United States Department of Agriculture

Animal and Plant Health Inspection Service

Veterinary Services

APHIS 91-39
July 1981

National Tick Surveillance Program
Calendar Year 1979

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Calendar Year 1979

During calendar year 1979, the collection and submission of ticks from native and imported animals and plant and animal material was 5.6 percent less than in 1978. There were 11,553 collections in 1979, compared with 12,242 collections in 1978 and 4,142 collections in 1977.

The Harry S Truman Animal Import Center Begins Operation

Almost 10 years after Federal legislation was signed authorizing the establishing of an isolated animal import station to allow the entry of breeding animals into the United States from countries where foot-and-mouth disease and rinderpest exist, the first shipment of 60 Zebu cattle was received on February 8, 1980. The shipment arrived by air from Brazil at the Boca Chica Naval Air Station.

The Harry S Truman Animal Import Center is located on Fleming Key, an island connected to Key West, Florida, by a short bridge. This location was selected as the site of the quarantine facility because it fulfilled the exacting requirements necessary for such a facility. High security, isolation from other animals, and logistical considerations were of prime importance in the selection of this site.

High security is required in order to limit access of unauthorized personnel onto the facility. This is readily accomplished by the fact that the import center is located within a U.S. Department of Defense facility which is a restricted area surrounded by a chain-link fence as well as other security features. Isolation from other animals is assured since there are no domestic or wild swine or ruminants on Fleming Key. The island is 60 air miles from the mainland and serviced by a single road which can be readily monitored.

Air transportation is provided by the commercial airlines which service the Key West Area. Ocean-going vessels carrying livestock, with special permission, are allowed to use the U.S. Navy's piers in Key West. Livestock arriving by air may use the nearby Boca Chica Naval Air Station.

The import center, which at present is only accepting cattle, has the capacity for 400 imported cattle as well as 100 test cattle and 100 test swine. All import animals are kept in isolation for 5 months during which time they are thoroughly tested and observed to assure they are free of disease. Two groups of 400 cattle can be handled each year. If any animal in the import center is affected with foot-and-mouth disease or rinderpest, then the entire group of import animals is refused entry into the United States.

Pre-entry procedures require that all animals are carefully screened and tested in the country of origin to assure that they meet the USDA standards of health before they are allowed in the animal import center. In addition to conducting a battery of sophisticated tests for viral, bacterial, and protozoal agents, all the animals are carefully inspected and treated to insure they are free of ticks, mites, and other external parasites. This thorough health study of the import animals as individuals and as a group is necessary to protect the U.S. livestock industry against the introduction of exotic diseases such as foot-and-mouth, rinderpest, and trypanosomiasis.

The Boophilus Microplus Eradication Program in Puerto Rico

Tick eradication efforts are currently in progress against *Boophilus microplus* in Puerto Rico. Surveillance activities and treatment operations are being conducted to detect and rid the island of this serious threat to the local beef and dairy industries. During calendar year 1979, there were 1,979 collections made from domesticated animals on the island. These included 1,947 collections identified from cattle, 22 from horses, 2 from dogs, 5 from goats, 2 from swine, and 1 from sheep.

The Status of Amblyomma Variegatum in Puerto Rico

The National Veterinary Services Laboratories (NVSL) identified only 4 collections of the tropical bont tick in 1979 as compared to 47 collections in 1978, 54 in 1977, and 26 in 1976. In the past, the collections have been principally from the municipalities of Cayey, Cidra, and Caguas. The collections identified in 1979 were from the municipalities of Cidra, Comerio, San German, and Rio Piedras.

The Boophilus Program in Texas

The overall Texas *Boophilus* situation continued to look good during calendar year 1979. As expected, there were the usual apprehensions of livestock which had strayed from Mexico into the buffer zone on the Texas side of the Rio Grande. A small problem area still exists in northern Webb County where there has been a spillover of *B. annulatus* from the normal cattle host onto white-tail deer.

The *Boophilus* tick identification from Texas made at the NVSL totaled 135 collections for calendar year 1979. This is appreciably higher than the 69 *Boophilus* collections made in 1978, and 66 *Boophilus* collections made in 1977. However, it should be pointed out that 72 of the 1979 calendar year collections were from deer and 1 from a coyote as the result of an intensive wildlife/tick survey conducted in the problem area of northern Webb County. During calendar year 1979, there were 62 *Boophilus* collections submitted from cattle in Texas, and the majority of the submissions involved cattle on a single premise in the problem area of nothern Webb County and do not represent new premise infestations.

Factors Affecting the Boophilus Tick Eradication Program

The *Boophilus* tick eradication program has as its goal the elimination of all *Boophilus* ticks in the United States and preventing their reintroduction. The two species of ticks of the genus *Boophilus* that are occasionally introduced into the United States are *Boophilus annulatus*, the cattle fever tick, and *Boophilus microplus*, the tropical cattle tick. Although closely related, sufficient biological and genetic differences exist between the two tick species so that they are not normally found in the same area.

The primary purpose of the *Boophilus* tick eradication program is to avert the economic disaster these two ticks are capable of causing. Both *B. annulatus* and *B. microplus* transmit *Babesia bigemina* and *B. bovis*, the causative agents of bovine babesiosis (cattle tick fever, Texas fever). Of no less importance is bovine anaplasmosis, a disease produced by Anaplasma marginale also transmitted by Boophilus ticks.

In order to free southern United States cattle of bovine babesiosis, the Boophilus tick eradication program was started in 1906. The tick vector was the most logical link to attack in the disease chain. Following the elimination of the Boophilus ticks, the Babesia soon died out because the other species of ticks were incapable of transmitting the disease agents. The livestock industry benefited by being free of both Boophilus ticks and babesiosis.

Even when not transmitting disease agents, Boophilus ticks are of economic importance for the following reasons:

1. They produce damage to the hide which reduces its commercial value.

2. They cause "tick worry", which reduces the efficiency of the living animal, resulting in lowered milk production and reduced weight gains.

3. They suck blood which results in anemia and occasionally death.

4. Tick bites serve as portals of entry for secondary disease agents, and/or as sites for screwworm infestations.

Tick epidemiology, the study of the various relationships between ticks, their hosts, and the environment is of tremendous importance to the eradication program. Environmental factors such as variations in seasonal weather may play a very important role in the yearly cycles of ticks. Temperature and humidity affect the incubation period of eggs and survival of larvae. People working in the Boophilus eradication program must be constantly aware of the changing ecological conditions in the environment. Ideal weather conditions may decrease natural mortality and allow the ticks to "overproduce". This increased tick population can result in the infestation of new hosts such as deer, which are not normally parasitized by Boophilus ticks. The "spillover" to a new host is rare in occurence. Such a "spillover" has taken place with Boophilus annulatus and white-tailed deer in northern Webb County, Texas.

