REPORT OF THE COMMITTEE ON PARASITIC DISEASES

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The Committee met on Wednesday, October 27, 2004. In attendance at the meeting were at least 39 people, including 13 members of the Committee. Reports were provided on a number of parasitic disease issues of interest.

John George, Diane Kammlah, and Mat Pound, United States Department of Agriculture (USDA), Agriculture Research Service (ARS), Kerrville, Texas, and Edwin Bowers, USDA, Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS), Laredo, Texas discussed "Recent Developments in the Occurrence of Cattle Fever Tick Outbreaks and Results of Research to Develop Improved Technology for Tick Eradication."

Historically, there are annual incursions of cattle fever ticks, *Boophilus annulatus* and *B. microplus,* into south Texas when errant tick-infested livestock and free-ranging white-tailed deer from Mexico cross the Rio Grande into Texas. Each year a variable number of such incursions result in populations of cattle fever ticks that infest cattle in Texas pastures that are usually close to the river. During the first nine months of calendar year 2004, 77 premises were quarantined after cattle fever tick-infested cattle were identified on them by personnel of the USDA-APHIS-VS Cattle Fever Tick Eradication Program (CFTEP). The number of infestations discovered thus far this year is 2.9 times greater than the number of tick outbreaks reported from January through September in 2003 and seven times greater than the total number for all of 2002. It is noteworthy that 21 (27%) of the tick-infested premises were located in the so-called "Tick Free Area" outside the Quarantined Zone (Systematic Area). In 2004, 65% of the infested premises have been in Zapata County, a county that is located in the lower one-third of the

800 km-long Systematic Area and which is separated from Mexico along most of its border by Falcon Lake, a large lake formed by a dam across the Rio Grande. Past attempts to relate the prevalence of tick outbreaks to climate have generated inconclusive results. Even so, a series of warmer than average winters and above average precipitation in southern Texas and northeastern Mexico would favor growth of *Boophilus* populations and seem likely to be important variables in the epidemiology of recent cattle fever tick problems.

The use of a Global Information System (GIS)-based approach by USDA-ARS, Kerrville, Texas to geo-reference and map historical and current locations of *Boophilus* infestations in the Systematic and Tick Free areas promises to be useful in the identification of factors related to the occurrence and distribution of infestations of *B. annulatus* and *B. microplus.* Maps pinpointing new infestations are being used currently by the CFTEP to delimit 3-mile buffer zones around an infested premise as part of the quarantine and tick eradication process.

Ticks collected from a *B. microplus* population discovered on a ranch in Starr County, and tested with standard bioassay methods and an experimental biochemical diagnostic method were found to be resistant to the organophosphate acaricide coumaphos. The high concentration of coumaphos used routinely by the eradication program to treat cattle on a tick-infested premise was used in a systematic series of four acaricide applications that prevented re-infestation of the cattle by coumaphos-resistant ticks and resulted in tick-free cattle that could then be moved from the infested premise.

Mat Pound, Allen Miller, John George and Diane M. Kammlah, USDA-ARS Kerrville, Texas, and Edwin Bowers, USDA-APHIS-VS, Laredo, Texas, reported on technologies developed by USDA-ARS to aid the USDA-APHIS-VS CFTEP through passive acaricidal treatment of ticks feeding on white-tailed deer and other wild ungulates.

Although the cattle tick, *Boophilus annulatus*, and the southern cattle tick, *B. microplus* were declared eradicated from 14 southeastern states in the United States as far back as 1943, frequent re-infestations from Mexico into Texas along the Rio Grande continue to be found and regulatory re-eradication measures implemented by USDA-APHIS-VS CFTEP personnel. The majority of these incursions are cattle-related, resulting either from native or Mexican exposures, however, there are increasing instances in which wild ungulates such as white-tailed deer and elk are implicated in the establishment and spread of infestations and also in helping to maintain tick populations on infested premises where cattle have been vacated in accordance with regulatory provisions. Because of the influence of increasing populations of both native and exotic wild ungulates within and near the tick quarantine zone in compromising tick eradication efforts, the USDA-ARS began research and development of technologies to control ticks

feeding on these animals in 1989. As a result of these efforts, several technologies have been developed and field-tested that include use of both systemically and topically active acaricides.

