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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

IND/STA

PRODUCTION SECTION
CURRENT SERIAL RECORDS

NOV 9 '81

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National Tick Surveillance Program
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 northern 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 occurrence. 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 occurred 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 achieved 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 LC₉₉. The LC₉₉ 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 LC₉₉. This extra pesticide concentration may be termed the "eradication factor". It is important to use pesticides at greater than the LC₉₉ in order to avoid the development of resistance. "Chemicals have been valueless following the development of resistance."¹ There appears to be

¹Nolan, 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 quantitative 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 strenuous 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 occurred.

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.

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	HOST
											Calendar Year 1979	All Hosts
STATE	TOTAL	CATTLE	DOGS	HORSES & MULES	ZOO ANIMALS & MISC.	NATIVE WILDLIFE	ANIMALS OFFERED FOR ENTRY					
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 345, DEC 1956, WHICH IS OBSOLETE

USDA-ARS

Tick Collections from Animals and Products Offered for Importation CY 1979

Report of Ticks Collected										PERIOD	HOST									
										Calendar Year 1979	Animals and Products Offered for Importation									
STATE	TOTAL	AMBL.YOMMA AHEB.CENTUM	AMBL.YOMMA COLENEFENSE	AMBL.YOMMA BUTTIGIE	AMBL.YOMMA MACULATUM	AMBL.YOMMA SPP.	ARGAS PERICUS	BORPHILLUS ANILLATUS	BORPHILLUS MICROPHILLUS	BORPHILLUS SPP.	DERMACENTOR ALBIPICTUS	DERMACENTOR VARIABILIS	DERMACENTOR SPP.	DERMACENTOR SPP.	DERMACENTOR SPP.	DERMACENTOR SPP.	DERMACENTOR SPP.	DERMACENTOR SPP.	DERMACENTOR SPP.	DERMACENTOR SPP.
TOTAL	161	3			3		9	23	38	34	1	1		1	2	12				
ARIZONA																				
Tucson	2													2BH ^d						
CALIFORNIA																				
Boulevard	1													1BO						
Potrero	1													1BO						
San Francisco	2																			1AH ^c 1AH ^c
COLORADO																				
Denver	3																			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						
Exile Pass	67							7BO	5BO	26BO	19BO			BB			2BO			
El Paso	30									10BO				1BO					16BO	2PM
Laredo	33	3BO			1BO			1DR	15BO	7BO	2BO								4BO	
Presidio	1									1BO										
Progreso	1																		1BO	
WASHINGTON																				
Blaine	1													1HO						

ANH FORM 5-55
MAY 1971

REPLACES AIC FORM 5-55, DEC 1964, WHICH IS OBSOLETE

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*

USDA-ARS

Map of the United States showing the number of people in each state who were born in the United States. The map is shaded with diagonal lines. The numbers are: Alaska (1), Arizona (1), California (1), Colorado (1), Connecticut (1), Delaware (1), Florida (101), Georgia (23), Hawaii (1), Idaho (1), Illinois (11), Indiana (1), Iowa (1), Kansas (1), Kentucky (1), Louisiana (1), Maine (1), Maryland (1), Massachusetts (1), Michigan (1), Minnesota (1), Missouri (1), Montana (1), Nebraska (1), Nevada (1), New Hampshire (1), New Jersey (1 N.J.), New York (1), North Carolina (15), North Dakota (1), Ohio (1), Oklahoma (1), Oregon (1), Pennsylvania (1), Rhode Island (1), South Carolina (2), South Dakota (1), Tennessee (129), Texas (3902), Utah (1), Vermont (1), Virginia (17), Washington (1), West Virginia (1), Wisconsin (1), Wyoming (1). The total number of people born in the United States is 7789.

ALASKA

HAWAII

KAUAI OAHU

MAUI HAWAII

PUERTO RICO

3416

VIRGIN ISLANDS

ST. THOMAS ST. JOHN

ST. CROIX

TOTAL 7789

HqST
Cattle

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

Key to Species:

n Amblyomma inernatum

n Amblyomma variegatum

USDA-ARS

Tick Collections from Dogs CY 1979

PERIOD	Calendar Year 1979
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[illegible]

ANH FORM 5-55
MAY 1971 Key

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

Key to Species:
m Ornithodoros turicata

*Dog from Texas

**Not known to be established in this state

USDA-ARS

Tick Collections from Horses and Mules CY 1979

Report of Ticks Collected

PERIOD	Calendar Year 1979
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HOST	Horses and Mules
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[illegible]

ANH FORM 5-55
MAY 1971

REPLACES AEC FORM 5-55, DEC 1964, WHICH IS OBSOLETE

USDA-ARS

Tick Collections from Native Wildlife CY 1979

Report of Ticks Collected

Report of Ticks Collected											PERIOD		Calendar Year 1979		HOST		Native Wildlife																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
STATE	TOTAL	AMBL.YOMMA AMERICANUM	AMBL.YOMMA CA.FEUNENSE	AMBL.YOMMA INULATORE	AMBL.YOMMA MACULATIM	AMBL.YOMMA SPP.	ARGAS PERICULUS	BOOPHILUS ANULATUS	BOOPHILUS MICROPUS	BOOPHILUS SPP.	DERMACENTOR ALBIPUNCTUS	DERMACENTOR BREVIPALPUS	DERMACENTOR SPP.	DERMACENTOR VIRGILII	DERMACENTOR SPP.	HAEMAPHYSALIS SPP.	IXODES SCUTELLUS	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	IXODES SPP.	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ANH FORM 5-55
MAY 1971

REPLACES ADE FORM 5-55, DEC 1954, WHICH IS OBSOLETE

*Brackets enclose Texas collections

USDA-ARS

Key to Host:

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

Key to Species:

a *Dermacentor perumanpertus* l *Dermacentor halli*
 c *Ixodes affinis* m *Amblyomma inornatum*
 d *Ixodes dentatus* o *Ixodes texanus*
 f *Amblyomma dissimile* t *Ixodes tovari*
 ta *Ornithodoros talaje*

Tick Collections from Zoo Animals and Miscellaneous Hosts CY 1979

MOIST
Zoo Animals and Miscellaneous
Hosts

ANH FORM 5-55

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

Key to Species:

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

USDA-ARS

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