Adverse weather conditions that cause a reduction in the survival of the tick larvae will help the eradication program only if we are aware that the ticks are present in an area and take appropriate action. Low populations of Boophilus ticks may not be detected for long periods of time. Failure to detect ticks can result in their spread to new land areas and new infestations not included within the active surveillance program.

Ecological disturbances by humans can also affect the distribution of Boophilus ticks. Land areas previously poorly suited for ticks often become a more suitable habitat for ticks if scrub and brush are replaced by grassland pasture. The introduction of predators, such as the fire ant, often influence the incidence and distribution of tick populations. Ecological changes may increase or decrease the host population, which in turn will affect the survival of the tick. Such ecological changes occured in southern Texas with the introduction of buffel grass and the implementation of the screwworm eradication program. These two changes resulted in greater populations of cattle and deer, as well improved tick habitat. Because of these changes, tick survival was enhanced.

The normal hosts for B. annulatus in the United States are cattle, horses, and occasionally sheep and goats. Boophilus microplus infests cattle, horses, goats, sheep and occasionally deer. Humans can influence the choice of hosts. Exotic animals which may be normal hosts for Boophilus ticks in their native country are sometimes introduced into the United States. This occurred with the introduction of nilgai, an antelope-like game animal, into the endemic tick area of south Texas.

Animals that do not normally associate, or do so only under special conditions, may be forced into sharing land area so that they become a common group composed of several species of animals. In such situations, surveillance programs must be developed to include all species which may be a threat to the tick eradication program. Recognition of changing epidemiologic factors must lead to the development of new surveillance methods and policies. The program must remain flexible and receptive to new concepts if total eradication is to be acheived and maintained.

Dipping Vat Management, Resistance, and Tick Eradication

The objective of dipping livestock is to kill parasites, normally external parasites, without causing harm or death to the animal being dipped. Dipping is generally considered the most convenient, efficient, and economical method of killing ticks on large numbers of cattle.

Dipping vats provide an efficient method of pesticide application in that the pesticide is confined which eliminates the problem of drifting sprays and exposes only the target animal to the pesticide. A drain pen functions as a recovery unit which returns excess dip carried out by the animal to the vat, thus protecting the environment and reducing the cost through better chemical utilization.

It is very important to use approved pesticides at the recommended concentration. Lethal concentration percentage (LC percent) have been established for each pesticide used in the official USDA tick eradication program. The minimum acceptable concentration of pesticide should be at least the LC_{99}. The LC_{99} is a mathematical estimate based on trials performed under controlled laboratory conditions in which 99 percent of the target species is killed. Years of field experience have documented the need to establish program pesticides that are above the LC_{99}. This extra pesticide concentration may be termed the "eradication factor". It is important to use pesticides at greater than the LC_{99} in order to avoid the development of resistance. "Chemicals have been valueless following the development of resistance."[1] There appears to be

[1] Nolan, James and Roulston, W. J., Acaricide Resistance as a Factor in the Management of Acari of Medical and Veterinary Importance, IN: Recent Advances in Acarology, Volume II, Edited by J. G. Rodriguez, Academic Press, New York, San Francisco, London, 1979, p. 12.

two classical approaches to the use of pesticides.

1. Attempting to overcome the development of tick pesticide resistance, as many countries of the world are doing.

2. Preventing the development of tick pesticide resistance as the United States Boophilus eradication program has done. Relative to resistance, pesticides used to treat livestock parasites must be considered as "a non-renewable resource".

Good dipping vat management is based on sound, technical knowledge of the pesticide being used, along with understanding the biology of the tick. Guidelines for dipping vat management should be established on the basis of well-designed field and laboratory studies.

Vat management must be concerned with the safe, efficient, economic use, and handling of pesticides from the time the program receives the pesticide until its final utilization and disposal. Disposal must include proper disposition of the pesticide, original pesticide containers, as well as other contaminated equipment or materials.

The dipping vat manager must follow specific directions. There is no excuse for failure in tick control or eradication because of pesticide mismanagement. Pesticide use is controlled by State and Federal regulations and laws. Environmental Protection Agency requirements must be considered since non-compliance may result in the banning of certain pesticides which might have critical consequences for the future of the tick eradication program.

Accuracy is a most important part of good vat management and encompasses all activities relating to the vat including:

1. Determining the vat capacity.

2. Charging the vat, which includes filling with water, premixing of the pesticide, and agitation of the charged vat.

3. Sampling of the dip for quantitative analysis and sedimentation.

4. Replenishing with water and/or pesticides.

5. Maintaining accurate dipping vat records.

When dipping vat activities are performed according to available directions, many dipping vat problems are eliminated. There would be no livestock deaths due to "over-charged" vats, nor would cattle be dipped in pesticides below the prescribed concentrations for killing ticks if official guidelines were followed.

Vat agitation is the most misunderstood and improperly utilized activity in vat management. Field experience indicates that vats are generally charged correctly; however, absence of a vat-side test for the organophosphorus and organochlorine pesticides has placed added responsibility on the people dipping livestock. Today, the laboratory conducted quantatitive analysis provides after-the-fact information; whereas the vat-side test used in the past with the arsenic dip, provided immediate concentration information before the animals were dipped.

Manual dipping vat agitation is strenous work. Air agitation assists in mixing the dip, but no device replaces the bottom scraping of the vat to resuspend the sediment. Sufficient time must be spent agitating the vat; a minimum of 30 to 45 minutes of hard work is necessary to agitate a large dipping vat. Once agitation is completed, dipping the livestock must proceed rapidly or the vat contents will begin to settle.

The pesticide's effectiveness is impaired by pollution of the dip by clay, dirt, manure, urine, hair, etc., carried in by the animals being dipped. The relationship between pollutants and the pesticide will vary with the chemical and the type of formulation. "The settling rate for a suspension is directly related to the type of formulation, age of the dip, and degree of pollution."[2] "Wettable powder formulations, like all dips are eventually reduced in efficiency by pollutants which, as they increase in quantity, virtually smother the insecticide's effectiveness".[3]

Density, temperature and chemical reaction between pollutants and the pesticide are factors causing layering to take place in the dipping vat. Agitation is more difficult if layering has occured.

The dipping vat design may be such that agitation is necessary while the cattle are being dipped. "In the use of wettable powder with poor suspendability, often 10 to 15 percent of the active ingredient is lost at the very beginning of a dipping operation. The pesticide is deposited at the "jump-off" end of the dipping vat where the dipping vat is deepest and where an eddy is created in the dipping process."[4] Adequate agitation in the area of the eddy will alter the eddy currents and reduce or prevent pesticide deposits. The eddy phenomenon is one reason vat samples are reported from the laboratory with low concentrations even after large numbers of cattle have been dipped. It is not possible to satisfactorily agitate a dipping vat by swimming cattle through it, nor is adequate agitation always maintained during the dipping process.

