

Invasion: Exotic Ticks (Acari: Argasidae, Ixodidae) Imported into the United States. A Review and New Records

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ABSTRACT A review of the literature and unpublished records from the U.S. National Tick Collection on the importation of ticks from foreign lands reveals that at least 99 exotic tick species assignable to 11 genera have been either detected and destroyed at ports of entry or inadvertently imported into the United States in the past half century. This number includes four argasid and 95 ixodid species, some of which are important vectors of agents that cause disease to both man and animals. If one includes *Aponomma* sp. and *Hyalomma* sp. and the subspecies of *Rhipicephalus*, the total exceeds 100 taxa. It is notable that the number of imported tick species recorded herein exceeds the total number of tick species native to the United States. It appears that the soft tick genera *Argas*, *Antricola* and *Nothoaspis* have not been imported, although at some point in time *Argas persicus* (Oken) was introduced because it is resident although not often collected. The hard tick genera *Anomalohimalaya*, *Cosmiomma*, *Margaropus*, *Nosomma* and *Rhipicentor*, and the nuttalliellid genus *Nuttalliella* have also not been imported.

KEY WORDS exotic tick importation, tick, Acari, imported

Ticks on Imported Animals and Other Items

The recent interest in the potential for *Cowdria ruminantium* (Cowdry), the causative agent of heart-water disease, to enter the United States in the tick species *Amblyomma variegatum* (F.) from various Caribbean islands where both agent and tick are present, has led to an increased interest in examining the need for protection against imported host animals that might harbor exotic ticks. For a brief review of the Caribbean *Amblyomma* program see Pegram et al. (1998).

Some tick species that are resident in the United States and in other countries are often also imported. Examples are, *Otobius megnini* (Dugès), *Anocentor nitens* (Neumann), *Amblyomma dissimile* Koch, *A. cajennense* (F.), *A. rotundatum* Koch, and although eradicated from the United States, both *Boophilus annulatus* (Say) and *B. microplus* Canestrini. These species and *Amblyomma longirostre* Koch, a common import on birds will not be mentioned further unless the importation is definite or at least a bit unusual.

Becklund (1968) presented a review of ticks of veterinary importance found on imports into the United States. He listed nine genera and 37 species. The present review lists 11 genera and 99 species. The genus *Anocentor* was entered under *Dermacentor* in Becklund's list and the genus *Aponomma* was not on his list because it does not contain species of veterinary importance.

The following is a review of the numerous instances of foreign ticks entering the United States from various areas of the world. Previously unpublished records from the U.S. National Tick Collection (cited by RML number) are also included. Records from the U.S. Department of Agriculture's U.S. National Parasite Collection have the prefix NPC.

Argasidae

Because almost all species of soft ticks feed rapidly in the postlarval stages, there are few records of argasids crossing the boundaries of the United States. However, Davis (1943) recorded the collection of *Ornithodoros nicolleti* Mooser, a fairly common parasite of wood rats in Mexico that was collected on a rattlesnake in the St. Louis Zoo. Cooley and Kohls (1944) gave further data on this collection. Thirty-two nymphs and one adult were collected on a Florida diamond back rattlesnake, St. Louis Zoo, November 1933.

In June 1991 members of the U.S. Fish and Wildlife Service found *Ornithodoros moubata* (Murray) on tortoises imported into Florida and Pennsylvania (Anonymous 1992). *Ornithodoros moubata* is the vector of *Borrelia duttoni* (Novy and Knapp), the agent of human tick-borne relapsing fever in sub-Saharan Africa. However, the finding of *O. moubata* on a tortoise is unusual. The determination may have been in error, and perhaps the tick was *Ornithodoros apertus* Walton, a closely related species to *O. moubata*, and one that can be found on reptiles.