The first technology involved systemically active macrocyclic lactones including ivermectin and doramectin that were coated onto recleaned whole kernel corn and fed to white-tailed deer. It was discovered that, in the presence of abundant forage, deer will consume only about 1% body weight of corn per day; therefore, corn is a self-limiting diet for deer that makes it an ideal dosing medium. In the early and mid-1990's, field trials of ivermectin-medicated corn were implemented to control cattle ticks on elk and white-tailed deer on the Apache and Catarina ranches, respectively, that are located adjacent to each other within the tick quarantine zone along the Texas-Mexico border. The selective treatment of elk on the Apache Ranch led to the successful eradication of ticks from the ranch for the time since the mid 1950's, and treatment of white-tailed deer on the Catarina resulted in eradication of ticks for the first time since records were begun in the mid 1930's.

Because consumption of macrocyclic lactones by humans is not legal in the United States, the systemic tick control technology may not be used in ungulate game animals during or within 90 days before hunting season. To circumvent this restriction, a passive topical treatment device for white-tailed deer was developed and named the '4-Poster' because of the 2 vertical application rollers located on each end. The '4-Poster' Deer Treatment Bait Station consists of a single centrally located bin to hold whole kernel corn used as bait and 2 feeding/treatment stations each located on either side of the corn bin. The feeding/treatment stations are designed to force the side of the head, neck, and ears of the deer to come in contact with acaricide impregnated application rollers as the deer feeds on corn that slowly flows via gravity down a slope leading from the corn bin. Whole body counts of the lone star tick, *Amblyomma americanum*, on deer anesthetized during field trials in Texas of '4-Posters' charged with an oily formulation of amitraz showed 97% control of ticks on deer from the Treatment Pasture as compared with those in a similar Control Pasture. After 3 years of treatment during periods of major tick activity, greater than 90% control of free-living adult and nymphal ticks was observed in the Treatment vs. Control pastures. Subsequently, extensive field trials in Maryland, New Jersey, New York, Connecticut, and Rhode Island demonstrated significant control of free-living populations of lone star and/or blacklegged ticks, *Ixodes scapularis*, through passive application of oily formulations of amitraz and permethrin. During 2003, a 10% oily formulation of permethrin was approved by the United States Environmental Protection Agency for use on white-tailed deer when applied by the '4-Poster' Deer Treatment Bait Station. Both the '4-Posters' and permethrin acaricide are now commercially available in most regions

of the United States, and experimental field trials are underway at the ARS tick quarantine facility at the Cattle Fever Tick Research Laboratory, Moore Field, Texas to quantify efficacy against *Boophilus* sp. feeding on white-tailed deer and other wild ungulates.

USDA-ARS scientists also have developed and patented a device that passively applies acaricidal or other neckbands on white-tailed deer and a portable capture and handling facility consisting of a rotunda, working boxes, and patented lift-chute for white-tailed deer that causes minimal stress and therefore minimizes development of trap-shyness in captured deer. A field trial with deer that were captured with the facility then manually fitted with amitraz impregnated neckbands showed similar efficacy against free-living populations of lone star ticks as was obtained in similar studies using either the ivermectin medicated bait or '4-Poster' technologies. In addition, ARS scientists have developed slow-release injectable macrocyclic lactone impregnated microspheres that, through slow degradation within the animal, provide doses of acaricide that extend efficacy for several months.

Miguel A. Borri-Diaz, USDA-APHIS-VS, Puerto Rico and United States Virgin Islands (USVI), gave an update on the effort to eradicate the Tropical Bont Tick (TBT) from St. Croix, USVI. The following was his report:

BACKGROUND:

The TBT, *Amblyomma variegatum*, was first observed in St. Croix, USVI, in 1967 when Dr. Duke Deller, State Veterinarian, USVI Department of Agriculture, collected the tick from cattle during a routine visit. At that time in history, six adjoining farms on the western end of St. Croix were infested by the TBT. By March 1968 the number of TBT infested farms had increased to 11. The appearance of the TBT in St. Croix was associated with the increase in the abundance and range of the cattle egret in the Caribbean region. The USVI Department of Agriculture began an aggressive eradication effort and in 1972 St. Croix was declared free of *A. variegatum*.