Federal standards have been established for pesticide dipping concentrations, dip sedimentation rates, the number of cattle that can be dipped per gallon of vat content, and the length of time the vat contents may be used. These standards, formulated to function on a program basis, are practical, since they are based on field program studies and controlled laboratory research. It is generally accepted that in the United States, the high standards established have prevented the development of tick resistance to pesticides.

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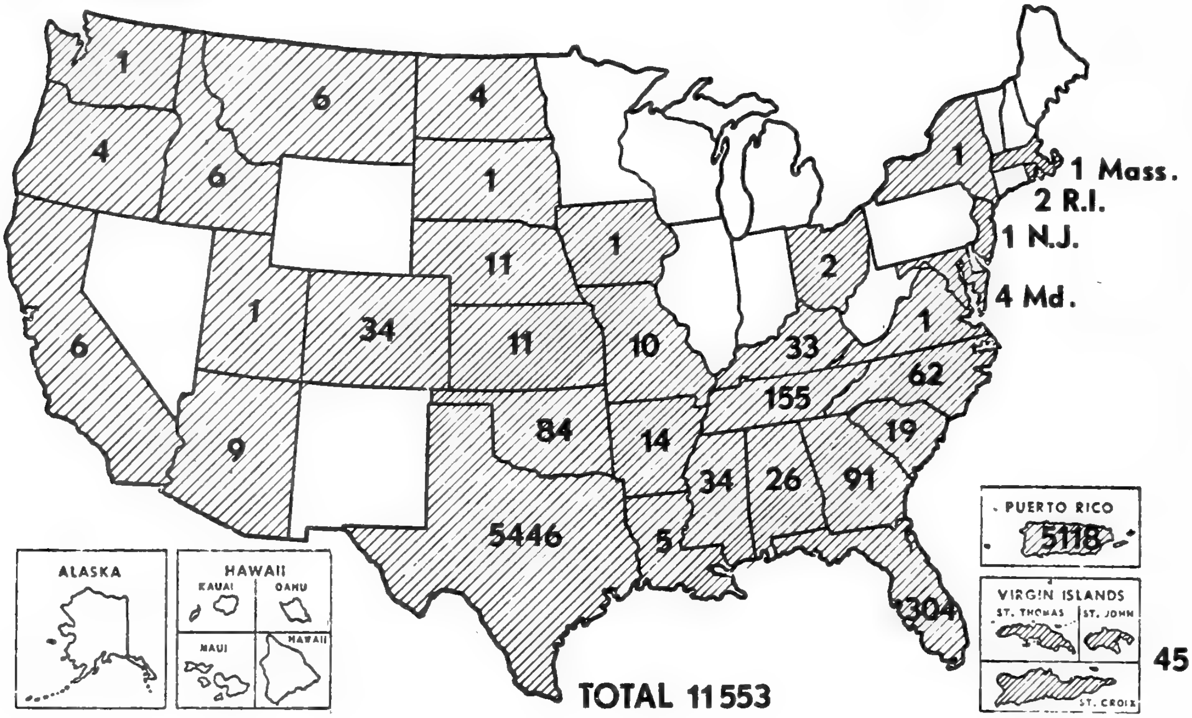
[2] ________________________, The Asuntol Story, Bayer, Leverkusen, Germany, Veterinary Department, p. 15.

[3] Ibid, p. 14.

[4] Carson, Nathan, B., unpublished presentation given to Tick Technical Meeting, Kerrville, Texas, March 6, 1980, "Phenomena Which Adversely Impact the Objective of Optimum Pesticidal Activity in Dipping Vats."