Table 1. Exotic ticks imported into the United States of America

Tick species	Host/item	Origin	Destination	Reference
Argasidae				
<i>Ornithodoros</i>				
<i>O. ambius</i>	Guano	Peru	USA	USDA (1962), Becklund (1968, 1969) (NPC 44056, 56078)
<i>O. moubata</i>	Tortoise	Unknown ^{a,b}	FL, PA ^c	Anonymous (1992)
<i>O. nicollei</i>	Rattlesnake	Mexico	MO	Davis (1943), Cooley and Kohls (1944)
<i>O. rudis</i>	Plant material	Unknown	FL, MO ^c	USDA (1972, 1975)
<i>Otobius</i>				
<i>O. megnini</i>	Antelope, nyala, zebra, sable antelope, gemsbok	Namibia	NY ^d	Becklund (1968) (NPC 58707-58709, 59459)
<i>O. megnini</i>	Horse	Peru	FL	USDA (1973b)
<i>O. megnini</i>	Zebra	Unknown	CA	USDA (1974b)
Ixodidae				
<i>Amblyomma</i>				
<i>A. albopictum</i> Neumann	Iguana	Hispaniola	FL	(RML 48967)
<i>A. auricularium</i> (Conil)	Cattle	Unknown	TX	USDA (1982)
<i>A. auricularium</i>	Armadillo	Unknown	FL	Lord and Day (2000)
<i>A. cajennense</i>	Horse	Guatemala	IL	Becklund (1968)
<i>A. cajennense</i>	Horse	Guatemala	GA	Becklund (1968)
<i>A. cajennense</i>	Human	Jamaica	CT	(RML 46017)
<i>A. calcaratum</i> Neumann	Unknown	Unknown	KY	Bloemer et al. (1987)
<i>A. clypeolatum</i> Neumann	Tortoise	Unknown	TX	USDA (1988)
<i>A. clypeolatum</i>	Tortoise	Unknown	NY	(RML 122461)
<i>A. coelebs</i> Neumann	On seeds	Costa Rica	LA	(RML 122144)
<i>A. compressum</i> Macalister	Pangolin	Togo	OH	(RML 122468)
<i>A. cyprium</i> Neumann	Iguana	Unknown	IL	USDA (1965)
<i>A. dissimile</i>	Snake	Unknown	PA	Snetsinger (1968)
<i>A. dissimile</i>	Boa	Colombia	ID	USDA (1973b)
<i>A. dissimile</i>	Boa	Colombia	IL	USDA (1973b)
<i>A. dissimile</i>	Reptile	Unknown	FL	Clark and Doten (1995)
<i>A. dissimile</i>	Amphibians & reptiles	Unknown	USA	Burridge (1997)
<i>A. dissimile</i>	Boa	Unknown	PA	(NPC 38351)
<i>A. dissimile</i>	Reptile	Paraguay	PA	(NPC 55662)
<i>A. dissimile</i>	Iguana	Colombia	CA	(NPC 56398)
<i>A. dissimile</i>	Snakes	S. America	CA	(NPC 58071)
<i>A. dissimile</i>	Alligator	S. America	UT	(NPC 59270)
<i>A. dissimile</i>	Boa	Unknown	CA	(RML 16468)
<i>A. dissimile</i>	Boa	C. America	FL	(RML 29100)
<i>A. dissimile</i>	Boa	Unknown	AK	(RML 34096)
<i>A. dissimile</i>	Boa	Unknown	OH	(RML 39454)
<i>A. dissimile</i>	Iguana	Unknown	DC	(RML 56879)
<i>A. dissimile</i>	Iguana	Mexico	TX	(RML 56884)
<i>A. dissimile</i>	Rat snake	Unknown	NY	(RML 56888)
<i>A. dissimile</i>	Iguanas	Unknown	NY	(RML 56889)
<i>A. dissimile</i>	Anaconda	Unknown	MT	(RML 63694)
<i>A. dissimile</i>	Cobra	Unknown	DC	(RML 66129)
<i>A. dissimile</i>	Iguana	Unknown	NY	(RML 105415)
<i>A. dissimile</i>	Boa	Unknown	NY	(RML 105418, 105419)
<i>A. dissimile</i>	Boa	Colombia	CT	(RML 113081)
<i>A. dissimile</i>	Iguana	Unknown	LA	(RML 113328)
<i>A. dissimile</i>	Reptile	Unknown	HI	(RML 120820)
<i>A. dissimile</i>	Iguana	Unknown	OH	(RML 121287, 121289, 121582)
<i>A. dissimile</i>	Snake	Suriname or Guyana	OH	(RML 121290)
<i>A. dissimile</i>	Iguana	Unknown	ND	(RML 122163)
<i>A. dissimile</i>	Iguana	Honduras	NY	(RML 119246-119254, 119256-119259, 119264-119268)
<i>A. echidnae</i> Roberts	Snake	Unknown	NM	USDA (1994)
<i>A. falsomarmorum</i> Rondelli	Lizard	Unknown	AZ	USDA (1975)
<i>A. geayi</i> Neumann	Sloth	Unknown	PA	USDA (1970)
<i>A. geayi</i>	3-toed sloth	Unknown	IL	USDA (1974b)
<i>A. gemma</i>	Rhinoceros	Unknown	TX	McIntosh (1963)
<i>A. gemma</i>	Trophy hide ^e	Unknown	MD	USDA (1965)
<i>A. gemma</i>	Zebra	Unknown	FL	USDA (1968)
<i>A. gemma</i>	Rhinoceros	E. Africa	MI	Becklund (1968)

Table 1. Continued.

Tick species	Host/item	Origin	Destination	Reference
<i>A. gemma</i>	Trophy hide	Unknown	LA	USDA (1975)
<i>A. gemma</i>	Rhinoceros	Unknown	NC	USDA (1975)
<i>A. gemma</i>	Ostrich	Unknown	TX	USDA (1989a, b, 1994), Burridge (1997)
<i>A. gemma</i>	Ostrich	Tanzania	TX	USDA (1989a, b), Mertens and Schlater (1991)
<i>A. geoemydae</i> (Cantor)	Turtles	Unknown	NY-FL ^f	Simmons and Burridge (2000)
<i>A. geoemydae</i>	Turtle	China	CA	(RML 122544)
<i>A. hebraeum</i>	Rhinoceros	S. Africa	NY	USDA (1963), Diamant (1965), Becklund (1968), Wilson and Richard (1984), Burridge (1997)
<i>A. hebraeum</i>	White rhino	Unknown	OK	Diamant (1965), Becklund (1968), Wilson and Richard (1984), Burridge (1997)
<i>A. hebraeum</i>	Rhinoceros	Unknown	CA	USDA (1967)
<i>A. hebraeum</i>	Antelope hide	Unknown	TX	Wilson and Richard (1984)
<i>A. hebraeum</i>	Trophy hide	Unknown	TX	USDA (1969)
<i>A. hebraeum</i>	Rhinoceros	Unknown	TX	USDA (1971), Wilson and Richard (1984)
<i>A. hebraeum</i>	White rhino	Unknown	VA	USDA (1974b), Wilson and Richard (1984)
<i>A. hebraeum</i>	Rhinoceros	Unknown	AL-CA ^f	Strickland et al. (1976)
<i>A. hebraeum</i>	Trophy hide	Unknown	CA	USDA (1978), Wilson and Richard (1984)
<i>A. hebraeum</i>	Cape buffalo	Unknown	CO	USDA (1981), Wilson and Richard (1984)
<i>A. hebraeum</i>	Eland	Unknown	CO	USDA (1982)
<i>A. hebraeum</i>	Zebra hide	Unknown	NC	USDA (1982), Wilson and Richard (1984), Burridge (1997)
<i>A. hebraeum</i>	Black rhino	Unknown	TX	USDA (1984, 1985b), Wilson and Richard (1984), Burridge (1997)
<i>A. hebraeum</i>	Rhino hide	Unknown	ME	USDA (1985b)
<i>A. hebraeum</i>	Trophy hide	Unknown	CO	USDA (1987a)
<i>A. hebraeum</i>	Trophy hide	Unknown	MS	USDA (1987b)
<i>A. hebraeum</i>	Trophy hides	Unknown	CO, GA ^e	USDA (1988)
<i>A. hebraeum</i>	Antelope & buffalo	Unknown	USA	Burridge (1997)
<i>A. hebraeum</i>	Buffalo	Africa	DC	(NPC 5516, 5522)
<i>A. hebraeum</i>	Zebra	Africa	MD	(NPC 14754)
<i>A. hebraeum</i>	Human	S. Africa	CT	(RML 122426)
<i>A. hebraeum</i>	Black rhino	S. Africa	MO	(RML 122465)
<i>A. helvolum</i> Koch	Snake	Unknown	MD	USDA (1971)
<i>A. helvolum</i>	Reptile	Unknown	FL	Clark and Doten (1995)
<i>A. humerale</i> Koch	Tortoise	Unknown	FL	Simmons and Burridge (2000)
<i>A. incisum</i> Neumann	Tapir	Unknown	NY	USDA (1965)
<i>A. javanense</i> (Supino)	Unknown	Unknown	USA	USDA (1965) (as <i>A.</i> <i>sublaeve</i> Neumann)
<i>A. javanense</i>	Pangolin	Unknown	OK	USDA (1969)
<i>A. javanense</i>	Pangolin	Thailand	IL	USDA (1972, 1973b)
<i>A. javanense</i>	Pangolin	Thailand	NY	USDA (1973b)
<i>A. javanense</i>	Anteater	Unknown	OK	USDA (1974b)
<i>A. lepidum</i>	Zebra hide	Unknown	MD	USDA (1966), Wilson and Richard (1984)
<i>A. lepidum</i>	Ostrich	Unknown	TX	USDA (1994)
<i>A. lepidum</i>	Ostrich	Unknown	USA	USDA (1989a, b), Mertens and Schlater (1991), Burridge (1997)
<i>A. marmoreum</i>	Tortoise	Unknown	FL	USDA (1966)
<i>A. marmoreum</i>	Tortoises	Unknown	MN, AZ ^e	USDA (1975)
<i>A. marmoreum</i>	Tortoise	Unknown	HI	USDA (1985b)
<i>A. marmoreum</i>	Tortoise	Unknown	TX	USDA (1988)
<i>A. marmoreum</i>	Reptiles	Unknown	FL	Clark and Doten (1995)
<i>A. marmoreum</i>	Tortoises	Unknown	USA	Burridge (1997)
<i>A. marmoreum</i>	Tortoises	Unknown	FL	Allan et al. (1998), Podolsky (1999),

