REPORT OF THE COMMITTEE ON PARASITIC DISEASES

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The Committee met on Wednesday, October 18, 2006, Minneapolis Hilton Hotel, Minneapolis, Minnesota. At least 33 persons were in attendance, including 15 members of the Committee. Reports were provided on a number of parasitic disease issues of interest.

Dr. Gustavo Rodrigues and Mr. Dale Maki, United States-Mexico Screwworm Commission, Tuxtla Gutierrez, Chiapas Plant, Mexico, gave a summary of the strategic plan to eradicate screwworm from the American continent. The United States and Mexico maintain trade with Latin American and Caribbean countries currently infested with screwworm resulting in a risk of reinfestation of the United States or Mexico, and infestation of other countries that are free of screwworm as was the case in the outbreak that occurred in Libya in 1990. The potential combined annual loses as a result of reinfestation would be over $1.2 billion dollars for the United States, Mexico and Central America. The Sterile Screwworm Production Plant located in Tuxtla Gutierrez, Chiapas, Mexico, can maintain its infrastructure and guarantee operation with only 0.8% of the screwworm economic impact in North America. The Food and Agriculture Organization has categorized the screwworm as one of the five most important trans-boundary animal diseases on the American Continent along with Foot and Mouth Diseases (FMD), Avian Influenza, Classical Swine Fever (CSF), and Bovine Spongiform Encephalopathy (BSE) with screwworm being the only parasitic disease.

South America (except Chile) as well as some Caribbean countries (excluding Virgin Islands, Puerto Rico, Curazao and Aruba) currently are infested by the screwworm. The United States and Mexico maintain commercial relationships with infested countries in Latin America and the Caribbean and so are at risk for re-infestation. Aruba was re-infested with screwworm in 2004, most likely via the introduction of infested animals from South America. A strategic plan to eradicate the screwworm from the American continent has been developed and the objectives are to (1) eradicate screwworm, (2) eliminate the risk of re-infesting screwworm-free countries in North and Central America and the Caribbean, (3) increase livestock production and the income of people inhabiting affected countries, and (4) reinforce security in international commerce and consolidate the programs to eradicate screwworm from the Western Hemisphere.

Justifications for the program include (1) the cost of treatment, management, and the loss of livestock where infestations occur, (2) human myiasis, (3) risk of re-infestation of areas free of screwworm, (4) the cost of eradicating screwworms from Caribbean countries is estimated at $100 million (U.S. dollars), (5) most of the investment should be recovered after the second year of eradication, and (6) the cost/benefit ratio has always been positive. Strategies for eradication include (1) establishing sub-regional and national reference laboratories, (2) strengthening veterinary services in each individual country, (3) creating alliances between the public and private sectors, (4) developing effective surveillance and reporting systems, and (5) implementing control and eradication activities. Prerequisites for eradication include (1) availability of adequate funding, (2) sterile flies destined for dispersion must be of optimum quality, (3) governments involved must fully support eradication campaigns and refrain from any future change in policy, (4) countries being treated must comply with the established objectives, and (5) screwworm-free countries must maintain adequate inspection and surveillance in airports, harbours and borders to prevent re-infestations.

