afrixodes) vandicus</i>	Artiodactyla: bovid (duiker); Macroscelidea: macroscelidid (black-and-rufous elephant shrew); Carnivora: canid (dog), felid (leopard), herpestid (marsh mongoose), viverrid (civet); Primates: hominid (human)		Africa
<i>I. (Ixodes) venezuelensis</i>	Didelphimorphia: didelphid (common opossum, gray four-eyed opossum, sepia short-tailed opossum, northern red-sided opossum, Mexican mouse opossum); Rodentia: cricetid (Alfaro's rice water rat, Costa Rican dusky rice rat, Talamancan rice rat, Tome's rice rat, short-tailed cane mouse, forest small rice rat, woodland Oldfield mouse, Mexican deer mouse, buff-bellied climbing mouse, Panamanian climbing rat), dasyproctid (red-rumped agouti, red acouchi, green acouchi), echimyid (Guyenne spiny rat, Tome's spiny rat), heteromyid (forest spiny pocket mouse, Trinidad spiny pocket mouse), murid (house mouse), sciurid (North Amazon red squirrel)		South America
<i>I. (Ixodes) ventalloi</i> (syn. <i>I. thompsoni</i>) (rabbit tick)	Lagomorpha: leporid (European rabbit, European hare); Eulipotyphla: erinaceid (European hedgehog, North African hedgehog), soricid (greater white-toothed shrew); Rodentia: glirid (garden dormouse), hystricid (crested porcupine), murid (black rat, brown rat, wood mouse, Barbary striped grass mouse, Algerian mouse, North African gerbil), sciurid (red squirrel); Carnivora: canid (dog, red fox), felid (cat, Iberian lynx), herpestid (Egyptian mongoose), mustelid (European badger, least weasel, beech marten); viverrid (common genet); Primates: hominid (human); Galliformes: phasianid (red-legged partridge, chukar partridge, ring-necked pheasant); Gruiformes: rallid (water rail); Strigiformes: strigid (little owl, long-eared owl, short-eared owl), tytonid (barn owl);	(possible vector for Q fever, rickettsioses, anaplasmosis, Eyach and Erve viruses)	Europe

	Passeriformes: corvid (Eurasian magpie), turdid (common blackbird, fieldfare); Sauria: agamid (North African rock agama), lacertid (Algerian sand racer), scincid (many-scaled cylindrical skink, Algerian orange-tailed skink)		
<i>I. (Eschatocephalus) vespertilionis*</i> (syn. <i>I. flavipes</i> , <i>longipes</i>)	Chiroptera: emballurid (sheath-tailed bat), hipposiderid (Sundevall's roundleaf bat), miniopterid (common bentwing bat, little bentwing bat, pale bentwing bat, Natal long-fingered bat), rhinolophid (greater horseshoe bat, lesser horseshoe bat, eastern horseshoe bat, Blasius's horseshoe bat, Geoffroy's horseshoe bat, Mediterranean horseshoe bat), vespertilionid (greater mouse-eared bat, lesser mouse-eared bat, brown long-eared bat, whiskered bat, pond bat, common noctule, serotine bat, long-fingered bat, western barbastelle, Bechstein's bat, Cape hairy bat, Daubenton's bat, Geoffroy's bat, common pipistrelle, Kuhl's pipistrelle, Nathusius's pipistrelle, Natterer's bat); Carnivora: canid (dog); Primates: hominid (human)	trauma (possible vectors for bartonellosis, babesiosis)	Europe, Asia, Africa, Australia
<i>I. (Exopalpiger) vestitus</i> (numbat tick)	Dasyuromorphia: dasyurid (western quoll), myrmecobiid (numbat); Serpentes: elapid (eastern brown snake), pythonid (unspecified python)		Australia
<i>I. (Endopalpiger) victoriensis</i>	Diprotodontia: potoroid (long-footed potoroo), pseudocheirid (common ringtail possum), vombatid (common wombat)		Australia
<i>I. viperarum</i>	Serpentes: viperid (unspecified viper)		Europe
<i>I. (Afrixodes) walkerae</i>	Carnivora: herpestid (water mongoose), viverrid (rusty-spotted genet); Galliformes: numidid (crested guinea fowl); Passeriformes: turdid (olive thrush)		Africa
<i>I. (Ixodes) werneri</i>	Rodentia: murid (Palawan spiny rat, chestnut white-bellied rat), Scandentia: tupaiid (treeshrew)		Philippines
<i>I. (Pholeoixodes) woodi</i>	Rodentia: cricetid (eastern woodrat, southern plains woodrat, bushy-tailed woodrat, Mexican woodrat, hispid cotton rat, deer mouse, white-footed mouse), geomyid (pocket gopher), heteromyid (kangaroo rat), sciurid (Mexican ground squirrel); Eulipotyphla: soricid (Crawford's gray shrew); Carnivora: mephitid (striped skunk, spotted skunk), procyonid (common raccoon); Primates: hominid (human); Passeriformes: tyrannid (western kingbird)		North America
<i>I. woyliei</i>	Diprotodontia: potoroid (woylie); Peramelemorphia: peramelid (quenda), thylacomyid (greater bilby)		Australia
<i>I. (Endopalpiger) zaglossi</i>	Monotremata: tachyglossid (western long-beaked echidna)		Indonesia
<i>I. (Afrixodes) zairensis</i>	Eulipotyphla: soricid (greater red musk shrew)		Africa
<i>I. (Multidentatus) zumpti</i>	Procellariiformes: diomedeid (sooty albatross, Atlantic yellow-nosed albatross), procellariid (great shearwater, prion, diving petrel)		Africa