In 1987, after being free of the TBT for 15 years, Dr. Duke Deller, on a routine sick call to Sion Farms, collected tick samples from a dead bull. These ticks were identified at the University of the Virgin Islands as a male and female of *A. variegatum*. Due to a lack of funds to establish an aggressive eradication program as was done in 1967, the affected farm was quarantined and the animals involved were routinely sprayed with an acaricide. By September 2003 the number of TBT infested farms had increased to eight.

The TBT is associated with acute dermatophilosis, and is an important vector of *Cowdria ruminantium*, which causes heartwater disease in ruminants. Livestock producers in the Continental United States,

Caribbean and South America have developed an interest in the St. Croix Senepol breed of cattle. The presence of the TBT in St. Croix limits the possibility of exportation of the Senepol to Continental United States and other interested countries.

In an attempt to encourage importation of the Senepol into the Continental United States and other interested countries, USDA-APHIS-VS entered into a Cooperative Agreement with USVI Department of Agriculture to establish a TBT eradication program on St. Croix. The expected increase in exportation of the Senepol cattle will greatly aid and increase the economy of St. Croix.

PROGRAM COMMENCEMENT AND PROGRESS:

USDA-APHIS-VS has been operating much of their TBT related activities in St. Croix during the past years using APHIS Administrator's Contingency Funds which were not assured each year and were very limited. During November 2002, VS and USVI Department of Agriculture representatives met in Miami, Florida to discuss and identify action items and issues that had to be addressed in an effort to request the total funding needed to attain TBT eradication in St. Croix during the next two years. During October 2003 VS and USVI Department of Agriculture representatives met again in St. Croix to discuss actions taken on the issues identified at the Miami meeting. It was determined that the USVI Department of Agriculture and USDA-APHIS-VS personnel in St. Croix had accomplished and resolved all action items. For FY04, $500,000 in funds was allocated for a TBT eradication program in St. Croix. The program will cover eradication efforts from September 2004 through September 2005. TBT funding for a second year will depend on progress attained in the eradication effort during the first year of the implemented program.

CURRENT STATUS:

The St. Croix TBT eradication program has entered the eradication stage. Two scratch teams are in the process of performing a 100% premise scratch in the eastern end of St. Croix. The purpose is to establish a dividing line between the quarantine and non-quarantine zones. At this time St. Croix has eight TBT infected premises. All of these premises are located at the western end of the island. These premises will be treated in accordance with the approved work plan by spraying with coumaphos every two weeks. The program is designed to attain eradication in 24 months. There will be an 18-month treatment period and a six-month surveillance period.

CONCLUSIONS:

In the Caribbean region, the presence of the TBT and its associated diseases dermatophilosis and heartwater disease has caused

major losses in productivity and international trade. In St. Croix, even though free of heartwater disease, the presence of the TBT has affected the exportation of its Senepol cattle to the Continental United States as well to interested South American and Caribbean countries. The eradication of *A. variegatum* will offer St. Croix the opportunity to strengthen its weak economy by increasing revenue through exportation of its highly regarded beef cattle. The reintroduction of *A. variegatum* into St. Croix in 1987 after 15 years of being free suggests that total eradication cannot be reached unless the entire Caribbean region is free of the TBT.

Richard E. Pacer (USDA) and Rupert G. Pegram, Food and Agriculture Organization, gave a progress report on the Caribbean Amblyomma Program.

BACKGROUND:

The TBT, *Amblyomma variegatum*, was first introduced into the Caribbean region in 1828 when infested cattle were imported from Senegal into Guadeloupe. During the past 25 years, it became established on several islands in the Lesser Antilles.

The TBT is associated with acute cases of dermatophilosis, and is an important vector of *Cowdria ruminantium,* which causes heartwater. The tick and its associated diseases cause high morbidity and mortality in domestic ruminants and wildlife, leading to considerable losses in production.