Financial issues assume that (1) the required funding will be available, (2) in the Caribbean Eradication, the program will be developed on an island-by-island basis, (3) the Dominican Republic and Haiti will be considered together as the Hispaniola Island, (4) funding sources may include multilateral and bilateral agencies, (5) the United States and the European Union are committed to supporting animal health and public health programs in the Caribbean, and (6) complementary projects for the national eradication programs could be funded by non-governmental agencies or organizations. Short and long term goals include (1) Jamaica free of screwworm, (2) sterile flies to Dominican Republic and Haiti, (3) negotiations with other Caribbean countries: Cuba, Trinidad and Tobago, (4) negotiations with countries of the Andian Region: Venezuela, Colombia, Ecuador and Peru, (5) negotiations with countries of the Southern Cone: Uruguay, Brazil, Argentina, Paraguay and Bolivia, (6) negotiations with Guayanas Region: Guayana, Suriname and French Guayana, and (7) set the goal for a world without Screwworm (SW) for the 21st century. Conclusions of the Screwworm International Workshop were as follows: (1) Pan American Health Organization (PAHO)/World Health Organization (WHO) will continue promoting joint operations, with Commission of Mexico Americo (COMEXA) through its Units of Transmissible Diseases and Veterinary Public Health. Would be included as part of the strategic regional plan for diseases neglected in marginal populations; (2) COMEXA will participate in the next meeting of the 15th Inter-American Meeting, at the Ministerial Level, on Health and Agriculture (RIMSA); (3) Request Agriculture Research Service (ARS) to accomplish population dynamic studies and the possibilities of obtaining and development of native strains; (4) Considering the successful experiences to incorporate its basic strategies so that the countries and the International Organisms related to Public Health and the Animal Health, we adopt the commitment to work together and apply the required technology to declare the American Continent free of Screwworm in the XXI Century; (5) To integrate a specialized Inter-agency plan to eradicate the SW from the American Continent (6) To proceed with the Binational Pilot Project for SW control, Río Grande do Sul, Brazil and Uruguay; (7) To support the Binational Pilot Project for SW control, in the Dominican Republic and Haití; (8) To involve in this Mission the Cattle Associations and

related Industrial Sectors (9) To involve Mercado Comun del Sur (MERCOSUR), in the countries that make the commitment and to look for financial support for execution; (10) That the Pilot Projects serve as a demonstrative program that will later lead to initiation of an eradication program (countries that make up the Cuenca del Plata); (11) To request the participation of International Organizations such as Food and Agriculture Organization (FAO), PAHO, International Atomic Energy Agency (IAEA) and ARS, to technically support the SW Eradication in Jamaica; (12) That the representatives of the Ministries of Agriculture and Livestock help to increase the awareness of there counterparts in Public Health; (13) PAHO, within the program of attention to malaria in Hispaniola, to include actions relative to SW; (14) To participate in United States Animal Health Association's (USAHA) meeting; (15) That COMEXA, as a specialized International Organization, request inclusion and total participation in the TADs (Transborders diseases); (16) That ARS begin a joint project with APHIS to develop a strain to produce only males; (17) That ARS continue development of the artificial wound and the corresponding trap; and (18) That a meeting be organized within six months to follow through on the Agreements.

Dr. Mark Camacho, Veterinary Services (VS), Animal and Plant Health Inspection Service (APHIS), United States Department of Agriculture (USDA), gave an update on the program to eradicate the tropical bont tick (*Amblyomma variegatum*) from St. Croix, United States Virgin Islands (USVI). The year 2006 is the second and last year of a two year cooperative agreement between the USDA and St. Croix to eradicate the tropical bont tick from the island territory. Much has been accomplished over the last two years but the tick has still not been eradicated. Despite scratching and spraying infested premises every two weeks, the tick still persists in a small number of hot spots in the western part of the island. As of October 2006 there are 10 known infested premises in St. Croix. As seen with other tick eradication efforts, the complicated interaction of weather, moisture, vegetation, wildlife and livestock conspire to make the understanding of tropical bont tick survival and eradication a real challenge. USDA is discussing the possibility of continuing the eradication effort for one or two more years and then transferring the program over to USVI for an ongoing surveillance effort, however nothing has been finalized at this point. Excellent work is being conducted by USDA-ARS using long-acting injectable Doramectin laden microspheres and by the Southeastern Cooperative Wildlife Disease Study (SCWDS) on the relationship between wildlife and tropical bont tick survival.

Dr. Joseph Corn, SCWDS, College of Veterinary Medicine, gave an update on SCWDS studies on the role of wildlife in the maintenance and dissemination of the tropical bont tick (*Amblyomma variegatum*) by wildlife in St. Croix, United States Virgin Islands. These studies are funded through a Cooperative Agreement with USDA-ARS. Surveys were conducted for *A. variegatum* and other ectoparasites on birds, mongooses, deer and feral cattle at nine premises where *A. variegatum* had previously been reported and in the rain forest region of the island during July – November 2005 and March – May 2006. Ticks or other ectoparasites were recovered from 144/385 mongooses and 3/400 birds examined at the nine premises. Ticks were recovered from 12/13 white-tailed deer and 8/12 feral cows collected in the rain forest area on the western end of the island. All ectoparasites collected have been submitted to the

USDA-APHIS, National Veterinary Services Laboratories (NVSL), and identification of the ticks collected is pending.