Parasite morphology: *Ixodes* spp. form 4 different types of developmental stages; eggs; larvae; nymphs; and adults. The eggs are small shiny-brown ovoid stages measuring up to 0.5 mm long and are often clustered together in large sticky masses. Emergent larvae (also known as seed ticks or pepper ticks) have ovate dorso-ventrally flattened bodies measuring less than 1 mm in length and are usually yellow-brown in colour. The idiosoma (body) has a hardened (sclerotized) pentagonal dorsal plate (scutum) located anteriorly while the remainder of the body has a rounded oval margin. Larvae have 3 pairs of long jointed legs located ventrally on the anterior idiosoma. The capitulum (head) is visible in dorsal view as a forward projection and has a gnathosoma with 2 palps flanking the mouthparts (comprising 2 chelicerae and a central toothed hypostome). Larvae lack respiratory stigmata, tracheae and genital pores. Nymphs have ovate flattened bodies with a conspicuous capitulum bearing mouthparts and an idiosoma with an anterior dorsal scutum. Nymphs are generally larger and darker in colour than larvae, measuring up to 2 mm long and ranging from brown to black, but often with a lighter posterior idiosoma, sometimes patterned. They characteristically have 4 pairs of long jointed legs attached ventrally, and a pair of respiratory openings (stigmata) surrounded by oval plates located behind the fourth pair of basal coxae. Like larvae, nymphs lack genital pores. Adult ticks have round dorso-ventrally flattened bodies that range in length from 2-4 mm when unfed, but females may become ovoid and swell to 10-20 mm in diameter when engorged. Most species are brown to reddish brown in colour, sometimes grey-black. Adults are clearly divided into 2 parts: a small anterior capitulum (head) and a larger posterior sac-like idiosoma (body). The capitulum projects forwards and is visible from above (whereas that of argasid ticks is ventral and not visible). It consists of the basis capitulum (integumental ring encircling mouthparts) and the gnathosoma (feeding structure comprising 2 palps, 2 chelicerae and toothed hypostome). In females, the basis capitulum also has 2 dorsal porose areas (absent in argasids) which are used to water-proof eggs. *Ixodes* spp. have long mouthparts (not short like *Rhipicephalus/Boophilus*, *Dermacentor*, *Haemaphysalis*) that are mounted on short triangular basis capituli (not rectangular like