Table 1. Continued.

Tick species	Host/item	Origin	Destination	Reference
<i>A. marmoreum</i>	Tortoise	Unknown	FL-AL ^f	(RML 117399)
<i>A. marmoreum</i>	Tortoise	Tanzania	NY	(RML 119230)
<i>A. marmoreum</i>	Tortoise	Unknown	FL-AZ ^f	(RML 122024)
<i>A. marmoreum</i>	Tortoise	S. Africa	MD	(RML 122476)
<i>A. moreliae</i> (Koch)	Python	Unknown	TX	USDA (1974b)
<i>A. multipunctum</i> Neumann	Tapir	Unknown	CA	USDA (1969)
<i>A. multipunctum</i>	Tortoise	Unknown	HI	USDA (1985b)
<i>A. nodosum</i> Neumann	Anteater	Unknown	NC	USDA (1970)
<i>A. nodosum</i>	3-toed sloth	Unknown	IL	USDA (1974b)
<i>A. nodosum</i>	Anteater	Unknown	IL	USDA (1977b)
<i>A. nodosum</i>	On pineapple	Unknown	FL	USDA (1987b)
<i>A. nodosum</i>	Anteater	Unknown	TX	USDA (1988)
<i>A. nuttalli</i>	Hedgehog	Unknown	NY	USDA (1969, 1978, 1987b)
<i>A. nuttalli</i>	Ball pythons	Ghana	NY	Kim et al. (1978)
<i>A. nuttalli</i>	Tortoise	Kenya	HI	Goff (1987)
<i>A. nuttalli</i>	Hedgehog	Unknown	FL, MS ^e	USDA (1994)
<i>A. nuttalli</i>	Reptiles	Unknown	FL	Clark and Doten (1995)
<i>A. nuttalli</i>	Snakes, lizard, tortoise	Unknown	FL	Burridge et al. (2000)
<i>A. nuttalli</i>	Python	Africa	NV	(RML 46086)
<i>A. nuttalli</i>	Ball python	Togo	NY	(RML 119193, 119236)
<i>A. nuttalli</i>	Lizard	W. Africa	OK	(RML 119020)
<i>A. nuttalli</i>	Lizard	Togo	NY	(RML 119219, 119220, 119222, 119225, 119229, 119233)
<i>A. nuttalli</i>	Tortoise	Unknown	CA-HI ^f	(RML 121588)
<i>A. oblongoguttatum</i> Koch	Human	Venezuela	MI	Walker et al. (1998), (RML 122352)
<i>A. ovale</i> Koch	Dog	Unknown	IA	Eddy and Joyce (1942)
<i>A. ovale</i>	Ocelot	Ecuador	CA	Becklund (1968, 1969)
<i>A. ovale</i>	Puma	Unknown	WA	USDA (1970)
<i>A. ovale</i>	Dog	Unknown	TX	USDA (1972, 1973b)
<i>A. ovale</i>	Coyote	Unknown	TX	USDA (1974b)
<i>A. ovale</i>	Cotton rat	Unknown	TN	Durden and Kollars (1992), (RML 25701)
<i>A. parvum</i> Aragão	Armadillo	Paraguay	OH	(RML 122872)
<i>A. pictum</i> Neumann	Anteater	Unknown	NY	USDA (1973a)
<i>A. pomposum</i>	Topi	Germany	NY	Becklund (1968, 1969)
<i>A. pseudoconcolor</i> Aragão	Armadillo	Paraguay	OH	(RML 122225)
<i>A. quadricavum</i> (Schulze)	Boa	Unknown	CT	Anderson et al. (1981b) (as <i>Aponomma quadricavum</i>)
<i>A. sabanerae</i> Stoll	Reptiles	Unknown	FL	Clark and Doten (1995)
<i>A. sabanerae</i>	Tortoises, boa	Unknown	FL	Burridge et al. (2000)
<i>A. sabanerae</i>	Reptile	Mexico	IN	(RML 120370)
<i>A. scutatatum</i> Neumann	Iguana	Unknown	NY	USDA (1977a), Hourigan (1977)
<i>A. scutatatum</i>	Reptiles	Unknown	FL	Clark and Doten (1995)
<i>A. scutatatum</i>	Iguana	Honduras	NY	(RML 119246-119254, 119256-119259, 119264-119268)
<i>A. sparsum</i>	Boa	Unknown	WA	USDA (1970), Wilson and Richard (1984)
<i>A. sparsum</i>	Tortoise	S. Africa	OR	USDA (1972, 1973b)
<i>A. sparsum</i>	Tortoise	Unknown	TN	Durden and Kollars (1992)
<i>A. sparsum</i>	Tortoise	Unknown	FL	Burridge et al. (2000)
<i>A. sparsum</i>	Tortoise	Unknown	CA	USDA (1994)
<i>A. sparsum</i>	Reptiles	Unknown	FL	Clark and Doten (1995)
<i>A. sparsum</i>	Tortoise Monitor lizard	Unknown	USA	Burridge (1997)
<i>A. sparsum</i>	Tortoise	Unknown	FL	Voyles (1999), Burridge et al. (2000), Monti (2000)
<i>A. sparsum</i>	Tortoise	Tanzania	NY	(RML 119230)
<i>A. sparsum</i>	Ball python	W. Africa	TN	(RML 120898)
<i>A. splendidum</i> Giebel	Trophy hide	Unknown	AZ	USDA (1973a)
<i>A. sylvaticum</i> (de Geer)	Tortoise	S. Africa	USA	USDA (1990) (as <i>A. sylvatica</i>)
<i>A. testudinarius</i> Koch	Rhinoceros	Unknown	DC	(RML 118528, 118529)
<i>A. testudinis</i> Supino	Unknown	Unknown	USA	Becklund (1968, 1969)