Tick Collections from All Hosts
CY 1979



Report of Ticks Collected

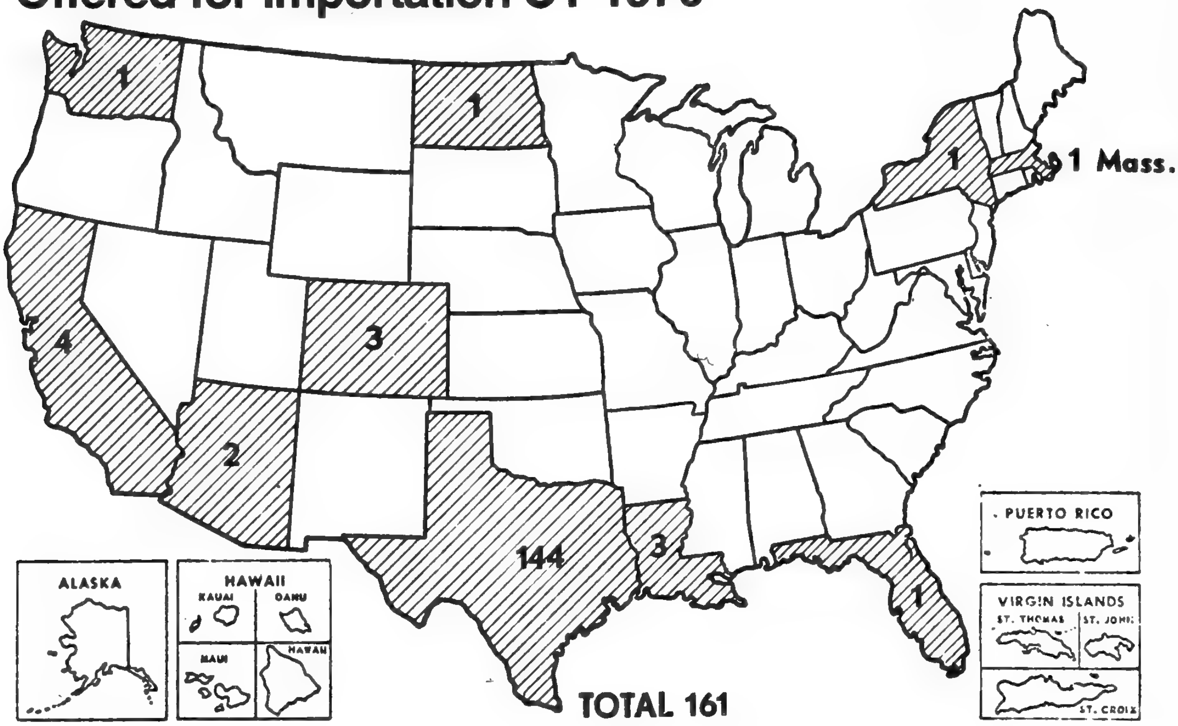
PERIOD: Calendar Year 1979

HOST: All Hosts

STATE	TOTAL	CATTLE	DOGS	HORSES & MULES	ZOO ANIMALS & MISC.	NATIVE WILDLIFE	ANIMALS OFFERED FOR ENTRY			BOOPHILUS SPP.	DERMACENTOR ALBIPICTUS	DERMACENTOR ANDERSONI STILES (=s.D. VENUSTUS BANKS)	DERMACENTOR NIGROLINEATUS	DERMACENTOR NITENS	DERMACENTOR OCCIDENTALIS	DERMACENTOR VARIABILIS	DERMACENTOR SPP.	HAEMAPHYSALIS LEPORIS-PALUSTRIS	IXODES COOKEI	IXODES PACIFICUS	IXODES SCAPULARIS	IXODES SPP.	ORNITHODOROS SPP.	OTOBIUS MEGNINI	RHIPICEPHALUS SANGUINEUS	RHIPICEPHALUS SPP.	MISCELLANEOUS SPP.
TOTAL	11553	7789	417	1902	136	1148	161																				
Alabama	26	17	5		2	2																					
Alaska																											
Arizona	9	1	2		1	3	2																				
Arkansas	14	11	2		1																						
California	6	1	1				4																				
Colorado	34	3	22	4	2		3																				
Connecticut																											
Delaware																											
Florida	304	101	67	106	21	8	1																				
Georgia	91	23	29	4	15	20																					
Hawaii																											
Idaho	6	5	1																								
Illinois																											
Indiana																											
Iowa	1		1																								
Kansas	11	11																									
Kentucky	33	7	18		7	1																					
Louisiana	5	2					3																				
Maine																											
Maryland	4		1			3																					
Massachusetts	1						1																				
Michigan																											
Minnesota																											
Mississippi	34	25	7		1	1																					
Missouri	10	4	3	2	1																						
Montana	6	1	1	4																							
Nebraska	11	2	9																								
Nevada																											
New Hampshire																											
New Jersey	1	1																									
New Mexico																											
New York	1						1																				
North Carolina	62	15	23		10	14																					
North Dakota	4		2		1		1																				
Ohio	2				2																						
Oklahoma	84	66	5	1		12																					
Oregon	4			1	1	2																					
Pennsylvania																											
Rhode Island	2				2																						
South Carolina	19	2	2		11	4																					
South Dakota	1	1																									
Tennessee	155	129	6		1	19																					
Texas	5446	3902	121	198	22	1059	144																				
Utah	1		1																								
Vermont																											
Virginia	1		1																								
Washington	1						1																				
West Virginia																											
Wisconsin																											
Wyoming																											
Puerto Rico	5118	3416	87	1580	35																						
Virgin Islands	45	43		2																							

ANH FORM 5-55 MAY 1971 REPLACES ADE FORM 5-55, DEC 1964, WHICH IS OBSOLETE USDA-ARS

Tick Collections from Animals and Products Offered for Importation CY 1979



Report of Ticks Collected

PERIOD: Calendar Year 1979

HOST: Animals and Products Offered for Importation

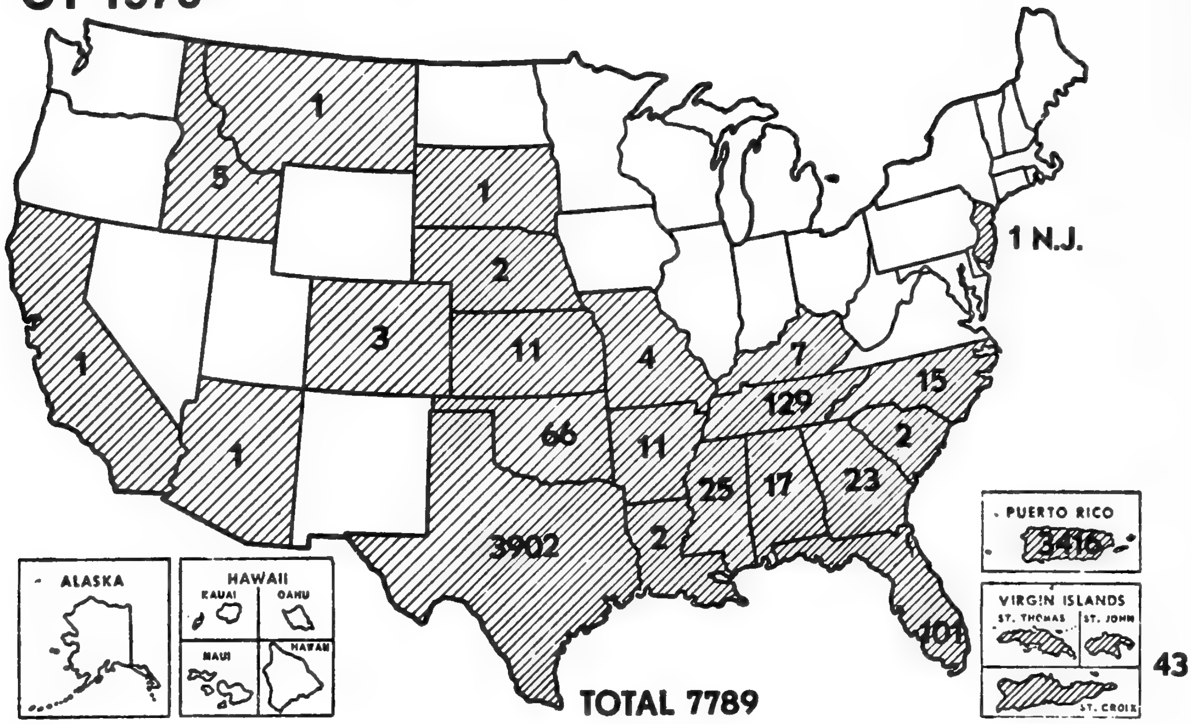
STATE	TOTAL	AMBLYOMMA AMERICANUM	AMBLYOMMA CAJENNENSE	AMBLYOMMA IMITATOR	AMBLYOMMA MACULATUM	AMBLYOMMA SPP	ARGAS PERSICUS	BOOPHILUS ANNULATUS	BOOPHILUS MICROPLUS	BOOPHILUS SPP.	DERMACENTOR ALBIPICTUS	DERMACENTOR ANDERSONI STILES (='S D. VENUSTUS BANKS)	DERMACENTOR NIGROLINEATUS	DERMACENTOR NITENS	DERMACENTOR OCCIDENTALIS	DERMACENTOR VARIABILIS	DERMACENTOR SPP.	HAEMAPHYSALIS LEPORIS-PALUSTRIS	IXODES COOKEI	IXODES PACIFICUS	IXODES SCAPULARIS	IXODES SPP.	ORNITHODOROS SPP.	OTOBIUS MEGNINI	RHIPICEPHALUS SANGUINEUS	RHIPICEPHALUS SPP.	MISCELLANEOUS SPP.
TOTAL	161		3			3		9	23	38	34	1	1		1	2	12				2			21	7	1	3
ARIZONA																											
Tucson	2																2BH[d]										
CALIFORNIA																											
Boulenard	1														1BO												
Potrero	1															1BO											
San Francisco	2																										1AH[y] 1AH[w]
COLORADO																											
Denver	3					1KU[v] 1CB[h]																				1KU[e]	
FLORIDA																											
Miami Airport	1																								1AC		
LOUISIANA																											
New Orleans	3																								2G 1DF		
MASSACHUSETTS																											
Boston	1																										1W[l]
NORTH DAKOTA																											
Portal	1											1HO															
NEW YORK																											
JFK Airport	1																								1DO		
TEXAS																											
Brownsville	2									1BO						1BO											
Del Rio	10							1BO	3BO	4BO	1BO						1BO										
Eagle Pass	67							7BO	5BO	26BO	19BO						8BO				2BO						
El Paso	30										10BO		1BO				1BO							16BO	2PM		
Laredo	33		3BO			1BO		1DH	15BO	7BO	2BO													4BO			
Presidio	1										1BO																
Progreso	1																							1BO			
WASHINGTON																											
Blaine	1										1HO																