Amblyomma/Aponomma, *Dermacentor*, *Haemaphysalis*, *Hyalomma*, nor hexagonal like *Rhipicephalus/Boophilus*, nor pentagonal like *Bothriocroton*). The palps are club-like sensory structures that move laterally and do not enter the skin when the tick is feeding. They are long (not short like *Rhipicephalus/Boophilus*, *Dermacentor*, and *Haemaphysalis*) and are composed of 4 unequal segments; the second segment being tapered at its base, and the fourth segment being greatly reduced and bearing chemoreceptor sensillae. The chelicerae are cutting structures used horizontally to rip and tear the flesh to form small pools of blood. They have 2 segments and are tubular with long curved shafts in spinose sheaths, and terminate in 2 cutting digits with recurved teeth. The central hypostome is an extension of the basis capitulum and is dentate with backward-facing teeth. It is inserted into the blood pool to facilitate feeding as well as to anchor the tick to its host. During feeding, the chelicerae and hypostome form the buccal canal to inject saliva and suck blood. The alimentary tract consists of a muscular pharynx (with pharyngeal valve), tubular oesophagus, large saccular midgut with branched diverticula (caeca) and excretory Malpighian tubules, a vesicular rectal sac (analogue of hindgut in ticks) and subterminal ventral anus. *Ixodes* spp. are prostriate ticks in that they possess an inverted U-shaped anal groove extending anteriorly and enclosing the anus, whereas all other ixodid genera are metastriate ticks and have a posterior anal groove. All ixodids are hard ticks with chitinized dorsal plates (scutum) which are absent in soft argasid ticks. The scutum covers the whole back of males (= conscutum) but only the anterior portion of females (often becoming obscured following engorgement). *Ixodes* spp. are inornate and have plain dorsal surfaces without coloured patterns (not ornate like *Amblyomma/Aponomma*, *Bothriocroton*, and some *Rhipicephalus* and *Dermacentor* spp.), without marginal notches or festoons (present in all other ixodid genera, except *Boophilus*), and without pigmented 'eyes' (present in *Amblyomma*, *Rhipicephalus/Boophilus*, *Dermacentor* and *Hyalomma*). The ventral idiosoma gives rise to 4 pairs of long jointed legs, each with 6 segments (coxae, trochanter, femur, patella (genu), tibia and tarsus) and all terminating in a pair of claws with a pad-like pulvillus (pulvillus absent or rudimentary in argasids). The legs are generally paler in colour than the body, but they lack conspicuous pale rings or markings (present on *Amblyomma* and *Hyalomma*). The first pair of legs have a special sensory structure (Haller's organ) on the dorsal tarsus which is used to detect temperature, odour and tactile stimuli. Ixodid coxae also have spurs (absent in argasids) with *Ixodes* spp. typically having a single large internal spur on coxae I. Adults have a pair of respiratory stigmata with large plates located behind coxae IV (whereas the stigmata in argasids are located between coxae III). *Ixodes* spp. exhibit marked sexual dimorphism, particularly with respect to body size (females are larger, especially after feeding), mouthparts (longer in females), dorsal scutum (complete covering on males, partial covering on females), ventral plates (on males only) and porose areas on the basis capitulum (on females only). Males have flat sclerotized plates covering much of their ventral surface: including an anal plate (around the subterminal anus), 2 adanal plates (either side of the anus), a large median plate (between the anus and the midbody gonopore), 2 epimeral plates (lateral to the median plate and containing the spiracles), and a pregenital plate (anterior to the gonopore). These plates are absent in most other ixodid genera (*Aponomma*, *Dermacentor*, *Haemaphysalis*, and *Bothriocroton*) and reduced in number in others (*Rhipicephalus*). Males have 2 tubular testes with vas efferentia fusing to form a common vas deferens (large multilobed accessory glands) leading to the ejaculatory duct and gonopore (genital opening) which is situated ventrally around the midbody and has an anterior sclerotized flap (genital apron). Males produce packets of spermatids (spermatophores) which are transferred to the genital operculum of females. Females have a single saccular ovary (becoming grape-like when gravid) with paired oviducts joined to a common uterus (with tubular accessory glands that help coat eggs) opening to a vagina with a saccular cervical region (acting as a receptaculum seminis) and a vestibular region (capable of prolapsing during oviposition). The female gonopore (genital opening) is located ventrally around the midbody and is U- or V-shaped with marginal folds and an anterior genital apron. Females also have special glands (Gene's organ) located near the gnathosoma-idiosoma junction which produce waxy coatings for eggs as they emerge during oviposition.

Site of infection: Larval, nymphal and adult ticks are obligate but transient ectoparasites that attach to the skin of their hosts. *Ixodes* spp. often have broad host ranges (euryxenous or stenoxenous) and infest multiple mammalian, avian and/or reptilian hosts. Different life-cycle stages may also occur on different animal species, with larvae often found on small terrestrial hosts, nymphs being found on a wider range of sympatric hosts, and adults also infesting larger vertebrates. *Ixodes* spp. have been reported on mammals belonging to 102 families in 25 orders (including herbivores, omnivores and carnivores), birds belonging to 64 passerine families and 57 non-passerine families in 29 orders (including seabirds, shore birds, waterfowl, forest birds, terrestrial birds and some birds of prey) and reptiles belonging to 8 lizard families, 6 snake families and 3 tortoise families. Most species have preferred (predilection) sites of attachment on different hosts, often involving cryptic areas among skin folds which are difficult for hosts to groom. Ticks on humans often move to the head behind the ears, or attach to the skin under tight-fitting clothing (such as elasticized waist-bands). Animals are generally infested by larvae on the belly, legs and groin, by nymphs on the head, forelegs, brisket and shoulders, and by adults on the neck, shoulders, face and ears.

Pathogenesis: Ixodid ticks are haematophagous ectoparasites causing traumatic tissue damage, inflammation, hypersensitivity, anaemia, production losses, toxicoses and paralysis as well as transmitting infectious diseases. When attaching to a new host, ticks use their chelicerae in a ripping and tearing motion to cut a channel in the skin resulting in the formation of a small pool of blood and fluid into which they insert their hypostomes, thus forming a tubular food channel through which saliva is injected and blood is ingested. This feeding process is known as telmophagy (pool feeding), as distinct from solenophagy (sucking direct from blood vessels) as practised by other ectoparasites (e.g. mosquitoes). Feeding ticks also concentrate their blood meals by secreting (regurgitating) host-derived fluids back into the host. Hard ticks attach and feed gradually over 2-14 days as they must grow new cuticle to accommodate their blood meals. Their hypostomes have recurved teeth which serve as anchors and many species secrete a cement-like substance from their salivary glands to aid attachment, thereby usually creating a sterile abscess-like feeding site. Tick saliva also contains numerous chemicals to assist feeding (anticoagulant and antihemostatic substances) as well as to suppress