Table 1. Continued.

Tick species	Host/item	Origin	Destination	Reference
<i>A. tholloni</i>	Elephant	Uganda	TX	Becklund (1968)
<i>A. tholloni</i>	Elephant	Unknown	TN	Wilson and Richard (1984)
<i>A. tholloni</i>	Trophy hide	Unknown	CO	USDA (1974b), Wilson and Richard (1984)
<i>A. tholloni</i>	Elephant hide	Unknown	CA	USDA (1975)
<i>A. tholloni</i>	Ruminant hide	Zimbabwe	AK	(RML 121144)
<i>A. triggittatum</i> Koch	Human	Australia	CA	(RML 120577)
<i>A. variegatum</i>	Rhinoceros	Unknown	MI	Becklund (1968), (NPC 59329)
<i>A. variegatum</i>	Trophy hide	Unknown	CO	USDA (1974b), Wilson and Richard (1984)
<i>A. variegatum</i>	Rhinoceros	Unknown	NC	USDA (1975)
<i>A. variegatum</i>	Kudu	Unknown	CO	USDA (1975), Wilson and Richard (1984)
<i>A. variegatum</i>	Ostrich	Unknown	USA	Mertins and Schlater (1991), Burridge (1997)
<i>A. variegatum</i>	Monitor lizard	Unknown	USA	Burridge (1997)
<i>A. variegatum</i>	Giraffe	Africa	NY	(NPC 18419)
<i>A. variegatum</i>	Zebra	Kenya	NY	(NPC 58702, 59248)
<i>A. variegatum</i>	Human	Africa	PA	(RML 109065)
<i>A. variegatum</i>	Human	Kenya	NY	(RML 122300)
<i>A. variegatum</i>	Human	Tanzania	AZ	(RML 123111)
<i>A. varium</i> Koch	Sloth	Unknown	CA	USDA (1967)
<i>A. varium</i>	2-toed sloth	Peru	IL	USDA (1972, 1973a, b)
<i>Anocentor</i>				
<i>A. nitens</i>	Donkey	Haiti	MD	Becklund (1968), (NPC 28928, 44880)
<i>A. nitens</i>	Deer	Honduras	LA	Becklund (1968)
<i>A. nitens</i>	Ocelot	Ecuador	CA	Becklund (1968), (NPC 57842)
<i>A. nitens</i>	Horse	Cuba	FL	(NPC 56573, 56900, 56903)
<i>A. nitens</i>	Horse	Guatemala	FL	(NPC 57289)
<i>A. nitens</i>	Horse	Venezuela	TX	(NPC 58072, 58750)
<i>A. nitens</i>	Horse	Jamaica	FL	(NPC 58732, 60364)
<i>A. nitens</i>	Horse	Colombia	FL	(NPC 59473)
<i>A. nitens</i>	Horse	Puerto Rico	TX	(RML 59701)
<i>Aponomma</i>				
<i>A. concolor</i> Neumann	Anteater	Unknown	IL	USDA (1974b)
<i>A. crassipes</i> Neumann	Lizard	Unknown	FL	(RML 122475)
<i>A. exornatum</i> (Koch)	Lizard	Unknown	CA	USDA (1969)
<i>A. exornatum</i>	Mamba and cobra	Unknown	MD	USDA (1970)
<i>A. exornatum</i>	Lizard	Unknown	NY	USDA (1975)
<i>A. exornatum</i>	Lizard	Unknown	NE	USDA (1994)
<i>A. exornatum</i>	Reptiles	Unknown	FL	Clark & Doten (1995)
<i>A. exornatum</i>	Lizards	Unknown	FL	Burridge et al. (2000)
<i>A. flavomaculatum</i> (Lucas)	Ball pythons	Ghana	NY	Kim et al. (1978)
<i>A. flavomaculatum</i>	Lizard	Ghana	GA	Wilson and Barnard (1985)
<i>A. flavomaculatum</i>	Lizards	Unknown	FL	USDA (1994)
<i>A. flavomaculatum</i>	Reptiles	Unknown	FL	Clark & Doten (1995)
<i>A. flavomaculatum</i>	Unknown	Unknown	OH	Anonymous (1996)
<i>A. flavomaculatum</i>	Lizards and pythons	Unknown	FL	Burridge et al. (2000)
<i>A. flavomaculatum</i>	Ball pythons	Togo	NY	(RML 119243)
<i>A. flavomaculatum</i>	Lizard	Togo	NY	(RML 119217, 119220, 119222, 119225-119228, 119231, 119233, 119234)
<i>A. flavomaculatum</i>	Lizard	¶Nigeria	OH	(RML 121053)
<i>A. fuscolineatum</i> (Lucas)	Python	Unknown	NY	Kaufman (1972)
<i>A. fuscolineatum</i>	Reptiles	Unknown	FL	Clark and Doten (1995)
<i>A. hydrosauri</i> (Denny)	Echidna	Unknown	IL	(RML 31463)
<i>A. komodoense</i> Oudemans	Komodo dragon	Indonesia	DC	(RML 119207-119208)
<i>A. latum</i>	Mamba	Unknown	MD	USDA (1970)
<i>A. latum</i>	Snake	Unknown	AZ	USDA (1974b)
<i>A. latum</i>	Cobra & boa	Unknown	FL	USDA (1977b)
<i>A. latum</i>	Ball pythons	Ghana	NY	Kim et al. (1978)
<i>A. latum</i>	Boa	Unknown	FL	USDA (1980)
<i>A. latum</i>	Snake	Unknown	IL	USDA (1980)
<i>A. latum</i>	Snake	Unknown	FL	USDA (1982)
<i>A. latum</i>	Python	W. Africa	CT	Anderson et al. (1984),

Table 1. Continued.