Dr. Jack Amen, VS-APHIS-USDA, gave an update on the Caribbean *Amblyomma* Programme. The Tropical Bont Tick (TBT), *Amblyomma variegatum*, is a vector of the rickettsial organism, *Ehrlichia ruminantium*, the causative agent of heartwater in ruminants. The tick and heartwater were introduced into the Caribbean on cattle shipped from Senegal, Africa to Guadeloupe, in the mid 1700's and, subsequently, introduced to Antigua approximately 100 years later. Heartwater is now known to occur in livestock on three TBT infested islands in the Caribbean; Guadeloupe, Marie Galante and Antigua. *Amblyomma variegatum* is also associated with an acute skin disease caused by the bacterium, *Dermatophilus congolensis*. In areas where the tropical bont tick is located, Dermatophilosis can be a problem. TBT and its associated diseases were confined to three tick infested islands until cattle egrets migrated into the Caribbean region, from Africa, in 1956. Spread of this tick is associated with the movement of cattle egrets, rodents, small ruminants and cattle. Increased trade of live animals among the islands and increased numbers of cattle egrets resulted in the spread of the tick. At one time or another, 19 islands have been infested with TBT. These include St. Croix, Virgin Islands and Puerto Rico.

Since 1994, USDA has been involved in the Caribbean Amblyomma Program (CAP). The goal of CAP was the eradication of TBT from the Caribbean. In addition to the USDA, the European Union (EU), Inter-American Institute for Cooperation on Agriculture (IICA) and the FAO were external donors and participants in the program. From 1994 to 2005 the program had approximately $1.3 million per year from external donors. However, IICA withdrew from the program in 1998. In 2003 the EU funds were exhausted and in 2005 the FAO funds were exhausted. The TBT eradication efforts in the English and Dutch speaking Caribbean continues to be carried out by the island nation governments with financial support from the USDA. Through a memorandum of understanding the FAO administers the USDA funds and the Caribbean Amblyomma Program. Oversight of the program is provided by the Amblyomma Program Council (APC). Members of the APC are either cooperating countries or donors to the eradication program. Currently the USDA is the only external donor of financial support and serves as consultant to the program and thus is a member of the APC. USDA's current financial contribution to the program is the line item amount of $350,000.

The Caribbean Amblyomma Program covers the following nine islands: Anguilla, St. Kitts, Nevis, Montserrat, Dominica, St. Lucia, Antigua, Barbados, and St. Maarten. Six of the nine islands had been certified as provisionally free from TBT: St. Kitts, St. Lucia, Anguilla, Montserrat, Barbados and Dominica. However, on analysis and review it was found that the pathway to certification was technically flawed (Certification was based on the absence of adult ticks for two quarters, when it is known that larvae and nymphs can survive in the environment up to 48 months). Only Anguilla and Montserrat have remained TBT free, along with St. Vincent. The other four islands have suffered from minor (Barbados) to major (St. Kitts, St. Lucia and Dominica) re-infestations or recrudescence of TBT. It should be noted that Montserrat and Anguilla are the two smallest islands in the program with the smallest livestock populations. St. Vincent had one hot spot of TBT, on the north end of the island, that was cleaned up early in the

program. Montserrat and Anguilla no longer have active TBT surveillance programs, which is a concern since re-infestation can occur.

At the December 2005 meeting of the APC the council realized that eradication was not attainable with the limited funding. External funding had dropped from $1.3 million a year to $350,000. In addition, the following are some of the reasons the program was not as successful as it was initially predicted: (1) Livestock Management practices were not conducive to pest eradication; (2) The program was inconsistently and inadequately funded; (3) Compliance with treatment schedules and the legislation were not enforced; (4) Management procedures were inconsistent and too complex with ten government administrations and six international agencies involved; (5) National staff and farmers suffered from considerable fatigue, initially it was to be a five to six year program, it is now in its twelfth year; (6) The original model for eradication was technically faulty as it was based on 24 months of treatment instead of 48 months; (7) Livestock populations were underestimated; (8) The French West Indies continue to be a source of re-infestation, especially for Dominica.