rejection by the host (anti-inflammatory compounds and immunomodulatory proteins and lipids). Paradoxically, when ticks detach after feeding, the salivary components they leave behind are antigenic and stimulate inflammation and granuloma formation. Nonetheless, host reactions to tick bites vary considerably. Many bites are painless and the hosts do not even notice them. However, tick mouthparts often penetrate to the dermis resulting in haemorrhage, collagen degeneration, focal necrosis and sometimes local hypersensitivity with papule and wheal formation. Bites may therefore cause discomfort, local irritation, erythema (redness), oedema (swelling), pruritus (itching), alopecia, papular dermatitis, sores, ulcers and sometimes burning sensations, rash, headache and fever. Small local granulomatous reactions consisting of mixed inflammatory cells (neutrophils, lymphocytes, plasma cells) with fibrosis are common. Tick bites often become secondarily infected with bacteria, especially when ticks are forcibly removed leaving their mouthparts embedded in the skin, resulting in abscesses which may spread to the circulation causing bacteraemia and septicaemia. Ticks require substantial blood meals for moulting to the next developmental stage or for egg production. Larvae may ingest 11-17 times their pre-feeding weight while adult females may ingest 60-120 times their pre-feeding weight. Estimates of the blood volume consumed vary from 0.7-8.9 mL per female in some ixodid species. Heavy infestations may therefore result in significant blood loss and the host may become anaemic.

The salivary gland secretions of some *Ixodes* spp. (notably *I. holocyclus* and *I. cornuatus* in Australia and *I. rubicundus* in Africa) also contain neurotoxins which may cause a progressive flaccid ascending motor paralysis in susceptible hosts by inhibiting production of the neurotransmitter acetylcholine at neuromuscular junctions. The neurotoxins are released during feeding by larval, nymph and adult stages, but especially by engorging females. Clinical signs usually appear 3 days after attachment and worsen thereafter, first paralysing the legs, then the arms and finally the thorax and throat. Accompanying signs include delayed cardiac repolarization (long QT syndrome), pulmonary oedema, tracheopharyngeal compression, dysphonia, depressed gag and swallowing reflexes, aspiration pneumonia, pupil dilation, regurgitation or vomiting, dyspnoea, cyanosis, laboured respiration with a prolonged expiratory phase and expiratory grunt. Small susceptible animals may die from respiratory failure unless the ticks are removed, although their condition may continue to deteriorate for 48 hours after tick removal. A single engorging female tick may release enough neurotoxin to kill a dog or cat, or cause partial paralysis in an infant or small child. Several ticks may produce enough to kill neonatal domestic animals, and heavy infestations may prove fatal to larger domestic animals. Host susceptibility to the neurotoxins varies considerably between species, with many native animals apparently being refractory to toxic effects, and thus acting as wildlife reservoirs for infestations. In endemic areas, some hosts may also acquire transient resistance, as evidenced by reductions in engorgement success, egg production and hatching and increased tick mortality. Resistant hosts often develop cutaneous granulocytic reactions around bite sites, with subsequent degranulation and histamine release inhibiting feeding success. Both specific humoral and cell-mediated immune responses have been demonstrated in infested hosts, but their role in the acquisition of any protection is unknown, especially since ticks have been shown to be able to modulate or suppress host immune responses. Nonetheless, tick paralysis responds well to treatment with antibodies contained in anti-serum raised in animals subject to repeated non-lethal challenge.

In addition to the direct effects of ticks on hosts, they also exert many indirect effects by acting as vectors (biological and/or mechanical) for the transmission of various infectious diseases. Their long life spans (years), frequent changing of hosts (3-host life-cycles), prolonged feeding (days to weeks), voracious appetites (large blood meals) and profuse secretory and excretory products (saliva, regurgitated fluids, faeces) make them efficient vectors for various viral, bacterial, protozoal and helminth infections. Many of these pathogens undergo trans-stadial transmission (from larva to nymph to adult ticks) while some also undergo transovarian transmission (from adult female ticks to their eggs). Pathogenic micro-organisms transmitted by ticks include: viruses causing tick-borne encephalitis, Powassan encephalitis, Omsk haemorrhagic fever, African swine fever and louping ill; rickettsial bacteria causing spotted fevers, tick typhus, anaplasmosis, ehrlichiosis and Q fever; coccobacilli causing tularemia; staphylococci causing pyaemia; spirochaetes causing Lyme disease; piroplasms causing babesiosis and theileriosis; and even the nematode *Ackertia* causing filariasis. The major vectors for tick-borne diseases in humans and domestic animals are *I. ricinus* and *I. persulcatus* in Eurasia and *I. scapularis* and *I. pacificus* in North America.