Tick species	Host/item	Origin	Destination	Reference
<i>A. latum</i>	Python	Unknown	MS	USDA (1987b)
<i>A. latum</i>	Ball python	Ghana	CA-AL ^f	Hammond & Dorsett (1988)
<i>A. latum</i>	Boa	Unknown	MD	USDA (1988) (as <i>Amblyomma latum</i>)
<i>A. latum</i>	Python	Africa	MD	Robbins (1990)
<i>A. latum</i>	Reptiles	Unknown	FL	Clark & Doten (1995)
<i>A. latum</i>	Snakes, lizard, tortoise	Unknown	FL	Burridge et al. (2000)
<i>A. latum</i>	Snake	Tanzania	CA	(NPC 57231)
<i>A. latum</i>	Ball python	W. Africa	MD	(RML 46128)
<i>A. latum</i>	Ball python	Unknown	KY	(RML 46141)
<i>A. latum</i>	Ball pythons	W. Africa	GA	(RML 118974, 118975)
<i>A. latum</i>	Ball python	Unknown	IN	(RML 119105)
<i>A. latum</i>	Ball pythons	Togo	NY	(RML 119191-119195, 121182)
<i>A. latum</i>	Snake	Unknown	PA	(RML 119723)
<i>A. latum</i>	Ball python	Unknown	NH	(RML 119805)
<i>A. latum</i>	Ball python	Unknown	IL	(RML 119500, 119501)
<i>A. latum</i>	Ball python	Unknown	TN	(RML 120816)
<i>A. latum</i>	Ball python	Africa	FL	(RML 120858)
<i>A. latum</i>	Python	Unknown	SC	(RML 120941)
<i>A. latum</i>	Ball pythons	?Nigeria	OH	(RML 121054, 121255, 121288, 121579-121581, 121583-121585)
<i>A. latum</i>	Ball python	W. Africa	KS	(RML 122875)
<i>A. transversale</i> (Lucas)	Python	Unknown	MA	Kaufman (1972)
<i>A. transversale</i>	Python	Togo	NY	(RML 119206)
<i>A. transversale</i>	Python	Unknown	TX	(RML 119974)
<i>A. transversale</i>	Ball python	?Nigeria	OH	(RML 121579)
<i>A. trimaculatum</i> (Lucas)	Lizard	Unknown	NM	USDA (1994)
<i>A. varanensis</i> (Supino)	Python	Unknown	CA	USDA (1981) (as <i>A. lucasi</i> Warburton)
<i>A. varanensis</i>	Python, lizard	Unknown	FL	Burridge et al. (2000)
<i>A. varanensis</i>	Cobra	Thailand	CA	(RML 25757)
<i>A. varanensis</i>	Python	Sumatra	FL	(RML 120804, 120805)
<i>A. varanensis</i>	Lizard	New Guinea	FL	(RML 121557)
<i>A. varanensis</i>	Lizard	Indonesia	FL	(RML 121802)
<i>Aponomma</i> sp.	Human	S. Africa	USA	Barrett-Connor and Ginsberg (1983)
<i>Boophilus</i>				
<i>B. decoloratus</i>	Giraffe, hartebeest	Africa	NY	USDA (1966), Becklund (1968)
<i>B. decoloratus</i>	Impala	Africa	NY	Becklund (1968)
<i>B. decoloratus</i>	Trophy hide	Unknown	CO	USDA (1973a)
<i>B. decoloratus</i>	Zebra	Unknown	NY	USDA (1974b, 1975, 1977b)
<i>B. decoloratus</i>	Trophy hide	Unknown	MS	USDA (1987a)
<i>Dermacentor</i>				
<i>D. auratus</i> Supino	Plant material	Unknown	IL	USDA (1987b)
<i>D. auratus</i>	Human	Nepal	AZ	(RML 119023)
<i>D. auratus</i>	Human	Nepal	ME	(RML 122175)
<i>D. nuttalli</i> Olenev	Trophy hide	Unknown	IL	USDA (1983)
<i>D. reticulatus</i>	Hedgehog	France	NY	McIntosh (1963), Becklund (1968) (NPC 56071)
<i>D. reticulatus</i>	Unknown	Unknown	USA	Becklund (1969)
<i>D. reticulatus</i>	White rhino	Unknown	VA	USDA (1974b)
<i>D. reticulatus</i>	Horse	France	NY	USDA (1987a)
<i>D. rhinoceros</i> Denny	Rhinoceros	Unknown	FL	USDA (1970)
<i>Haemaphysalis</i>				
<i>H. elongata</i> Neumann	Tenrec	Madagascar	OH	(RML 120596)
<i>H. hoodi</i> Warburton	African grey parrot	Unknown	NY	USDA (1985b)
<i>H. juxtakochi</i> Cooley	Palm frond	Unknown	LA	USDA (1985b)
<i>H. juxtakochi</i>	Deer	Unknown	OH	Keirans and Restifo (1993)
<i>H. leachi</i> (incl. <i>leachi</i> group)	Lion	Unknown	TX	USDA (1966)
<i>H. leachi</i> (incl. <i>leachi</i> group)	Unknown	Unknown	USA	Hourigan (1977)
<i>H. leachi</i> (incl. <i>leachi</i> group)	Hedgehog	Unknown	NY	USDA (1977a)
<i>H. leachi</i> (incl. <i>leachi</i> group)	Dog	S. Africa	CT	Anderson et al. (1984), (RML 116873)

Table I. Continued.