The APC proposed that the main focus should be reoriented to a seasonal tick control program, or in some cases TBT hot spot management, and to continue the important activity of TBT surveillance. In addition, a cost recovery element should be introduced in each island for the acaricide, Bayticol pour-on. The APC also supported the plan to continue the following activities in support of the revised strategy: (1) Surveillance for the TBT and other potential trans-boundary animal diseases and pests; (2) Emergency preparedness in the face of new TBT infestations; (3) Improving the understanding of the importance of epidemiology and database management; (4) Regular reporting of animal diseases at the regional level.

An Estimate for the eradication of TBT in the English Speaking Caribbean is approximately $30 million over a seven year period. This would only be attempted if the French West Indies pushed for eradication as well.

Dr. Arnaldo Vaquer, National Center for Import and Exports (NCIE) VS-APHIS-USDA, gave an update on imported reptiles and exotic ticks. Formal action on reptiles will be dependant on the outcome of the pathway analysis currently being conducted by USDA-APHIS-VS and appropriate funding. In addition, the Centers for Disease Control and Prevention (CDC) currently is looking at zoonotic issues associated with importation of exotic animals, including reptiles. USDA-APHIS-VS is looking at long term strategies to address exotic animal trade as well.

Dr. Tom Kasari, Center for Epidemiology and Animal Health (CEAH), VS-APHIS-USDA, gave an update on the preliminary findings of an analysis of pathways for exposure of domestic and wild ruminants in the United States to heartwater (*Ehrlichia ruminantium*). Pathways that were evaluated for release of heartwater (*Ehrlichia ruminantium*) into the US included: (1) legal and illegal importation of heartwater-infected domestic or wild ruminant species, (2) legal and illegal importation of domestic and wild ruminant species, birds, and reptiles infested with *Amblyomma spp.* tick vectors, (3) migration of cattle egrets infested with heartwater-infected tick vectors, (4) accidental importation of heartwater-infected tick vectors on fomites (e.g. people; horses, donkeys, mules; bedding and feedstuffs; animal hides, skins, and furs;

commodity containers and hull of transport vessel), and (5) smuggling of *E. ruminantium*. Each pathway was evaluated for its importance using data confined to the calendar years 2000-2005.

Legal importation of domestic ruminants from heartwater endemic African or Caribbean countries is currently not a feasible pathway. However, importation of wild ruminants for zoological purposes or birds for zoological or private intents may be a feasible pathway, provided circumvention of quarantine and inspection procedures occur for these animals at the country of origin and then again at the point of entry into the U.S. Illegal importations of wild or domestic ruminants indigenous to Africa or the Caribbean into the US do not appear to be occurring. Legal and illegal entry of birds, however, may be a feasible pathway for the release of heartwater tick vectors (with or without *E. ruminantium* infection) into the US. Legal importations of reptiles are frequently made into the US through ports in MD, IL, TX, MI, MT, CA, FL, NY, GA, District of Columbia, and are a feasible pathway for release of tick vectors (with or without *E. ruminantium* infection) into the US. Because illegal entry of reptiles has occurred in the US in recent years, this should also be considered a feasible pathway. The migration of tick-infested cattle egrets from the Caribbean should also be considered a feasible pathway for release of *Amblyomma spp*. tick vectors (with or without *E. ruminantium* infection) into the US.

Many commodities from heartwater-endemic countries flow into the U.S. Ports in FL, GA, NY, and TX received the greatest volume of commodities shipped by ocean-going vessels or air freight. No data were found that reported the number and species of arthropods recovered from containers or hulls of transport vehicles. Airline passengers originating from heartwater-endemic countries that enter the US are a feasible pathway for release of heartwater vector ticks into the US. *Amblyomma spp*. ticks have been found attached to humans and free in passenger baggage. Airports in NY, FL, NJ, NC, PA, GA, and the District of Columbia received nearly all of the passengers from these countries. Smuggling of *E. ruminantium* into the US for agroterrorism purposes was considered a feasible pathway, but of unknown importance.