Developmental cycle and mode of transmission: Ticks actively seek hosts, not by pursuing them but by sedentary questing; i.e., climbing vegetation and waiting for hosts to brush past. Questing behaviour is influenced by changes in environmental temperature, humidity and day length. Ticks are prone to desiccation so they quest more actively when hydrated, and return to humid ground level when dehydrated. Body heat, movement, vibrations, visual images, odours and carbon dioxide act as stimuli for tick attachment to passing hosts. Ticks are found in wooded and forested regions of world, often near water sources where warm-blooded animals come to drink, or along trails, or on pastures. Many *Ixodes* spp. are nidicolous (nest-dwelling) and are closely associated with nests, hides, shelters or burrows of their small mammalian or bird hosts, or in nearby soil, leaf litter, bark or foliage. Once contact is made with a host, ticks migrate to suitable or preferred sites of attachment. Ticks exhibit hemimetabolous (incomplete) metamorphosis whereby eggs hatch larvae which moult to nymphs and then adults (ixodid ticks only have 1 nymphal instar whereas argasids have 2-7 instars). Most *Ixodes* spp. have 3-host life-cycles whereby larvae, nymphs and adults all feed on different hosts for several days before dropping off the host to continue development. Eggs in the environment hatch when climatic conditions are suitable (warm and humid), usually from 40-110 days after being laid. Emergent hexapod larvae (known as seed, grass or pepper ticks) undergo 7-44 days of hardening before attaching to small hosts (rodents, birds) to feed for 4-6 days. Once replete, they detach and moult 19-41 days later in the environment to form octopod nymphs. The nymphs attach to mid-sized hosts (rodents, carnivores, birds) 5-30 days later and feed for 4-7 days. Replete nymphs then detach and moult 3-11 weeks later to form adults which become sexually mature soon thereafter. Male and female ticks may mate before or after attachment to mid-sized to

large hosts (carnivores, herbivores, omnivores) 7-77 days later. Males feed very little on blood, instead they may attach to female ticks by piercing her cuticle and feeding on haemolymph. Attached females usually do not fully engorge on host blood unless they are inseminated and their ovaries become vitellogenic (although parthenogenesis has been observed in several tick species). Inseminated females feed for periods ranging from 6-30 days, becoming grossly enlarged during engorgement. When replete, the fecund females detach and lay eggs 11-20 days later in the environment in soil crevices, underneath leaf litter or on vegetation. Eggs are laid in cohesive masses of several thousand eggs at a rate of 20-200 eggs per day for 3-34 days. Female ixodid ticks die 1-2 days after egg production is completed, so they only undergo a single gonotrophic cycle (compared to multiple cycles for argasid ticks). The amount of time each stage spends in the environment (off-host) varies considerably according not only to host availability but also prevailing climatic conditions. In temperate and subpolar regions, tick activity is seasonal and influenced by ambient temperature, photoperiod and incident solar energy. Many species may undergo temporary diapause to survive adverse environmental conditions by lowering their metabolic rates, becoming inactive, delaying development or delaying oviposition. Larvae and nymphs are generally more active in autumn before over-wintering and forming adults which feed and breed during spring and early summer. In tropical regions where day length and temperature vary only slightly throughout the year, tick activity is influenced by the transition from the dry to the rainy season. Hard ticks have been found to live for 2-6 years, but the whole life-cycle is often completed within a year in tropical regions or within 2-3 years in more temperate colder regions.

Differential diagnosis: Questing ticks may be recovered from the environment using baits (carbon dioxide from dry ice) or by dragging cloth strips or flags through vegetation. Infestations on hosts, however, are usually detected by finding feeding stages attached to the skin, especially large engorging females. Evidence of recent infestation may be seen at predilection sites as small inflamed nodules, sometimes accompanied by nonspecific pathophysiological changes (such as rash, fever, peripheral nerve dysfunction, respiratory difficulty, oesophageal dysfunction and hypertension). Nonetheless, differential diagnosis is performed by removing ticks and examining them microscopically for species-specific morphotypic characters. A range of dichotomous and polychotomous taxonomic keys are available to identify the different developmental stages (larvae, nymphs, males and females) of most ixodid tick species. Protein electrophoresis and cuticular hydrocarbon analyses have been used to complement taxonomic studies, and molecular characterization studies have used polymerase chain reactions (PCR) to amplify specific gene sequences: including nuclear ribosomal RNA (18S, 28S, ITS1, ITS2) and mitochondrial RNA (12S, 16S), cytochrome c oxidase subunit 1 (cox1) and nicotinamide adenine dinucleotide dehydrogenase subunit 5 (pnad5).