ANH FORM 5-55 MAY 1971 REPLACES AOE FORM 5-55, DEC 1964, WHICH IS OBSOLETE USDA-ARS

Key to Host:
AC Air Cargo
AH Animal Hide
BH Bighorn Sheep
BO Bovine
CB Cape Buffalo
DF Dried Flowers
DH Deer Hide
DO Dog
G Grass
HO Horse
KU Kudo
PM Plant Material
W Wool

Key to Species:
h *Amblyomma hebraeum*
v *Amblyomma variegatum*
d *Dermacentor hunteri*
e *Rhipicephalus evertsi*
l *Haemaphysalis* sp.
w *Hyalomma rufipes*
y *Hyalomma truncatum*

Tick Collections from Cattle
CY 1979



Report of Ticks Collected

PERIOD: Calendar Year 1979

HOST: Cattle

STATE	TOTAL	Amblyomma americanum	Amblyomma cajennense	Amblyomma imitator	Amblyomma maculatum	Amblyomma spp.	Argas persicus	Boophilus annulatus	Boophilus microplus	Boophilus spp.	Dermacentor albipictus	Dermacentor andersoni Stiles (='s D. venustus Banks)	Dermacentor nigrolineatus	Dermacentor nitens	Dermacentor occidentalis	Dermacentor variabilis	Dermacentor spp.	Haemaphysalis leporis-palustris	Ixodes cookei	Ixodes pacificus	Ixodes scapularis	Ixodes spp.	Ornithodoros spp.	Otobius megnini	Rhipicephalus sanguineus	Rhipicephalus spp.	Miscellaneous spp.
TOTAL	7789	1602	433	6	944	106		40	2003	9	188		17	1444		514	4				67			393	19		
Alabama	17	3			10											3								1			
Alaska																											
Arizona	1										1																
Arkansas	11	9			1											1											
California	1																							1			
Colorado	3																							3			
Connecticut																											
Delaware																											
Florida	101	18	1		52											8					20			1	1		
Georgia	23	10			3											10											
Hawaii																											
Idaho	5										5																
Illinois																											
Indiana																											
Iowa																											
Kansas	11	1			2											8											
Kentucky	7	1														6											
Louisiana	2	2																									
Maine																											
Maryland																											
Massachusetts																											
Michigan																											
Minnesota																											
Mississippi	25	16			6								1			1					1						
Missouri	4	2														2											
Montana	1										1																
Nebraska	2															2											
Nevada																											
New Hampshire																											
New Jersey	1															1											
New Mexico																											
New York																											
North Carolina	15	10			1											4											
North Dakota																											
Ohio																											
Oklahoma	66	36			6								1			1					5			17			
Oregon																											
Pennsylvania																											
Rhode Island																											
South Carolina	2	1			1																						
South Dakota	1															1											
Tennessee	129	43			1											84									1		
Texas	3902	1450	432	6	861	10^{n} 78		40	13	9	181		15			382	4				41			370	10		
Utah																											
Vermont																											
Virginia																											
Washington																											
West Virginia																											
Wisconsin																											
Wyoming																											
Puerto Rico	3416					18^{v}			1947					1444											7		
Virgin Islands	43								43																		

ANH FORM 5-55 MAY 1971 REPLACES ADE FORM 5-55, DEC 1964, WHICH IS OBSOLETE

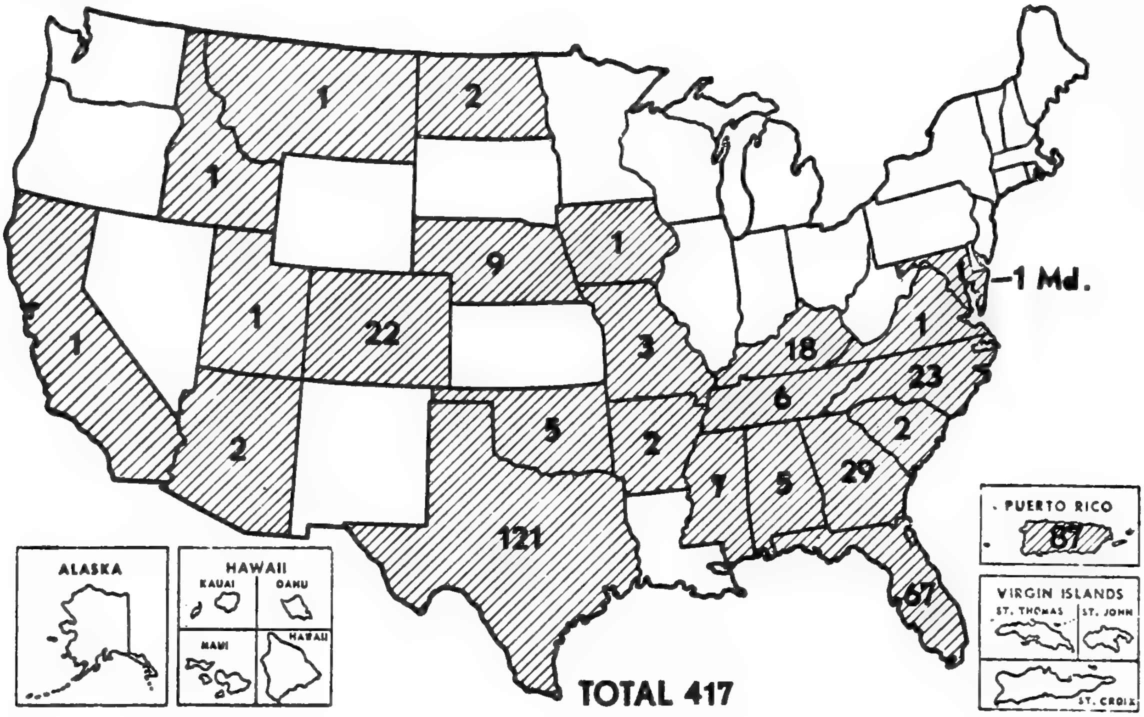
USDA-ARS

Key to Species:

n Amblyomma inornatum

v Amblyomma variegatum

Tick Collections from Dogs CY 1979



Report of Ticks Collected

PERIOD: Calendar Year 1979

HOST: Dogs

STATE	TOTAL	AMBLYOMMA AMERICANUM	AMBLYOMMA CAJENNENSE	AMBLYOMMA IMITATOR	AMBLYOMMA MACULATUM	AMBLYOMMA SPP.	ARGAS PERSICUS	BOOPHILUS ANNULATUS	BOOPHILUS MICROPLUS	BOOPHILUS SPP.	DERMACENTOR ALBIPICTUS	~~DERMACENTOR ANDERSONI~~ STILES (='s D. VENUSTUS BANKS)	DERMACENTOR NIGROLINEATUS	DERMACENTOR NITENS	DERMACENTOR OCCIDENTALIS	DERMACENTOR VARIABILIS	DERMACENTOR SPP.	HAEMAPHYSALIS LEPORIS-PALUSTRIS	IXODES COOKEI	IXODES PACIFICUS	IXODES SCAPULARIS	IXODES SPP.	ORNITHODOROS SPP.	OTOBIUS MEGNINI	RHIPICEPHALUS SANGUINEUS	RHIPICEPHALUS SPP.	MISCELLANEOUS SPP.
TOTAL	417	26	3		34				2			6		7		149			1		24		1	1	163		
Alabama	5															4									1		
Alaska																											
Arizona	2																								2		
Arkansas	2	1														1											
California	1															1											
Colorado	22											4				4					1*				13		
Connecticut																											
Delaware																											
Florida	67	2			18											27					14				6		
Georgia	29	2			1											15					7				4		
Hawaii																											
Idaho	1											1															
Illinois																											
Indiana																											
Iowa	1															1											
Kansas																											
Kentucky	18	1			1**											15			1								
Louisiana																											
Maine																											
Maryland	1	1																									
Massachusetts																											
Michigan																											
Minnesota																											
Mississippi	7	1														2					1				3		
Missouri	3	1														2											
Montana	1											1															
Nebraska	9															9											
Nevada																											
New Hampshire																											
New Jersey																											
New Mexico																											
New York																											
North Carolina	23	4														16									3		
North Dakota	2															2											
Ohio																											
Oklahoma	5															2									3		
Oregon																											
Pennsylvania																											
Rhode Island																											
South Carolina	2	1																							1		
South Dakota																											
Tennessee	6	1														5											
Texas	121	11	3		14											42					1		1[m]	1	48		
Utah	1																								1		
Vermont																											
Virginia	1															1											
Washington																											
West Virginia																											
Wisconsin																											
Wyoming																											
Puerto Rico	87								2					7											78		
Virgin Islands																											

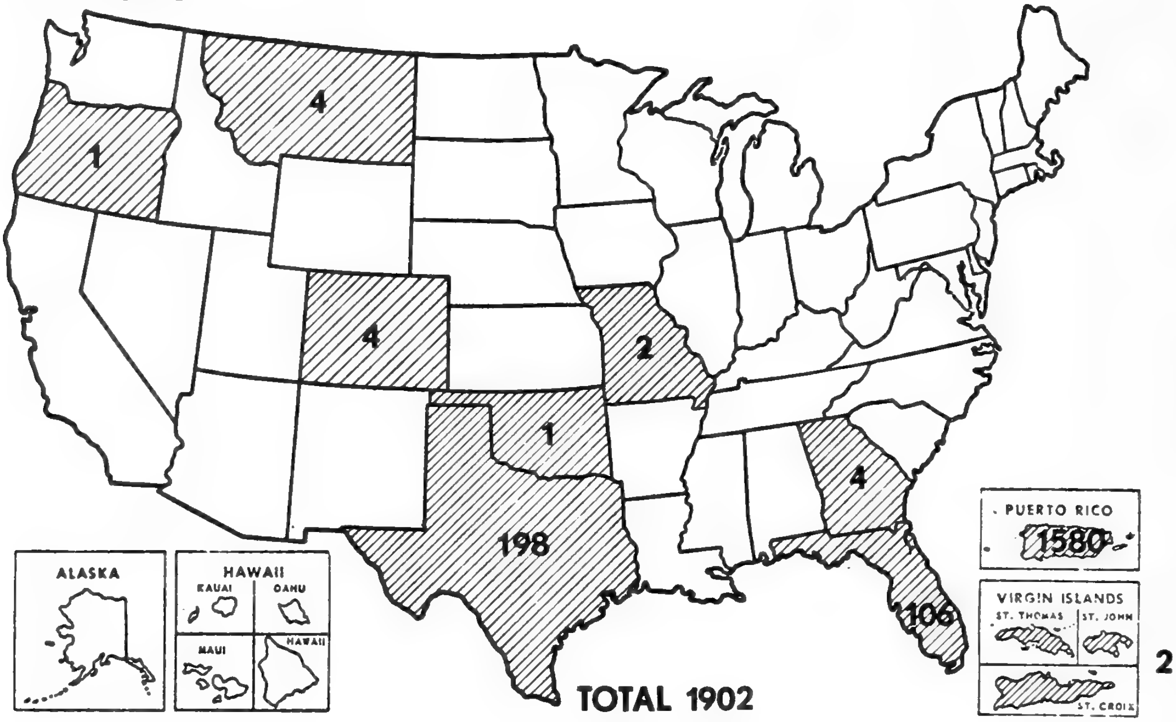
ANH FORM 5-55 MAY 1971 REPLACES ADE FORM 5-55, DEC 1964, WHICH IS OBSOLETE