Dr. J. Mathews Pound, USDA-ARS, Knipling-Bushland U.S. Livestock Insects Research Laboratory, gave an update on studies on white-tailed deer and the cattle fever tick. Cattle ticks, *Boophilus annulatus*, and southern cattle ticks, *B. microplus* were declared eradicated from 15 states (14 southeastern states plus California) in the U.S. as far back as 1943, however, frequent re-infestations originating from errant tick-infested cattle or ungulate wildlife entering from Mexico transporting ticks into Texas across the Rio Grande continue to be found 63 years later. Measures to detect and re-eradicate these re-infestations are constantly implemented through the cooperative efforts of the USDA-APHIS-VS Tick Eradication Program and the Texas Animal Health Commission (TAHC). Although the predominance of these re-infestations are most likely related to Mexican cattle crossing the Rio Grande into the U.S., there is evidence that increasing populations of wild white-tailed deer and exotic ungulates including nilgai antelope, axis deer, and others may be responsible for the establishment, dispersal, and maintenance of tick populations on infested premises where cattle have been vacated in accordance with regulatory statutes. In past years there have been numerous confirmed reports of heavily infested white-tailed deer, elk, and nilgai, proving

their potential role as viable hosts for fever ticks. Epidemiological data from Zapata County show that during 2004 and 2005 approximately 26% of the adjacent quarantined premises became infested and 10% of the infested quarantined premises became re-infested, which strongly implicates white-tailed deer in transporting and distributing fever ticks among these premises.

Although systematic dipping of cattle continues to be the preferred and proven method of eradicating ticks from infested premises that also have abundant deer populations, simultaneously infested quarantines currently numbering 60 (46 in the systematic area and 14 in the free area) severely tax available resources of the Fever Tick Eradication Program to employ the 14-day dipping schedule at all 60 sites. Therefore, when the presence of white-tailed deer is suspected or directly demonstrated as in the case of the La Anacua Ranch in Starr County where 19 of 25 white-tailed deer were captured and determined to be heavily infested with southern cattle ticks, systemic or topical treatment of deer is implemented to minimize their effects as viable hosts. The use of macrocyclic lactones including ivermectin or doramectin coated onto re-cleaned whole kernel corn and fed to deer at a prescribed dose by employing a calibrated automatic sling feeder is a preferred method to systemically control ticks on deer. Because, when in the presence of abundant forage, deer will consume only approximately 1 to 1.25% of body weight in corn per day; corn is a self-limiting diet which makes it an ideal dosing medium for deer. Field trials of ivermectin-medicated corn were successfully implemented to control cattle ticks on elk and white-tailed deer on the 6,500 acre Apache Ranch and a 22,000 acre portion of the Catarina Ranch, respectively, both of which lie within the tick quarantine zone along the Rio Grande adjacent to the Texas-Mexico border in Webb County, TX, north of Laredo. To circumvent the restriction on human consumption of macrocyclic lactone residues in systemically treated venison, '4-Poster' Deer Treatment Bait Stations and 4-Poster 'Tickicide'®, an oily 10% formulation of permethrin requiring no withdrawal time from application to consumption of venison, is used to treat deer when restrictions or situations otherwise prevent use of the medicated bait.

Although cattle and cattle fever ticks have often been observed on white-tailed deer, and epidemiological evidence strongly suggests their role as viable hosts in infested premises, we used cattle to infest two deer-fenced pastures within the Cattle Fever Tick Research Laboratory, Moore Field, TX, removed the cattle and replaced them with white-tailed deer. Subsequently, deer were captured, scratched, and proven capable of maintaining the ticks beyond the regulatory 9 month vacation period. Two additional pastures have been planted with native vegetation and will be used to repeat the white-tailed deer experiment, as well as determine viability of several common exotic species.