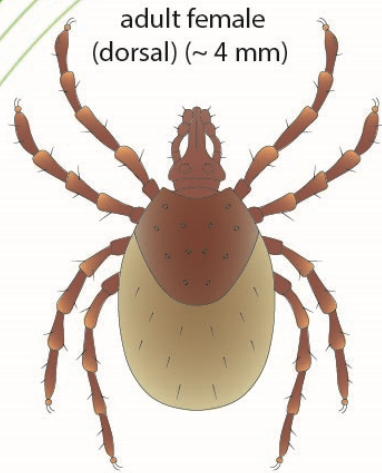
Treatment and control: Individual ticks attached to hosts can be physically removed, preferably by sliding fine forceps/tweezers or special removal devices (tick keys, twists, loops/lassos, or V-shaped tools) under their mouthparts and then exerting gentle backwards pressure until the tick lets go. Excessive force should not be used to avoid squeezing tick contents into the wound as well as to avoid tearing out the mouthparts leaving them behind (in which case they should be surgically removed). It is advisable not to use heat, detergents or irritant solvents to treat ticks before removal as this may cause them to inject or regurgitate more material into the bite site. However, some studies have indicated that treating them with permethrin creams, pyrethroid sprays, chloroform, benzyl benzoate, bicarbonate of soda or freeze-drying them with ether-containing sprays may aid in their removal. People should exercise personal protection by covering exposed skin, tucking pants into boots or socks, applying insect repellents (containing permethrins, DEET or picaridan) to skin and clothing, and avoiding grassy areas and shrubs during active tick seasons. Routine skin inspection should be practiced especially for humans and animals most at risk (i.e. those regularly moving through bush vegetation). Various acaricides have proven effective for the treatment of animals when used as dips, sprays, pour-ons, slow-release collars or ear-tags, tablets, drenches, in-food medications or applied using devices associated with feeders or nesting materials. Domestic animals have been treated successfully with topical organophosphonates (chlorfenvinphos, dichlorvos, dioxathion, tetrachlorvinphos, trichlorfon), monothiophosphates (chlorpyrifos, coumaphos, diazinon, fenthion, propetamphos), dithiophosphates (malathion, phosmet), chlorinated hydrocarbons (DDT, lindane), neonicotinoids (imidacloprid), arsenical preparations, carbamates (carbaryl), pyrethroids (permethrin, deltamethrin, flumethrin, cyfluthrin, decamethrin, cypermethrin, alphamethrin), formamidines (amitraz), phenylpyrazoles (fipronil) as well as with parenteral macrocyclic lactones (ivermectin, selamectin), salicylanilide (closantel) and isoxazoline-substituted benzamide derivatives (fluralaner). Several studies have found treatment with insect growth regulators and hormones (methoprene, ecdysteroid mimics, juvenile hormones) disrupt tick development but these formulations are not widely available. There are mounting concerns about the development of resistance to acaricides in some tick populations with treatment failures being recorded with increasing frequency against arsenical compounds, organochlorines, organophosphates, pyrethroids and formamidines. To combat the development and spread of resistance, it is recommended that tick populations be checked for acaricidal resistance (by *in situ* or *in vitro* larval immersion, larval packet or adult immersion tests, immunoassays or genotypic screening) and that the major classes of acaricides (except organochlorines) be used in cyclic rotation or as co-formulations. The management of patients experiencing tick paralysis is based on tick removal, treatment with anti-serum and providing supportive care. Finding ticks on animals can be difficult and should include thorough visual and tactile examination of the whole body (including crevices and orifices), using grooming devices or clippers as required. Empirical treatment with an acaricide should also be provided to ensure any stages overlooked will be killed. Clinically-affected animals should be treated with anti-serum to neutralize circulating toxins, even after tick removal in mild or highly suspect cases (clinical signs often worsen for several days). A variety of management strategies have been developed for tick infestations of domestic animals but their efficacy is diminished in many instances by the persistence of ticks on wildlife reservoirs, especially in areas where wildlife and domestic stock constantly intermingle. Efforts should be taken to exclude wildlife from animal-holding facilities using barriers, traps, baits and other vermin control strategies. Pet owners should regularly inspect their animals for infestations, provide long-lasting prophylactic