In 1994 the Caribbean *Amblyomma* Program (CAP) commenced in 8 English-speaking islands, namely Anguilla, Antigua, Barbados, Dominica, Montserrat, St. Kitts, Nevis, and St. Lucia, with the goal to eradicate TBT from these islands; in 1999 the Dutch-speaking island of St. Maarten was also included. The FAO provides the lead technical role for the eradication activities of CAP.

As of September 2004, external donors have invested about US $12 million in the program with over half of these funds contributed by USDA. Collectively, these funds have made a major positive impact and at this time, six of the nine CAP islands have been certified as provisionally free from TBT: St. Kitts and St. Lucia (November 2001), Anguilla and Montserrat (February 2002); and Barbados and Dominica (February 2003).

CAP also coordinates TBT surveillance activities on other Caribbean islands and was very instrumental in assisting St. Vincent in 2000 when that island became infested for the first time. Following emergency intervention, St. Vincent is now believed to be provisionally free from TBT since 2002-2003.

PROGRESS AND CHALLENGES DURING THE PAST YEAR:

During the past year, the CAP Regional Coordination Unit (RCU) and key technical personnel were relocated from Barbados to Antigua where it provides training and support to the national programs and overall coordination. Its strategic geographical position and proximity are facilitating more cost-effective support to Nevis and St. Maarten, as well as Antigua. The move has also fostered and allows for greater collaboration and liaison between CAP and French program officials in Guadeloupe.

During the past year, CAP has focused primarily on TBT eradication efforts on Antigua, Nevis, and St. Maarten. Major activities and outputs of the RCU during the year include regional workshops, production of a public awareness CD/video program and accompanying brochure in English, French and Spanish, other training manuals, etc., and coordination of production of quarterly, annual, consultants and other reports.

CAP has continued good collaboration and relationships with the French International Agricultural Research & Development Center (CIRAD) in Guadeloupe. The RCU, together with CIRAD, continued further development and supervision of the CAP database Tick*INFO* 4 with a GIS module to monitor TBT surveillance data. The former CAP website was incorporated into the CIRAD website, *CARIBvet*, in 2002, and during 2004 CIRAD implemented major system upgrades.

Despite the above successes, a lack of adequate funds in 2004 required program officials to scale back eradication efforts on Antigua until additional funds can be secured. Although national governments continue to provide both financial and material resources to the program, presently, the USDA is the sole external donor to CAP.

Furthermore, a lack of sufficient funds for surveillance and emergency response during the past 2 years has not allowed for adequate follow-up and surveillance efforts on the islands provisionally free from TBT. This is of great concern and urgency at this time because two islands, St. Kitts and St. Lucia, have identified serious re-infestations and spread of TBT during 2004 from the former much smaller residual hot-spots that were identified during 2002 - 2003.

CURRENT STATUS AND NEXT STEPS:

In early 2004 USDA-APHIS officials in consultation with CAP, university and industry officials wrote a comprehensive 5-year “Strategic Plan to Eradicate TBT from the Caribbean.” That document identifies needed financial and material resources and establishes target dates and milestones to achieve eradication of TBT and declare all CAP islands “provisionally free from TBT” by 2009. USDA-APHIS-VS also continues TBT control and eradication efforts on St. Croix, which became re-infested in 2000.

Following completion of TBT eradication on St. Croix and the CAP islands, funds will still be needed to assist Caribbean islands with disease surveillance activities to detect the introduction of TBT, as well as other exotic animal diseases until TBT is eradicated from the French West Indies. A 3-year proposal for an Animal Disease Surveillance network was developed and submitted to the International Fund for Agricultural Development (IFAD), but was not approved by their board. Consequently, the critical overall funding deficit for effective implementation of both eradication and surveillance program activities for 2005 has not yet been resolved.

CONCLUSIONS:

In the Caribbean region, the presence of TBT, and its associated disease dermatophilosis, has caused major losses in productivity in cattle, sheep, and goats. Similar losses in productivity of livestock and wildlife could be expected if TBT were to spread beyond the Caribbean to neighboring countries.

As stated previously at the 2003 USAHA Meeting, at the continental, regional level, area-wide eradication of the TBT from the Caribbean is essential to eliminate the foremost, original risk of spread to the mainland Americas of TBT.