USDA-ARS

Key to Species:
m Ornithodoros turicata

*Dog from Texas
**Not known to be established in this state

Tick Collections from Horses and Mules CY 1979



Report of Ticks Collected

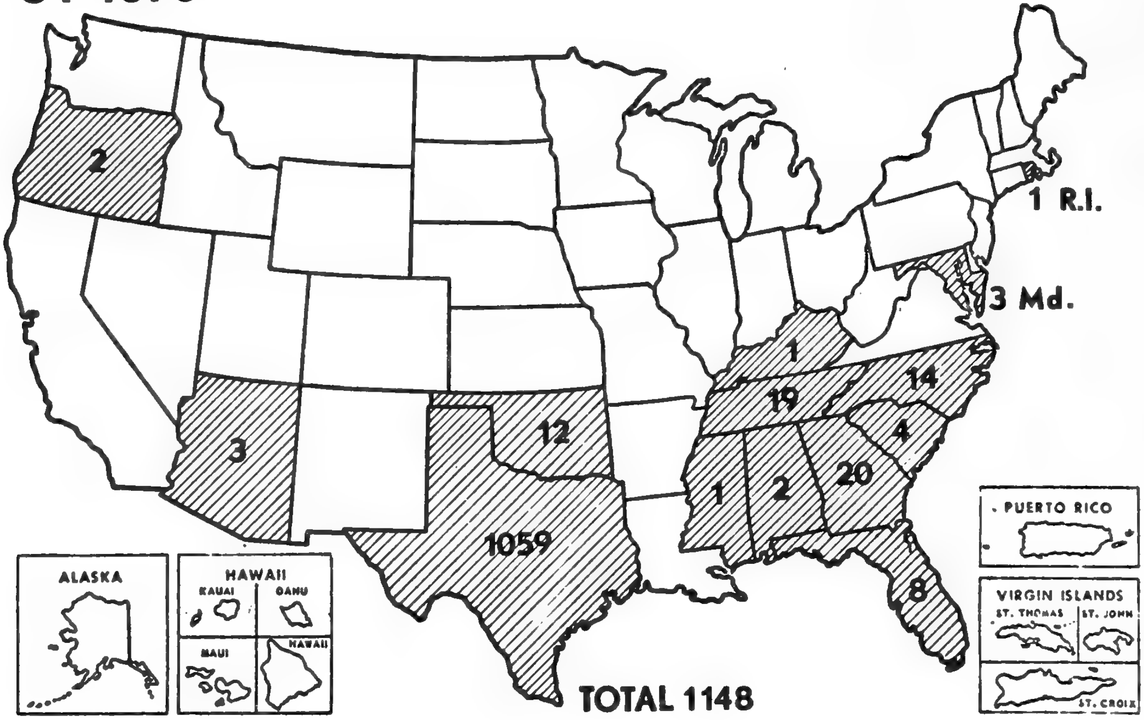
PERIOD: Calendar Year 1979

HOST: Horses and Mules

STATE	TOTAL	AMBLYOMMA AMERICANUM	AMBLYOMMA CAJENNENSE	AMBLYOMMA IMITATOR	AMBLYOMMA MACULATUM	AMBLYOMMA SPP.	ARGAS PERSICUS	BOOPHILUS ANNULATUS	BOOPHILUS MICROPLUS	BOOPHILUS SPP.	DERMACENTOR ALBIPICTUS	DERMACENTOR ANDERSONI STILES (D. VENUSTUS BANKS)	DERMACENTOR NIGROLINEATUS	DERMACENTOR NITENS	DERMACENTOR OCCIDENTALIS	DERMACENTOR VARIABILIS	DERMACENTOR SPP.	HAEMAPHYSALIS LEPORIS-PALUSTRIS	IXODES COOKEI	IXODES PACIFICUS	IXODES SCAPULARIS	IXODES SPP.	ORNITHODOROS SPP.	OTOBIUS MEGNINI	RHIPICEPHALUS SANGUINEUS	RHIPICEPHALUS SPP.	MISCELLANEOUS SPP.
TOTAL	1902	19	13		54	4			23		24	4		1610		120					18			4	9		
Alabama																											
Alaska																											
Arizona																											
Arkansas																											
California																											
Colorado	4										3													1			
Connecticut																											
Delaware																											
Florida	106	1			21									55		10					18				1		
Georgia	4															4											
Hawaii																											
Idaho																											
Illinois																											
Indiana																											
Iowa																											
Kansas																											
Kentucky																											
Louisiana																											
Maine																											
Maryland																											
Massachusetts																											
Michigan																											
Minnesota																											
Mississippi																											
Missouri	2	1														1											
Montana	4											4															
Nebraska																											
Nevada																											
New Hampshire																											
New Jersey																											
New Mexico																											
New York																											
North Carolina																											
North Dakota																											
Ohio																											
Oklahoma	1	1																									
Oregon	1										1																
Pennsylvania																											
Rhode Island																											
South Carolina																											
South Dakota																											
Tennessee																											
Texas	198	16	13		33	4					20					105								3	4		
Utah																											
Vermont																											
Virginia																											
Washington																											
West Virginia																											
Wisconsin																											
Wyoming																											
Puerto Rico	1580								22					1554											4		
Virgin Islands	2								1					1													

ANH FORM 5-55 MAY 1971 REPLACES ADE FORM 5-55, DEC 1964, WHICH IS OBSOLETE USDA-ARS

Tick Collections from Native Wildlife CY 1979



Report of Ticks Collected

PERIOD: Calendar Year 1979

HOST: Native Wildlife

STATE	TOTAL	AMBLYOMMA AMERICANUM	AMBLYOMMA CAJENNENSE	AMBLYOMMA IMITATOR	AMBLYOMMA MACULATUM	AMBLYOMMA SPP.	ARGAS PERSICUS	BOOPHILUS ANNULATUS	BOOPHILUS MICROPLUS	BOOPHILUS SPP.	DERMACENTOR ALBIPICTUS	~~DERMACENTOR ANDERSONI~~ STILES (='s D. VENUSTUS BANKS)	DERMACENTOR NIGROLINEATUS	DERMACENTOR NITENS	DERMACENTOR OCCIDENTALIS	DERMACENTOR VARIABILIS	DERMACENTOR SPP.	HAEMAPHYSALIS LEPORIS-PALUSTRIS	IXODES COOKEI	IXODES PACIFICUS	IXODES SCAPULARIS	IXODES SPP.	ORNITHODOROS SPP.	OTOBIUS MEGNINI	RHIPICEPHALUS SANGUINEUS	RHIPICEPHALUS SPP.	MISCELLANEOUS SPP.
TOTAL	1148	26	1		113	11		62		11	355		19		1	239	17	231	3	1	18	15	25				
Alabama	2				2D																						
Alaska																											
Arizona	3																1JR[a]	1SP 1GQ									
Arkansas																											
California																											
Colorado																											
Connecticut																											
Delaware																											
Florida	8	1D				1SN[f]										1D 1BC					3D 1BC						
Georgia	20	15D											2D								3D						
Hawaii																											
Idaho																											
Illinois																											
Indiana																											
Iowa																											
Kansas																											
Kentucky	1															1D											
Louisiana																											
Maine																											
Maryland	3	1F														1F			1F								
Massachusetts																											
Michigan																											
Minnesota																											
Mississippi	1																				1F						
Missouri																											
Montana																											
Nebraska																											
Nevada																											
New Hampshire																											
New Jersey																											
New Mexico																											
New York																											
North Carolina	14	2D																1R	1RC		1D	8RC[o] 1R[d]					
North Dakota																											
Ohio																											
Oklahoma	12	1WT 1D																			3CO 2D,4BC	1RC[o]					
Oregon	2														1D					1D							
Pennsylvania																											
Rhode Island																											
South Carolina	4	1D			2D																	1D[c]					
South Dakota																											
Tennessee	19	1D														18RC											
Texas	1059	3D	1RT	*	3RT 92D 1J 13CO	4D,3RT 3R[m]		1CO 61D		11D	355D		17D	*		42RT 3D,13R 3BC 22M 67J 5F,54CO 3SK 5RC	1D[i],1R[a] 12D[a] 1JR[a] 1J[i]	220R 8D	1RC	*		1JR[t] 1D,1BI[t] 1RC[d]	16RT[ta] 1R[ta] 1BC[ta] 4M[ta] 2GS[ta] 1J[ta]				
Utah																											
Vermont																											
Virginia																											
Washington																											
West Virginia																											
Wisconsin																											
Wyoming																											
Puerto Rico																											
Virgin Islands																											