treatment and restrict their access to bush areas where ticks are endemic. Many states and countries have adopted legislature which restricts livestock movement into and from endemic areas and facilitates appropriate quarantine. Various management strategies (such as pasture rotation or spelling, clearing vegetation by cultivation/ploughing, cutting/slashing or prescribed burning) have also been used to minimize the transmission of infestations and reduce tick burdens on pastures. Several computerized mathematical prediction models have been developed to help schedule treatment times and other interventions based on multiple biotic factors, including prevailing weather (temperature, moisture, rainfall), microclimate (photoperiod, circadian rhythms), macroclimate (seasons), vegetation (type, structure, density), geographic location (latitude, longitude, elevation), land-use and animal husbandry (cohorts, grazing history). Many native animal species are genetically resistant to heavy tick infestations. This is being exploited in cross-breeding programs e.g. *Bos indicus* (Zebu) cattle and Sanga breeds of *Bos taurus* cattle are more tick-resistant than European *Bos taurus* breeds. More recently, several experimental vaccination studies using salivary gland proteins (Salp25D and tHRF) and other metabolic extracts (subolesin) from *I. scapularis* have provided variable protection to laboratory and field animals exposed to homologous tick challenge. [Note that very successful results have been reported in vaccination studies using hidden gut antigens from a range of other ixodid tick spp. (notably *Boophilus microplus*, but also including *Rhipicephalus appendiculatus* and *Hyalomma anatolicum*)]. Many biological control options are also being investigated to reduce tick populations using predators, parasites and pests: including the use of parasitic chalcid wasps that oviposit in ixodid nymphs, seeding pastures with parasitic nematodes (*Steinernema*, *Heterorhabditis*) or entomopathogenic fungi (*Beauveria*, *Metarhizium*) that prey on tick stages; encouraging natural predators (such as oxpecker grooming birds); and growing plants which use structural or chemical deterrents to tick-questing behaviours.

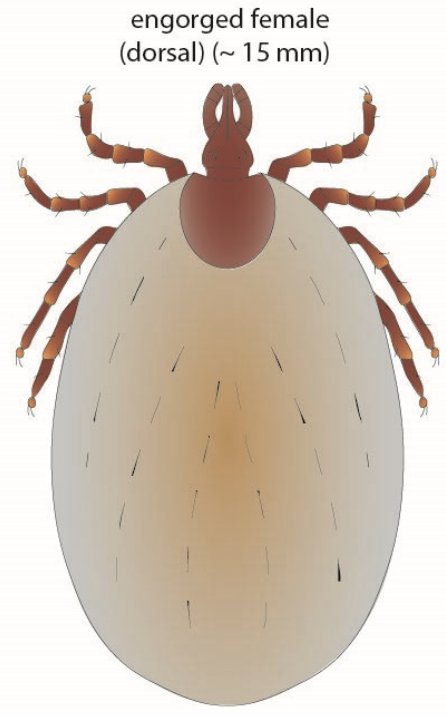
Ixodes



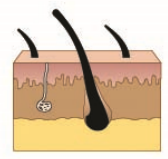
Hosts
(mammals,
birds,
reptiles)



adult female
(dorsal) (~ 4 mm)

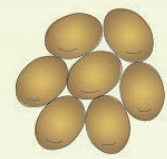


engorged female
(dorsal) (~ 15 mm)

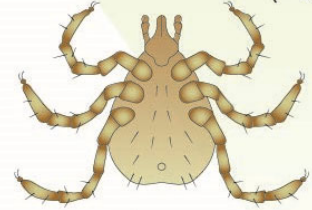


skin
(blood loss,
lesions,
toxicosis)
(vectors for
infectious
microbial
diseases)

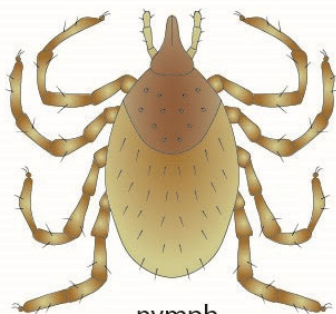
eggs laid
in soil/litter



eggs
(~ 0.5 mm)



larva
(ventral)
(~ 1 mm)



nymph
(dorsal)
(~ 2 mm)

hatch

questing
(host-seeking)

motile stages
(L+N+A) are
transient
haematophagous
ectoparasites on
vertebrate hosts

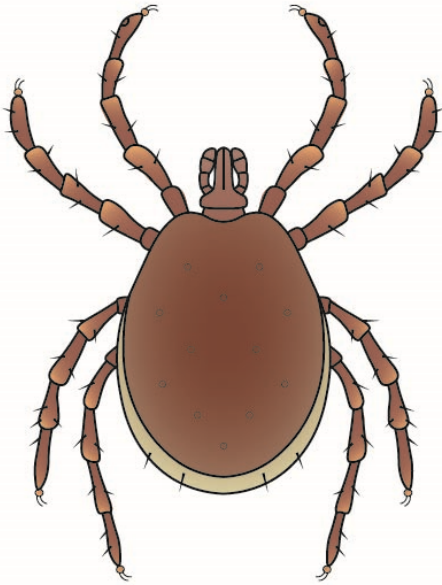
1
2
3

most *Ixodes* spp. have 3-host cycles
where larvae (L), nymphs (N) and adults (A)
occur on different hosts