Joseph L. Corn and Britta Hanson, Southeastern Cooperative Wildlife Disease Study (SCWDS), College of Veterinary Medicine, University of Georgia, Athens, Georgia, discussed "Surveillance for Exotic Ticks on Wildlife in the Southeastern United States and Puerto Rico." SCWDS is conducting surveillance for exotic ticks on wildlife in the southeastern United States and Puerto Rico in cooperation with USDA-APHIS-VS. Early detection of exotic ticks in these areas will increase the potential for eradication or control where exotic tick populations become established. One tick of great concern is the TBT, *Amblyomma variegatum.* This tick was introduced from Africa into the Caribbean in the 1800s, is a vector of heartwater and other diseases, and is a threat to wildlife and livestock in the Americas. Surveillance currently is being concentrated in Florida and Puerto Rico. Surveillance activities include examination of free-ranging wildlife captured at selected survey sites, environmental sampling using tick drags, examination of animals at wildlife rehabilitation facilities, examination of hunter-killed wildlife, and collection of specimens from wildlife examined during other collaborative projects involving live-captures and mortality investigations. All ectoparasites are submitted to the USDA-APHIS-VS National Veterinary Services Laboratories (NVSL) in Ames, Iowa.

The climate and abundance of wildlife in Florida are conducive to survival of introduced exotic ticks, and surveillance thus far has been concentrated in southern Florida. Active surveillance, including trap-

ping of free-ranging wildlife, began in Florida in August 2003. Free-ranging wild animals were captured at 71 sites, and over 1400 animals were examined from August 2003 – October 2004. Ectoparasites were collected from 511 animals, and identifications have been completed for 186 of these submissions. Environmental sampling using tick drags and/or tick traps was conducted at 24 sites, but ticks were only collected at three sites using these methods. Surveillance of wildlife at wildlife rehabilitation centers was conducted 11 times during August 2003-October 2004, and over 270 animals were examined. Ectoparasites were collected from at least 75 of these animals, and identifications have been compiled for 25 of the submissions. Surveillance of hunter-killed white-tailed deer and feral hogs was conducted at three sites; ectoparasites were recovered from 113/136 animals examined. Road-killed wildlife surveillance was conducted on survey routes that totaled 2,292 miles. Of 115 animals found during road-kill surveys, most were not suitable for examination.

Several areas in Puerto Rico have been targeted for surveillance due to the presence of feral animals. Active surveillance was conducted on Mona Island in Puerto Rico during February 2004. On Mona Island, a total of 82 animals including one native species; the Mona Island iguana, and three feral species; feral swine, goats, and cats, were examined. The island of Vieques, Puerto Rico is of special concern because of its proximity to St. Croix, U. S. Virgin Islands, an island where the TBT is present. Also, large areas of Vieques are in a natural state, and potential hosts for the TBT such as feral cattle, horses, and goats are present. Over 200 mongooses have been examined on Vieques, and ticks were recovered from about 30% of the mongooses examined. All ticks from Puerto Rico currently are being processed.

Although ectoparasite identification has been completed for only about 35% of the nearly 1000 submissions, several exotic lice and mites with origins in the Old World, South America, and the Caribbean have been identified. Intensive surveillance will continue at sites selected in Florida and Puerto Rico based on environmental factors, wildlife host abundance, and risk associated with pathways for introduction of ectoparasites. Surveillance will be conducted mostly by active trapping of free-ranging wildlife at selected sites as this method has been by far the most productive in terms of collection of ectoparasites.

Jack Schlater, USDA-APHIS-VS-NVSL, Ames, Iowa, reported on parasitology activities at USDA-APHIS-VS-NVSL. The purpose of the Parasitology Unit is to identify animal parasites of interest to USDA-APHIS-VS. To that end, most of the Unit's routine work revolves around ticks, screwworm suspects, and mange mites. At times other parasites, such as intestinal helminthes, *Cryptosporidium*, and *Giardia*, have been identified for large-scale surveys conducted by Veterinary

Services. In addition, the Unit has been able to participate in a number of cooperative activities that include identifying parasites from wildlife for the SCWDS, identifying bird lice and feather mites for the book *Parasites and Diseases of Wild Birds in Florida*, identifying lice associated with hair loss syndrome in black-tailed deer, and supplying data for the National Tick Survey website. Behind-the-scene activities include moving into new facilities and improving disaster recovery capabilities. The Unit is in the process of hiring additional personnel to improve the timeliness of identifications and in anticipation of additional tick submissions from enhanced surveillance in Florida.