While the '4-Poster' technology has widely tested and shown to be quite efficacious against lone star and blacklegged ticks feeding on white-tailed deer, it has not been scientifically evaluated against cattle fever ticks. Therefore, the quarantined pastures also will be used to evaluate the '4-Poster', and also a proposal and protocol has been written and submitted to the USDA-APHIS-VS Cattle Fever Tick Eradication Program to demonstrate efficacy of the technology under real world conditions within the quarantine zone. When a suitable situation is found, deer will be captured to confirm infestation and'4-Posters' will be deployed and closely monitored in infested

pastures that have been vacated of cattle. Similarly infested deer in infested and vacated pastures also will be monitored simultaneously as an untreated control. ARS-designed short octagonal exclusion fences encircling individual '4-Posters' also will be evaluated as needed to prevent javelina and feral swine from accessing and destroying the devices.

A third technology that has much promise in controlling fever ticks on deer is the ARS-patented automatic collaring device that passively applies and individually sizes acaricidal neckbands to deer. Field tests with lone star ticks show equivalent efficacy to both medicated bait and '4-Poster' technologies but with considerably less labor involved. A 4th generation device is currently being field tested for acceptance by deer, and actual collaring trials should commence shortly.

Dr. John Welch, Knipling-Bushland U.S. Livestock Insects Research Laboratory, ARS presented a summary of cattle fever tick epidemiology. Current research being conducted at the Knipling-Bushland U.S. Livestock Insects Research Laboratory is focusing on the development of a geological information system (GIS) database as a tool for epidemiological analysis of cause and effect relationships associated with risk of cattle fever tick infestations. The goal is to incorporate historical data collected since 1976 that include details on all cattle fever tick infestations such as types of quarantines, dates of quarantine inception and release, and the geographic location of the quarantined premises. Maps generated with data from the tick-infested premises and the adjacent areas are currently used by Cattle Fever Tick Eradication Program personnel to assist them with the process of demarcation of adjacent and check premises around the tick-infested property. In recent years Zapata County, Texas, has had the largest number of infestations and re-infestations of the eight counties located within the quarantine zone along the Texas-Mexico border and is a major focus of current research. One emphasis of this project is an analysis of relationships between white–tailed deer and cattle fever ticks. An investigation of deer and tick habitats, using remote sensing including satellite imagery and aerial photography, is underway.

Dr. Paul Ugstad, VS-APHIS-USDA, gave an update on the Cattle Fever Tick Eradication Program in Texas. Year 2006 is the 100th anniversary of the initiation of the Cattle Fever Tick Eradication Program. The United States was initially declared free of cattle fever ticks in 1943. The fundamental activities of the program are to (1) service quarantined premises, (2) conduct horseback river patrols, and (3) trace movements from infested premises.

Drs. Gale Wagner, Texas A&M University, gave a presentation on bovine babesiosis and cattle fever ticks and efforts to partner with Mexico. A number of significant changes have occurred in South Texas and Northeastern Mexico in the last twenty years or so which have possible bearing on both the frequency of tick outbreaks, the increased difficulties in eliminating ticks, and the potential for outbreaks of bovine babesiosis. (1) Increasing brush invasion has covered the majority of both South Texas and Northeastern Mexico rangeland. Research has shown that temperature and humidity conditions in canopy covered habitats are more conducive to tick survival than open grass habitats. (2) Improved grasses tolerant of periodic droughts in the region, and methods of managing brush have enabled cattle