Tick species	Host/item	Origin	Destination	Reference
<i>H. leachi</i> (incl. <i>leachi</i> group)	Jackal	S. Africa	MO	(RML 121742)
<i>H. leachi</i> (incl. <i>leachi</i> group)	Cat	Zimbabwe	HI	(RML 121759)
<i>H. longicornis</i> Neumann or <i>H. bispinosa</i> Neumann	Household goods	Unknown	CA	USDA (1983)
<i>H. longicornis</i> Neumann or <i>H. bispinosa</i> Neumann	Horse	Unknown	CA	USDA (1985a)
<i>H. muhsamae</i> Dias	Hedgehog	Kenya	NY	Becklund (1968, 1969) (NPC 57582) (as <i>H. leachi muhsami</i>)
<i>H. muhsamae</i>	Fox	Unknown	NY	USDA (1967) (as <i>H. leachi muhsami</i>)
<i>H. punctata</i>	Ostrich	Portugal	USA	Mertins and Schlater (1991)
<i>H. wellingtoni</i> Nuttall & Warburton	Pheasant	Thailand	HI	USDA (1965), Joyce (1965), Garrett and Haramoto (1967), Goff (1987)
<i>Hyalomma</i>				
<i>H. aegyptium</i>	Tortoise	Unknown	FL	USDA (1971)
<i>H. aegyptium</i>	Unknown	Unknown	USA	Hourrigan (1977)
<i>H. aegyptium</i>	Tortoise	Unknown	NY	USDA (1977a)
<i>H. aegyptium</i>	Reptiles	Unknown	FL	Clark and Doten (1995)
<i>H. aegyptium</i>	Tortoise	N. Africa	NC	(RML 120785)
<i>H. albiparmatum</i> Schulze	Rhinoceros	Unknown	TX	Becklund (1968, 1969)
<i>H. albiparmatum</i>	Giraffe	Unknown	NY	Becklund (1968, 1969) (NPC 56298)
<i>H. albiparmatum</i>	Zebra	Unknown	NY	USDA (1977b)
<i>H. albiparmatum</i>	Ostrich	Unknown	USA	Mertins and Schlater (1991)
<i>H. albiparmatum</i>	Ostrich	Unknown	TX	USDA (1994), (RML 119784)
<i>H. anatolicum</i> Koch	Horses	Jordan	NY	Becklund (1968, 1969) (NPC 59273)
<i>H. anatolicum</i>	Onager	Iran	NY	Becklund (1968, 1969) (NPC 57564)
<i>H. dromedarii</i> Koch	Camel	Unknown	NY	McIntosh (1963), Becklund (1968)
<i>H. dromedarii</i>	Zebra	Unknown	NY	USDA (1973a)
<i>H. impeltatum</i> Schulze or <i>H. truncatum</i> Koch	Ostrich	Unknown	USA	Mertins and Schlater (1991) (RML 119785)
<i>H. impressum</i> Koch	Rhino hide	Unknown	ME	USDA (1985b)
<i>H. lusitanicum</i> Koch	Ostrich	Portugal	USA	Mertins and Schlater (1991)
<i>H. marginatum</i> Koch	Horse	Spain	NY	USDA (1967), Becklund (1968)
<i>H. marginatum</i>	Unknown	Unknown	USA	Becklund (1969)
<i>H. marginatum</i>	Human	Greece	USA	(RML 120838)
<i>H. rufipes</i> Koch	Zebra	Germany	NY	McIntosh (1963), Becklund (1968) (NPC 56087)
<i>H. rufipes</i>	Oryx	Namibia	NY	McIntosh (1963), Becklund (1968)
<i>H. rufipes</i>	Trophy hide	Unknown	CA	USDA (1981)
<i>H. rufipes</i>	Ostrich	Botswana	USA	Mertins and Schlater (1991)
<i>H. truncatum</i>	Zebra	Germany	NY	McIntosh (1963) (NPC 56088)
<i>H. truncatum</i>	Trophy hide	Unknown	CO	USDA (1974b)
<i>H. truncatum</i>	Rhinoceros	Unknown	NC	USDA (1975)
<i>H. truncatum</i>	Trophy hide	Unknown	CA	USDA (1981)
<i>H. truncatum</i>	Trophy hide	Africa	MS	USDA (1987a)
<i>H. truncatum</i>	Trophy hide	Unknown	AZ	USDA (1988)
<i>H. truncatum</i>	Ostrich	Angola	USA	Mertins and Schlater (1991)
<i>Hyalomma</i> sp.	Sunbird	Unknown	FL	USDA (1975)
<i>Hyalomma</i> sp.	Ostrich	Unknown	TX	USDA (1989b, 1994)
<i>Ixodes</i>				
<i>I. hexagonus</i>	Hedgehog	France, UK	NY	McIntosh (1963), Becklund (1968) (NPC 56069, 56072, 57562, 59235, 59274, 59454, 59499)

Table 1. Continued.