Angela James, Jerome Freier, Suzanne Joy, Andrew Fox, and Kenneth Geter, USDA-APHIS-VS Center for Epidemiology and Animal Health (CEAH), Fort Collins, Colorado discussed "Reducing the Threat of Exotic Ticks by Geospatial Countermeasures." The introduction and possible establishment of foreign animal diseases in the United States is a growing concern based on recent reports describing the detection of exotic ticks on reptiles, birds, and mammals imported into the United States (Keirans and Durden, 2001). Of the diseases that may be carried by imported tick species, heartwater has the most serious implications on the U.S. livestock industry. Heartwater fever, caused by *Ehrlichia ruminantium*, occurs in sub-Saharan Africa and the eastern Caribbean and is transmitted by ticks belonging to the genus, *Amblyomma* (Uilenberg et al., 1984, Norval et al., 1992). The TBT, *Amblyomma variegatum* and the Bont tick, *A. hebraeum* are competent vectors of heartwater and these tick species have been found on imported wildlife species (Burridge et al., 2003). Resident *Amblyomma* species experimentally shown to transmit heartwater are *Amblyomma dissimile, A. maculatum*, *and A. cajennense*. *Amblyomma marmoreum* and *A. sparsum* are currently found in Africa and Central and South America, respectively; however, recently both species have been collected from captive reptile breeding facilities in Florida and both are competent experimental vectors of heartwater (Allan et al., 1998, Burridge et al., 2000).

CEAH is using geospatial methods to determine the distribution of arthropod vectors and vector-borne diseases affecting humans and livestock. Because, ticks are important vectors of pathogens, knowledge of their geographic distribution is important in developing targeted surveillance and control strategies. Therefore, our objective was to develop a model to describe the distribution of two African heartwater vectors, *A. hebraeum* and *A. variegatum* based on climatic, ecological, and topographic features and then apply this information as a predictive model to find locations in the U.S. with environmental conditions similar to those found in the normal habitat range.

Spatially-referenced data layers for the Bont and TBT were obtained

from an African Species Distribution Database housed at the University of Oxford (Cumming, 2000). Ecological and climate factors used in model development included: soil texture, soil type, elevation, minimum and maximum temperatures, precipitation, vegetation, sand and clay, slope, aspect, and landform. We randomly selected 10% of the Bont tick observations and 20% of the TBT observations for later use to cross-validate each model. The remaining tick observations were used to generate a model for each tick species and an equal number of random points were also selected throughout Africa. Attribute tables were populated with the same environmental variables for each set of tick observations and random points.

Likely presence or absence of the Bont tick and the TBT were modeled using logistic regression methods. Logistic regression models consider multiple, interactive, and curvilinear relationships among one or more predictive variables. In developing the TBT model, a principal component analysis, was used to reduce data redundancy and autocorrelation effects. In addition, we developed climatic zones using monthly minimum temperatures and monthly precipitation for Africa and North America to take into account seasonality differences on each continent. Our final logistic regression model for each tick species was selected by backwards elimination, based on the model with the lowest AUC (Area Under Curve). The predictive performance of the final models for Africa was evaluated using 10-fold cross validation and by predicatively comparing the results with those observations withheld from the model's development to the models' predictions.

The logistic regression model for *A. hebraeum* used 13 variables and *A. variegatum* model used 11 variables with a probability threshold of 0.5 for each model. The regression model for *A. he*braeum included the independent variables elevation, minimum temperature in August and May, maximum temperature in November, and precipitation in April. The logistic model predicted Bont tick presence in Africa with high accuracy (94% and 100% for independent accuracy assessment, respectively and 94% cross validation accuracy). In contrast, the logistic regression model for the TBT included the independent variables vegetation index in August and September, maximum and minimum temperatures in January and February. The logistic model predicted the TBT presence in Africa had a 78% and 85% for independent accuracy assessment, respectively and 85% cross validation accuracy. The logistic regression model predicted that the Bont tick would survive in 29 states dominated by the Pacific Northwest including parts of the southern and eastern coastlines. The logistic regression model for the TBT in the U.S. is currently under development.