producers in many areas to improve rangeland and increase carrying capacity. Range improvements in Northeastern Mexico have also fostered larger cattle populations. As a result, the potential for both tick infestations and disease has increased. (3) Recent innovations in range and wildlife management practices have promoted the production of cattle, elk and deer, as well as nilgai and many other species of exotic hoofstock. The management of wildlife has added both diversity and increased the density of suitable tick hosts. In recent years, *Boophilus* infestations in Texas have been traced to tick-infested nilgai from Mexico. (4) *Boophilus* spp. have been shown to be able to complete all stages of the life cycle on deer and elk. The implication is that deer and elk are also exposed to *Babesia bovis* and *Babesia bigemina*. In fact, *Babesia odocoilei* is endemic in deer in northeast Texas. Natural transmission of *Babesia* from deer to cattle by ticks has been difficult to demonstrate, but the possibility cannot be discounted. (5) The smuggling of livestock, and smuggling of contraband using livestock for transportation continues to present a threat to the introduction of ticks and tick-borne diseases. (6) Several recent infestations of *Boophilus microplus* in South Texas have been diagnosed as resistant to an organophosphate, pyrethroid, or formamidine (amitraz) acaricide. Because of the complex problem in Mexico with acaricide-resistant populations of *B. microplus*, we can expect continuing problems with resistant ticks in South Texas. These issues have increased the resolve of scientists from both Mexico and the US to increase cooperative research and more frequent communication on these issues.

Dr. Hugo Fragoso-Sánchez, Centro Nacional de Servicios de Constatación en Salud Animal / Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria (SENASICA) Carretera Cuernavaca-Cuautla Km. 11.5. Jiutepec, Mor. México, gave a presentation on the Mexico National Campaign against *Boophilus* spp. ticks. *Boophilus microplus* is an important problem for pasture cattle production in tropical and subtropical regions. The geographical distribution of this tick includes 53% of Mexico (1,043,72 Km^2) and affects 70% of the cattle. In Mexico, *Boophilus spp.* tick control began in the second decade of the 20th century, with isolated actions being taken against the tick in the states of Chihuahua in 1927 and Sonora in 1928. The state of Sonora initiated a campaign in a technical and intensive way in 1960, ending with the liberation of 2.5 million hectares in 1972, and establishing the essential program characteristics that still persist. In 1969 the Secretary of Agricultural and Cattle Production (SAG) established a federal program by which each state of the country was incorporated into national program of *Boophilus spp* control and eradication.

At the end of 1975, in trying to improve the eradication and control program and in attending to the petitions of cattlemen, the Fideicomiso National Campaign Against the Cattle Tick was created. This program operated for 10 years with special financial support for the construction of dip vats, the acquisition of acaricides, supervision of the development of the Campaign, and the construction of the National Center of Animal Parasitology being given by the World Bank. In those ten years, the number of dip vats increased to 36,665, and in 1985 a total of 45.8 million treatments were given. A national financial crisis in 1984 resulted in a restructuring of the Campaign, and the program was reduced to operations in the Animal Health Department under the direction of the Secretary of Agricultural and Hydraulic Resources (SARH). After1984 the financial resources available to the program continued to be reduced, resulting in the suspension of the eradication and surveillance efforts, and leading to delays in the

program as manifested by the following: (1) Loss of almost 60% of the dip vat infrastructure and quarantine stations; (2) Appearance and dispersion of tick resistance to acaricides in 1993; (3) Reinfestation of free areas previously liberated by the campaign in the north of Sinaloa, Durango and Baja California states; (4) Lack of information about the situation in the tick free zones; (5) Absence of supervision in the operation of dip vats with evident technical deficiencies; (6) Relaxation of the inspection service, with movement of cattle with ticks throughout the country; (7) Lack of national coordination, with the only leadership in tick control by the cattle producers and state governments.

In 2003, the Animal Health General Director of Servicio Nacional de Sanidad, Incocuidad y Calidad Agroalimentaria (SENASICA)-Secretaria de Agricultura, Ganaderia, Desarrollo Rural, Pesca y Alimentacion (SAGARPA) took advantage of a federal reorganization and reorganized the national campaign**,** providing additional financial resources and designating state coordinators. After 2003 a new program was proposed, with the different operations organized into four main strategic programs; (1) Regionalization; (2) Eradication; (3) Animal Movement Control; (4) Management and Prevention of Resistance. The Tick Campaign now has a National Coordinator, who is integrated into the Direction of Zoosanitary Campaigns, National Director of Animal Health, SENASICA, 22 state coordinators that depend on state committees, and a national laboratory for the diagnosis of resistance and efficacy evaluation of acaricides registered by the government. The legal basis for the operation of the campaign can be found in the NOM-019-ZOO-1994, "Campaña Nacional contra la Garrapata *Boophilus spp*", which contains procedures and strategies for the cattle tick control. In addition, it is supported by the Ley Federal de Sanidad Animal de los Estados Unidos Mexicanos (D.O.F. 18 de junio de 1993). Beginning in 2004 several states, including Baja California Sur, Zacatecas, Aguascalientes, Coahuila, Tlaxcala y San Luis Potosí initiated studies to understand the distribution of the areas naturally free of the ticks.