Tick species	Host/item	Origin	Destination	Reference
<i>I. hexagonus</i>	Load of cork	Portugal	MD	USDA (1987a)
<i>I. luciae</i> Senevet	Bananas	Mexico	TX	Eads et al. (1966)
<i>I. pilosus</i> Koch	Plant material	S. Africa	NY	USDA (1985a, b, 1987a)
<i>I. ricinus</i>	Dog	Germany	HI	Joyce (1962), Garrett and Haramoto (1967)
<i>I. ricinus</i>	Lizard	Unknown	PA	Snetzinger (1968)
<i>I. ricinus</i>	Horse	Germany	NY	Becklund (1968) (NPC 58068)
<i>I. ricinus</i>	Donkey	Unknown	NY	USDA (1974b)
<i>I. ricinus</i>	Human	England	CA	(RML 121575)
<i>I. ricinus</i>	Dog	Germany	HI	(RML 121589)
<i>I. ricinus</i>	Horse	Switzerland	CA	(RML 122412)
<i>I. schillingsi</i> Neumann	Hyrax	Unknown	IL	USDA (1968)
<i>Rhipicephalus</i>				
<i>R. appendiculatus</i>	Zebra	Unknown	NY	USDA (1967)
<i>R. appendiculatus</i>	Unknown	Unknown	SC	USDA (1968)
<i>R. appendiculatus</i>	Trophy hide	Unknown	CO	USDA (1973a, 1974b, 1975)
<i>R. appendiculatus</i>	Trophy hide	Unknown	MS	USDA (1987b)
<i>R. bursa</i> Canestrini & Fanzago	Horse or goat	Italy	NY	USDA (1967), Becklund (1968) (NPC 59425)
<i>R. capensis</i> Koch	Flowers	S. Africa	NY	USDA (1987a)
<i>R. compositus</i> Neumann	Plant material	Unknown	NY	USDA (1985a)
<i>R. e. evertsi</i>	Wild animals	Africa	FL	USDA (1960), Bruce (1962), USDA (1962, 1974a, b), Diamant and Strickland (1965), Strickland et al. (1976), (RML 37232)
<i>R. e. evertsi</i>	Eland	Unknown	NY	USDA (1966)
<i>R. e. evertsi</i>	Eland & zebra	Unknown	NY	USDA (1967)
<i>R. e. evertsi</i>	Zebra	Unknown	NY	USDA (1971, 1977a, 1977b, 1985a)
<i>R. e. evertsi</i>	Zebra & trophy hide	Unknown	CO	USDA (1973a)
<i>R. e. evertsi</i>	Zebra	Africa	NY	USDA (1973b)
<i>R. e. evertsi</i>	Gnu & zebra	Unknown	NY	USDA (1975)
<i>R. e. evertsi</i>	Zebra hide	Unknown	NC	USDA (1982)
<i>R. e. evertsi</i>	Rhino hide	Unknown	ME	USDA (1985b)
<i>R. e. evertsi</i>	Trophy hide	Unknown	AZ	USDA (1988)
<i>R. e. evertsi</i>	Zebra	Germany	USA	(NPC 56089, 56090)
<i>R. e. evertsi</i>	Zebra	Kenya	NJ	(NPC 56094, 57007)
<i>R. e. evertsi</i>	Zebra	Kenya	FL	(NPC 57007, 57020)
<i>R. e. evertsi</i>	Zebra	Africa	FL	(NPC 57013, 57024, 57029)
<i>R. e. evertsi</i>	Zebra	Kenya	NY	(NPC 58701, 59250, 59254, 59741)
<i>R. e. evertsi</i>	Zebra	Tanzania	NY	(NPC 58978)
<i>R. e. evertsi</i>	Zebra	Namibia	NY	(NPC 58999)
<i>R. e. evertsi</i>	Zebra	Germany	NY	(NPC 59203, 59472)
<i>R. e. evertsi</i>	Eland	Africa	FL	(NPC 56285, 56286, 56990, 57006, 57023)
<i>R. e. evertsi</i>	Nilgai	Africa	FL	(NPC 56287, 57026)
<i>R. e. evertsi</i>	Oryx	Germany	OH	(NPC 56294)
<i>R. e. evertsi</i>	Camel	Africa	FL	(NPC 56991, 57000, 57017)
<i>R. e. evertsi</i>	Abyssinian asses	Africa	FL	(NPC 56995, 57018)
<i>R. e. evertsi</i>	Zebra × horse	Africa	FL	(NPC 57025)
<i>R. e. evertsi</i>	Hartebeest	Germany	NY	(NPC 59239)
<i>R. e. evertsi</i>	Antelope	Namibia	NY	(NPC 59460)
<i>R. e. evertsi</i>	Gemsbok	Namibia	NY	(NPC 59470)
<i>R. evertsi mimeticus</i> Dönitz	Giraffe & eland	Unknown	NY	USDA (1967)
<i>R. evertsi mimeticus</i>	Zebra	Namibia	NY	USDA (1973a, b)
<i>R. evertsi mimeticus</i>	Gnu	Unknown	NY	USDA (1975)
<i>R. evertsi mimeticus</i>	Zebra	Unknown	NY	USDA (1985a)
<i>R. evertsi mimeticus</i>	Zebra	Germany	USA	(NPC 56089)
<i>R. kochi</i> Dönitz	Flowers	Unknown	NY	USDA (1985b)
<i>R. muehlensii</i> Zumpt	Bushbuck	Unknown	CA	USDA (1971)
<i>R. pulchellus</i> Gerstäcker	Giraffe	Unknown	NY	McIntosh (1963)
<i>R. pulchellus</i>	Zebra	Kenya	FL	Becklund (1968) (NPC 57019, 57028)

Table 1. Continued.

Tick species	Host/item	Origin	Destination	Reference
<i>R. pulchellus</i>	Zebra	Kenya	NY	USDA (1967), Becklund (1968) (NPC 57008, 58700, 58710, 59249, 59253)
<i>R. pulchellus</i>	Zebra	Unknown	NY	USDA (1971, 1973a, b, 1975, 1977b)
<i>R. pulchellus</i>	Elephant shrew	Unknown	IL	USDA (1973a)
<i>R. pulchellus</i>	Rhinoceros	Unknown	NC	USDA (1975)
<i>R. pulchellus</i>	Zebra & others	Unknown	NY	Strickland et al. (1976)
<i>R. pulchellus</i>	Zebra	Africa	MD	(NPC 14755)
<i>R. pulchellus</i>	Giraffe	Unknown	NJ	(NPC 56245)
<i>R. pulchellus</i>	Eland	E. Africa	PA	(NPC 15578)
<i>R. pulchellus</i>	Zebra	Germany	USA	(NPC 56091)
<i>R. pulchellus</i>	Zebra	Tanzania	NY	(NPC 58977)
<i>R. pulchellus</i>	Rhinoceros	E. Africa	MI	(NPC 59331)
<i>R. pulchellus</i>	Human	Kenya	MI	(RML 120026)
<i>R. simus</i> Koch	Rhinoceros	E. Africa ^e	MI	Becklund (1968) (NPC 59330)
<i>R. simus</i>	Human	Kenya ^e	CT	Anderson et al. (1981a)
<i>R. simus</i>	Wart hog	Unknown	MS	USDA (1985a)
<i>R. simus</i>	Jackal	S. Africa	MO	(RML 121742)
<i>R. sulcatus</i> Neumann	Hedgehog	Unknown	NY	USDA (1974b)
<i>R. turanicus</i> Pomerantsev	Ostrich	Tanzania	USA	Mertins and Schlater (1991)

^a We have followed the information as presented by the author(s) throughout. If no origin for an imported tick species is provided, the word "unknown" is given, even though a distribution in sub-Saharan Africa could be inserted for *Ornithodoros moubata* and several other species.