ANH FORM 5-55 MAY 1971 — REPLACES ADE FORM 5-55, DEC 1964, WHICH IS OBSOLETE

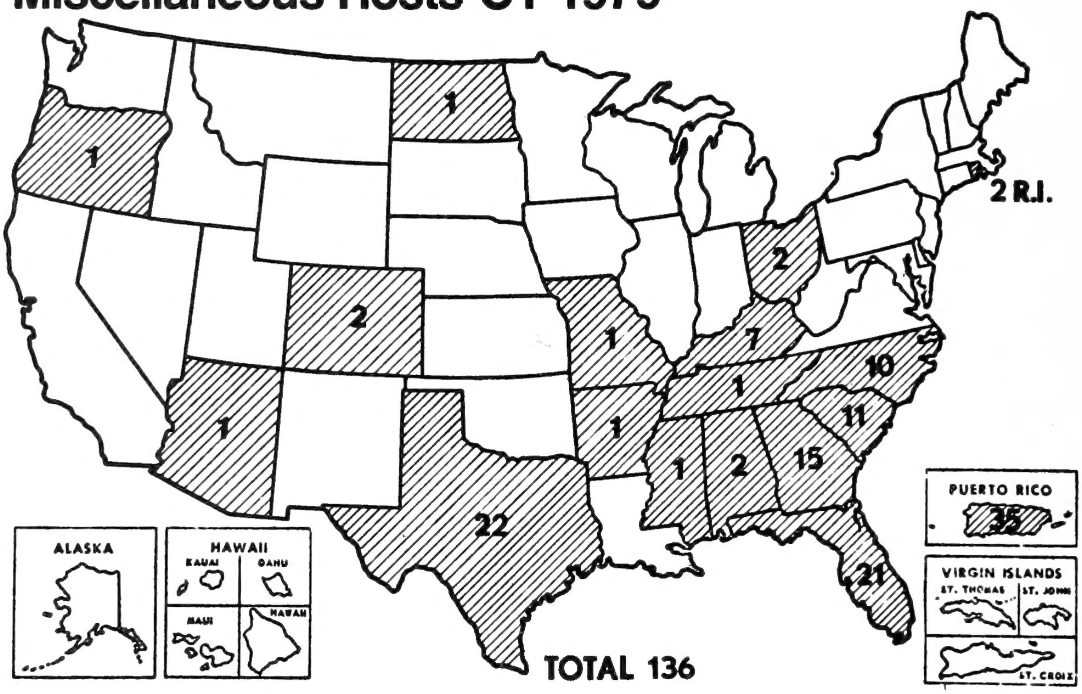
*Brackets enclose Texas collections

USDA-ARS

Key to Host:
- BI Bird
- BC Bobcat
- CO Coyote
- D Deer
- F Fox
- GQ Gambel's Quail
- GS Ground Squirrel
- J Javelina
- JR Jack Rabbit
- M Mouse
- R Rabbit
- RC Raccoon
- RT Rat
- SK Skunk
- SN Snake
- SP Sparrow
- WT Wild Turkey

Key to Species:
- a Dermacentor parumapertus
- c Ixodes affinis
- d Ixodes dentatus
- f Amblyomma dissimile
- i Dermacentor halli
- m Amblyomma inornatum
- o Ixodes texanus
- t Ixodes tovari
- ta Ornithodoros talaje

Tick Collections from Zoo Animals and Miscellaneous Hosts CY 1979



Report of Ticks Collected	PERIOD Calendar Year 1979	HOST Zoo Animals and Miscellaneous Hosts

STATE	TOTAL	AMBLYOMMA AMERICANUM	AMBLYOMMA CAJENNENSE	AMBLYOMMA IMITATOR	AMBLYOMMA MACULATUM	AMBLYOMMA SPP.	ARGAS PERSICUS	BOOPHILUS ANNULATUS	BOOPHILUS MICROPLUS	BOOPHILUS SPP.	DERMACENTOR ALBIPICTUS	~~DERMACENTOR ANDERSONI~~ STILES (='s D. VENUSTUS BANKS)	DERMACENTOR NIGROLINEATUS	DERMACENTOR NITENS	DERMACENTOR OCCIDENTALIS	DERMACENTOR VARIABILIS	DERMACENTOR SPP.	HAEMAPHYSALIS LEPORIS-PALUSTRIS	IXODES COOKEI	IXODES PACIFICUS	IXODES SCAPULARIS	IXODES SPP.	ORNITHODOROS SPP.	OTOBIUS MEGNINI	RHIPICEPHALUS SANGUINEUS	RHIPICEPHALUS SPP.	MISCELLANEOUS SPP.
TOTAL	136	25	5			2			8		2			27		33					24			1	7		2
Alabama	2															2Q											
Alaska																											
Arizona	1																								1Q		
Arkansas	1															1Q											
California																											
Colorado	2																							1C	1X		
Connecticut																											
Delaware																											
Florida	21													1H		1H 1Y,1C					5C 11Y,1H						
Georgia	15	1H 6Y,1Q														1Y,1C					3Y,1H						1PY[al]
Hawaii																											
Idaho																											
Illinois																											
Indiana																											
Iowa																											
Kansas																											
Kentucky	7															1G,1V 1Q,4H											
Louisiana																											
Maine																											
Maryland																											
Massachusetts																											
Michigan																											
Minnesota																											
Mississippi	1	1H																									
Missouri	1															1H											
Montana																											
Nebraska																											
Nevada																											
New Hampshire																											
New Jersey																											
New Mexico																											
New York																											
North Carolina	10	4H														5H,1Q											
North Dakota	1															1H											
Ohio	2					2IG[f]																					
Oklahoma																											
Oregon	1										1Q																
Pennsylvania																											
Rhode Island	2															1H,1C											
South Carolina	11	1H,8Y																			2Y						
South Dakota																											
Tennessee	1															1H											
Texas	22	1H,2Y	2H,3Y								1Q					4H 2Y,1X					1C				4X,1H		
Utah																											
Vermont																											
Virginia																											
Washington																											
West Virginia																											
Wisconsin																											
Wyoming																											
Puerto Rico	35								5G 2Y,1S					21G 5S													1CH[b]
Virgin Islands																											

ANH FORM 5-55 MAY 1971 REPLACES AOE FORM 5-55, DEC 1964, WHICH IS OBSOLETE

USDA-ARS

Key to Host:
C Cat
CH Chicken
G Goat
H Human
IG Iguana
PY Python
Q Host not Given
S Sheep
V Vehicle
X Inanimate Object
Y Swine

Key to Species:
al *Aponomma lucasi*
b *Argas miniatus*
f *Amblyomma dissimile*

*U.S. GOVERNMENT PRINTING OFFICE: 1981-0-340-932/APHIS-154