The distribution of *A. hebraeum* in Africa was predicted to present in 30 different countries covering an area of 2,959,827 km^2 in the southern region of Africa, however, A. variegatum's distribution was predicted to present in 44 different countries covering an area of 7,221,203 km^2 with two large areas covering parts of the eastern and western half of Africa.

The potential distribution of *A. hebraeum* in the U.S. appears to reflect its likelihood of becoming established in areas with a high-level of precipitation during the winter months with moderate temperatures, about 40-70 degrees Fahrenheit. Although, the climatic factors associated with the distribution of *A. hebraeum* in Africa only appear to be similar along the coastline of California, Oregon, and Washington as well as areas along the mid-Atlantic coast, it is likely that A. maculatum has the capability of playing a major role in the establishment and spread of the disease in livestock and wildlife within the inner regions of the United States.

This work is on going and refinements to these models are being made that incorporate additional predictive variables, such as heating degree-days and soil temperatures. Identifying environmental factors that determine the preferred habitat of heartwater vectors is essential in developing spatially targeted surveillance measures for protecting animal agriculture in the United States.

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James Novy, International Advisor/Director, International Atomic Energy Agency, National Screwworm Eradication Programme, Veterinary Services Division, Ministry of Agriculture, Kingston, Jamaica discussed screwworm eradication in Jamaica. The New World Screwworm has been successfully eradicated from the United States, Mexico, Puerto Rico, the United States and British Virgin Islands, all of Central America and Panama. The screwworm continues to exist in the Caribbean in Cuba, Dominican Republic, Haiti, Jamaica and Trinidad and Tobago, as well as in most of the South American countries.

The Government of Jamaica (GOJ) organized a National Screwworm Eradication Programme in 1998 in partnership with the International Atomic Energy Agency. A three year program was planned. The GOJ had the commitment of $8 million from the U.S. PL480 funds (PL 480 - an "Emergency and Private Assistance" program to provide agricultural commodities to foreign countries on behalf of the people of the United States to: address famine or other urgent or extraordinary relief requirements; combat malnutrition, especially in children and mothers; carry out activities that attempt to alleviate the causes of hunger, mortality or morbidity; promote economic and community development; promote sound environmental practices; and carry out feeding programs) for the project and a commitment of $1 million from the International Atomic Energy Agency, including a Technical Advisor. An agreement was made with the Mexico-U.S. Commission for the Eradication of Screwworm whereby the GOJ would purchase the sterile screwworm flies for the project at cost. There was also an agreement with USDA-APHIS whereby the GOJ would reimburse the USDA-APHIS for the cost of airplanes used to transport the sterile insects from the production plant in Tuxtla Gutierrez, Mexico to Jamaica and to disperse the sterile flies over the island of Jamaica. Also, USDA-APHIS agreed to post an Animal Health Technician as a field advisor to the project in Jamaica.

By mid-1999, the infrastructure for the program was established and the first sterile screwworm flies were received in August 1999. Some reduction in the number of animal infestations was noted during 2000, but eradication was not achieved. In December 2000 there was a three-week interruption in the supply of sterile flies due to a labor problem at the plant in Mexico. Again at the end of June 2001 there was a five-week interruption in the supply of sterile flies due to a labor problem at the plant in Mexico. During this time the strain of sterile flies being produced was changed from the Costa Rica 92 strain to the Panama 95 strain. The number of infested animals has continued to be approximately the same each month since the inception of the program with about 3,000 cases reported each year. About 45% of the reported cases are from canine and about 2.5% from humans. The swine, bovine and caprine account for the majority of the remainder of cases reported.