^b Perhaps *Ornithodoros apertus*.

^c Where there is a "," (comma) between one state and another, it signifies that the host and tick were found in both states.

^d Although NY is used throughout this table for the state of New York, some of these exotic ticks were collected at the port of entry at Clifton, NJ. The USDA used NY for both localities in some of their publications.

^e In addition to the term "trophy hide," the term "animal hide" has also been used. We have used "trophy hide" throughout.

^f Where there is a "-" (dash) between one state and another, it signifies that the host and tick were introduced into one state and then shipped to another.

^g Since the publication by Pegram et al. (1987), these collections are quite likely to be classified as *Rhipicephalus praetextatus* Gerstäcker.

a port of entry into the United States on a shipment of bird guano from Peru.

Ornithodoros rudis Karsch was found on an inanimate object in Missouri (USDA 1972), and was also intercepted at Miami on plant material (USDA 1975).

At some time in the past, *Argas persicus* (Oken) was imported into the United States, probably on chickens, and the U.S. National Tick Collection has valid records of this species from California, Maryland, North Carolina, Pennsylvania, Virginia, and Texas. As can be seen from this short list of states, *A. persicus* is spottily distributed with most collection records from Maryland and Pennsylvania.

Becklund (1968) cited three imports of *Otobius megnini* into the United States—(1) cattle from Mexico to Texas, (2) horses from Peru and Venezuela to Florida and (3) various wild animals from Namibia to New York. The USDA (1973b) also cited instances of *O. megnini* originating on a horse in Peru being collected at Miami, FL, on a stray bovine from Mexico collected in California, and on a horse imported into Texas probably from Mexico. USDA (1974b) recorded *O. megnini* on an imported zebra intercepted at San Ysidro, CA, and USDA (1975) recorded *O. megnini* on gemsbok, bontebok, hartebeest, blesbok and greater kudu collected at Clifton, NJ. Although the presence

Ixodidae

By far, species of the genus *Amblyomma* are the ticks that are most often imported into the United States. This is a genus found primarily in the warmer areas of the world, and they are ectoparasitic on amphibians, reptiles, birds and mammals. Because they are commonly found on animals imported from Africa for zoos and game parks, and on reptiles imported from Asia, Africa and the Neotropics, this genus is well represented by the richness of species coming across the borders of the United States.

Fifteen of the 43 listed species of *Amblyomma* are reptile parasites (Table 1), although two of those, *A. nuttalli* Dönitz and *A. sparsum* Neumann, can be found on both reptiles and mammals in their areas of normal distribution in Africa. The last named species is most often found on the African buffalo, black rhinoceros or various reptile species, and is a known vector of the agent of heartwater disease in ruminants (Walker and Olwage 1987). Seven other known vectors of *Cowdria ruminantium* found on animals imported into the United States (Table 1) are *Amblyomma gemma* Dönitz, *A. hebraeum* Koch, *A. lepidum* Dönitz, *A. marmoreum* Koch, *A. pomposum* Dönitz, *A. tholloni* Neumann, and *A. variegatum*.

The monotypic genus (Burridge 2001), *Anocentor*

(1968) cited records of its importation into the United States from Haiti, Honduras, and Ecuador.

The genus *Aponomma* consists of ≈ 24 species with only *Aponomma elaphense* Price occurring in the Western Hemisphere. Most species are parasitic on snakes or varanid lizards, and, thus, are regularly imported into the United States on reptile shipments primarily from Africa but also from other areas of the world to supply zoos and pet stores with exotic reptiles for the enjoyment and sale to the public. In fact, probably the most commonly imported tick into the United States is *Aponomma latum* (Koch) (Table 1). Examination of ball pythons, *Python regius* (Shaw), at almost any store selling reptiles would very likely yield collections of this tick species. Burrige (2001) reviewed introductions of four species of *Aponomma* into Florida.

Species of *Boophilus* are all economically important one-host ticks parasitic on man's domesticated livestock, primarily cattle, sheep and goats. *Boophilus decoloratus* (Koch), commonly known as the blue tick, is widely distributed in the Afrotropical region where heavy infestations can be found on cattle and horses, and on such wild animals as zebra, wildebeest and giraffe.

Most species of the genus *Dermacentor*, and all species of *Hemaphysalis* and *Ixodes* are three-host ticks, and some species within all three genera are of medical/veterinary importance. Species such as *D. reticulatus* (F.), *H. leachi* (Audouin) and *H. punctata* Canestrini, and *I. hexagonus* Leach and *I. ricinus* (L.) could all become established in the United States, and some would be potential vector species of great importance. Luckily, relatively few species of these three genera have been found on imported hosts.

The genus *Hyalomma* is found from Africa and southern Europe eastward to the Indian subcontinent and southeast Asia. They are large ticks that may be the reason that there are not many records of this genus recorded on imports. For example, *Hyalomma aegyptium* (L.) is a common parasite of tortoises, so common in fact that it was one of the three tick species described by Linnaeus. However, because it is so large and easily seen, its size may account for the fact that there are only five records of this tick finding its way into the United States.

Rhipicephalus is the fourth largest ixodid genus with 74 species and two subspecies. Most species occur in Africa (Walker et al. 2000), but *R. sanguineus* (Latreille), the brown dog tick, is probably the most widely distributed tick in the world, and at some time in the past was imported into the United States. It can now be found in all 50 states.

In 1960, *Rhipicephalus e. evertsi* Neumann, the most widespread rhipicephaline in the Afrotropical region, was found in both Florida and New York game parks, and touched off an extensive eradication campaign. Although *R. e. evertsi* is not an important vector of *Theileria parva* (Theiler), the agent of East Coast Fever, it is an important vector of *Theileria separata* (Uilenberg & Andreasen), *Babesia caballi* (Nuttall),

important disease-causing pathogens of domestic livestock. Bruce (1962) discussed the eradication of this tick from the Florida game compound.

As economically important as *Rhipicephalus evertsi* is, the records of *R. appendiculatus* Neumann are even more disturbing, for, as Walker et al. (2000) pointed out, *R. appendiculatus* is undoubtedly the most economically important tick of the genus *Rhipicephalus* in Africa. It, along with several other rhipicephalines listed in Table 1, could thrive in most areas of the United States.

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