Strategic Programs

A. Regionalization

A.1. Delimitation of Free and Infested Areas

In 1984, when the initial tick control program was discontinued, a total of 94,438,508 hectares had been declared free of the *Boophilus spp*, tick. We still consider as free of *Boophilus* spp, parts of the states of Baja California, Baja California Sur, Chihuahua, Coahuila, Nuevo León, Durango, Zacatecas, San Luis Potosí, Guanajuato, Hidalgo, Estado de México, and Puebla, and all the states of Aguascalientes, Sonora, Tlaxcala and Distrito Federal. This corresponds to approximately 48% of the national territory. However, we don't know how far the reinfestation has proceeded, nor do we know how recent climatic changes have affected the natural free zones. Currently, some states have initiated surveys to determine the actual limits of the natural free zones.

A.2. Establishment of the buffer zones

There is only one buffer zone established in the country and it is located in the south of the state of Sonora. The program is part of the disease surveillance managed by the state government to reduce the risk of introduction of fever ticks and other exotic disease agents. A division of Federal government is notified when a tick outbreak is detected and confirmation is needed. With the reorganization of the national campaign two new buffer zones will be established in the north part of the country

B. Eradication

Before 1994 the only place that worked in the way of eradication was Coahuila border zone (next to Texas), none the less the program after 10 years have not shown any advance. Since 2003 new eradication zones have been included in the campaign in the states of Ensenada, Baja California, Sinaloa North and south-west of Chihuahua. Important advances have been made using long-acting Ivermectin applied every 60 days. Baja California obtained recognition from the Federal Government as tick free state. Chihuaha has been able to release two of five municipalities and Sinaloa will have a new free zone in 2007 including more than 100,000 animals.

In 2006 the National Program is trying to include a new eradication zone in northern states bordering with Texas. The main goal is to eradicate *Boophilus* spp. from an area including more than 700,000 animals in two stages, first in the border over a period of two years and the second in the rest of the states of Coahuila, Nuevo Leon and part of Tamaulipas for 2011. The advance will depend on the financial resources that the government can apply.

C. Animal Movement

C.1 Evaluation of Quarantine Stations and Line Dip Vats

Mexico has two systems of animal movement control. One is operated by the Federal Government and identified as the Quarantine Line, the other is operated by the state governments and identified as the Intrastate Verification Point. In the first case there are 43 stations in two different lines, north and south, 22 of them with dip vats. Since 2006 the reference laboratory receives frequent samples of the medicated water to determine the pesticide concentration. All the dip vats are using double the commercial concentration of Amitraz (400 ppm) to avoid moving Amitraz resistant ticks to different parts of the country. Three stations have trained personnel and microscopes in order to make immediate tick identifications when shipped cattle are stopped.

D. Tick resistance prevention and management

In 1993, permanent surveillance was established with the support of the pharmaceutical industry and cattlemen. Surveillance began due to the fact that pyrethroid-resistant ticks had been detected in the gulf zone of Mexico. The program works on opportunistic identification of cases of resistance, consultation with cattlemen as to the resistance detected, and establishment of a quarantine when a new resistance is detected. The

program has maintained a database since 1993 that includes pesticide resistant type, geographical distribution, pesticide use history and date of report.

An important focus of the program is to train bovine practitioners on management of resistance and to train approved veterinarians by SAGARPA on tick control. Usually the state coordinators provide conferences for cattlemen on tick resistance and rational use of pesticides. Mexico has a reference laboratory for testing for acaricide resistance that receives samples from throughout the country and gives training on diagnosis to technicians from Mexico and Central America. There are three additional labs in Nuevo León, Yucatán and Tamaulipas.