- 1-1-host cycle (LNA on same host)
- 2-2-host cycle (L-NA on successive hosts)
- 3-3-host cycle (L-N-A on separate hosts)

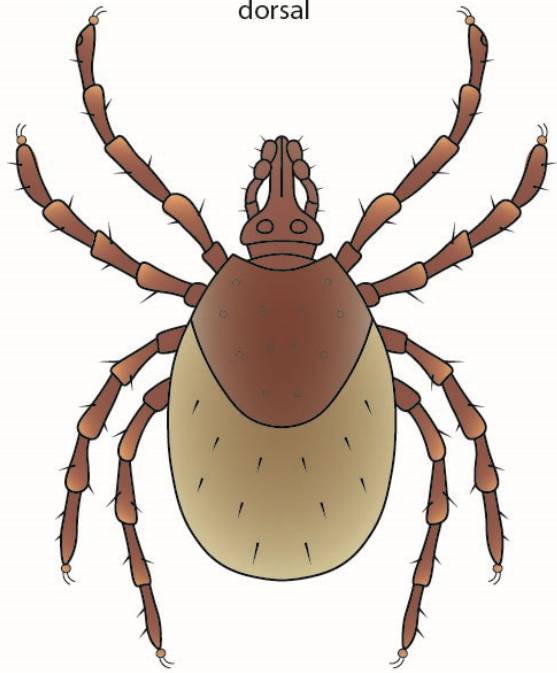
Ixodes

dorsal



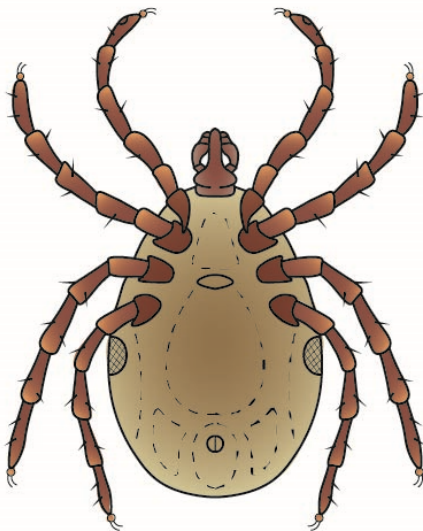
male (~ 3 mm)

dorsal

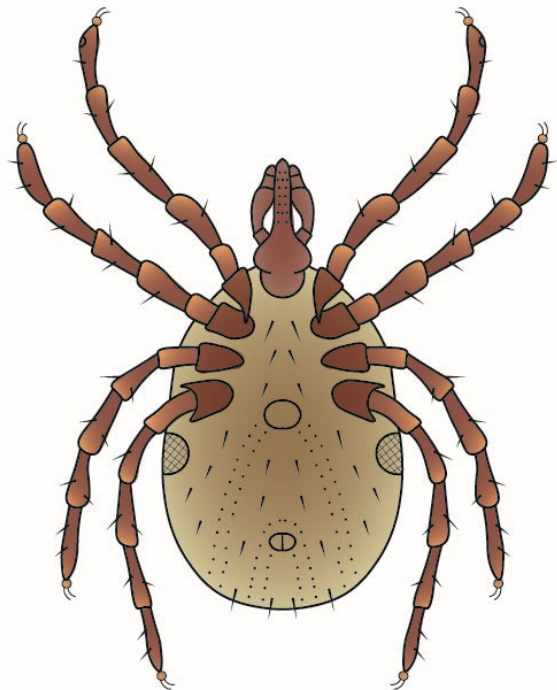


female (~ 4 mm)

adult ticks



ventral



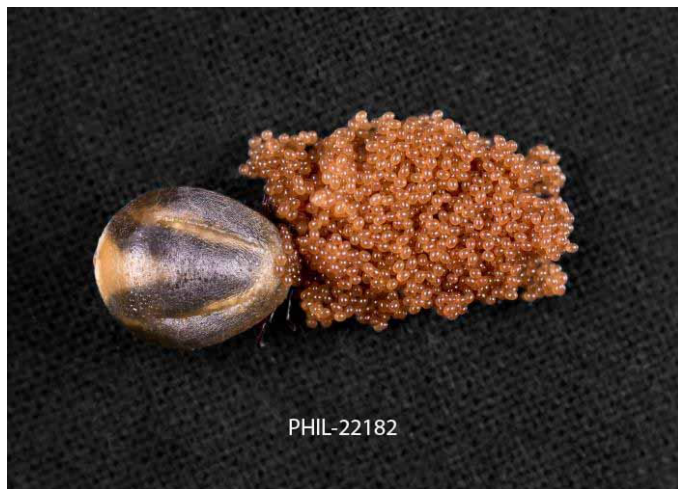
ventral



Ixodes adult



Ixodes adult female, engorged



Ixodes adult female and eggs



Ixodes larva



Ixodes nymph



Ixodes paralysis tick on dog