Problems encountered and some of the reasons that the screwworm has not been eradicated from Jamaica:

1) Lack of importance given to the Programme by the livestock and animal owners;
2) Jamaica is a paradise for the screwworm: ideal climate and a very high density of hosts;
3) The level of the screwworm population was underestimated;
4) Nearly 70% of the animals are not attended to on regular basis. There are thousands of dogs, cattle and goats that roam freely over the island;
5) Funding and cash flow has been a problem. The GOJ has had difficulty allocating sufficient funds for the program. After the PL480 funds were expended at the end of 2001 the GOJ has had to fund 95% of the program. The IAEA has funded the remaining 5%;
6) There were interruptions in the supply of sterile screwworm flies and the distribution of sterile screwworm flies in the field. In addition to the labour problems at the plant in Mexico in 2000 and 2001 there were interruptions due to weather in May of 2002, in September 2002, and again in September 2004. There was a mechanical failure of one of the irradiators at the plant in Mexico in January 2003 that resulted in some of the screwworm flies to not be sterilized. In August 2003 the chill fly unit used to emerge and collect the sterile flies in Jamaica failed and was down for five weeks. Without consistent distribution of quality sterile flies eradication can not be achieved;
7) There were insufficient numbers of field inspectors during the first three years of the Programme. During 2003 and 2004 the U.S. Embassy to the IAEA in Vienna, Austria (as a result of the expressed need made by the USDA-APHIS) agreed to contribute US $400,000 to the IAEA, Division of Technical Co-Operation for the screwworm program in Jamaica provided that the IAEA would match this amount. This money was to be used to employ temporary field inspectors and supplies, and to pay for the salary and subsistence of the IAEA Technical Advisor; and
8) The management of the program has been part-time in that the Director of the Veterinary Services Division is also the Director of the National Screwworm Eradication Programme. Most of the time is spent on dealing with Import/Export Issues. Field supervision has also been insufficient for the same reason.

The GOJ has agreed to fund the National Screwworm Eradication Programme through March 2005, the end of the current GOJ fiscal year. The IAEA is only committed to fund the program until December 31, 2004. If there is no significant progress shown toward eradication of the screwworm by December 2004 it is very likely that the GOJ will not continue to fund the program beyond March 2005.

From March to July 2004 a portion of the island of Jamaica was treated with the Jamaica 03 strain of sterile flies, but no difference in

cases occurred in that region compared to the part of the island treated with the Panama 95 strain. In July 2004, the entire island once again has been treated with the Panama 95 strain. In June 2004, the contracted the services of a retired USDA-APHIS Entomologist who has been working to improve the quality of the sterile flies being produced and dispersed in Jamaica. The dispersal of sterile flies has been consistent with the exception of two weeks in September 2004 as a result of the passage of hurricane IVAN. Improving the quality of the sterile flies and getting consistent dispersal in the field over the next three months is probably the last effort to take this program to a successful completion.

The screwworm has been successfully eradicated from every country where the sterile flies have been used. Not only will this be a disaster for Jamaica, but a political problem as well since the GOJ has spent more than US $12 million on this program. It will also impact on future screwworm eradication efforts. The Dominican Republic is very interested in the eradication of the screwworm, but securing the necessary funding will be difficult if the program in Jamaica fails. Funding the project has been a major difficulty in Jamaica and will be in the other Caribbean countries. The programs in Mexico and Central America were funded at least 80% by the U.S. because there was the risk of re-infestation to the U.S. if the screwworm was not eliminated from those countries. Currently, the funding of the sterile fly barrier in Panama is being funded by more than 80% U.S. because it is an insurance that the screwworm will not migrate back north to the U.S. Unfortunately, the presence of the screwworm in the Caribbean islands is apparently not seen as a threat to re-infestation of the U.S. and these countries must look elsewhere for assistance.

Efforts to provide some influence to get the U.S. to help with the eradication of the screwworm from Jamaica, and also from the other Caribbean islands would be very beneficial. With the tourist traffic between the Caribbean islands and the U.S. there is some risk of reintroduction of the screwworm into the United States.

The Committee approved two (2) resolutions which were forwarded to the Committee on Nominations and Resolutions for approval by the general membership. The resolutions addressed:

1. Continued and increased funding for the Caribbean *Amblyomma* Program (CAP) and the TBT eradication program; and requesting USDA-APHIS-VS to encourage the French to place greater emphasis on eradication of TBT from the French West Indies; and
2. Funding for replacement of the USDA-ARS laboratory in Kerrville, Texas.