REPORT OF THE COMMITTEE ON BLUETONGUE AND RELATED ORBIVIRUSES

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The Committee met on October 22, 2012 at the Sheraton Hotel, Greensboro, North Carolina, from 1:00 to 5:20 p.m. There were 15 members and at least 40 guests present. James Maclachlan and William Wilson, Chair and Vice-chair, respectively, introduced the meeting. There was discussion of the previous year's resolution that the USAHA support efforts to remove the serotypes of bluetongue virus (BTV) that have been identified since 1999 in the Southeastern United States from the Department of Homeland Security's select agent list. Two resolutions were advanced for consideration from this year's meeting.

Presentations

Ten Years of Experience with Bluetongue in the EU. Lessons Learned

Francisco Javier Reviriego Gordejo
Head of Sector Disease Control and Identification; European Union, Brussels, Belgium

Dr. Reviriego Gordejo presented an overview of the sequence of events that occurred in Europe during their recent outbreaks that began in the Mediterranean Basin in 1998. He then reviewed the EU response to this event, the current situation, and an analysis of its economic and production impacts.

Spatial Analysis of Bluetongue and Epizootic Hemorrhagic Disease Virus Isolations as a Model to Monitor Impacts of Climate Change

David Dargatz
USDA-APHIS-Veterinary Services (VS)

This study focuses on bluetongue (BT) and epizootic hemorrhagic disease (EHD) viruses as candidates for an animal disease model that might be sensitive to large-scale climatic conditions associated with climate change. Data on BT and EHD virus isolations were provided by USDA's National Veterinary Services Laboratory (NVSL), the Southeastern Cooperative Wildlife Disease Study (SCWDS), and Newport Laboratories. Only virus isolation data were available, because records are not maintained on general serological test results for samples submitted for antibody detection. A total of 1,643 virus isolation records were obtained that had geographic information at the county level along with sample collection dates. The records used spanned 35 years (1976 - 2010) for BT virus and 30 years (1981 - 2010) for EHD virus. A total of 779 and 864 virus isolation records were analyzed for serotypes of BT and EHD viruses, respectively. For BT virus, 13 serotypes were identified with type 17 representing 51.0% of all samples identified to serotype. Three serotypes of EHD virus were found with type 2 accounting for 81.2% of all samples identified to serotype. In the temporal analysis of virus isolation records from each year, cyclic fluctuations were observed for both viruses. For BT virus isolations, a peak periodicity of about every ten years was observed; whereas, a five year peak periodicity was noted for EHD virus isolations. Virus isolation records were grouped into five-year blocks to minimize variability observed from year to year and to examine trends in virus isolation frequency, in addition to observing changes in the geographic distribution of virus isolates. Within the grouped data, BT virus isolates continued to show cyclic fluctuations in the frequency of occurrence; however, the EHD virus isolates showed a steady increase in reporting frequency beginning in the early 1990s. To assess potential impacts of climate change, the northernmost latitude of virus isolations was compared for each five-year group. Bluetongue virus isolations were found to show an increasing northward progression during the past 20 years; however, no similar trend was observed for EHD virus isolations. Geographic distribution comparisons of the accumulated BT virus isolation records showed that most virus isolations were from the southeastern US, the central Midwest, California, and the Pacific Northwest. Isolations of EHD virus were mostly from areas in the Midwest, central eastern states, and Texas. Nearly all of the endemic BT serotypes had a wide geographic distribution, except for type 2 which was only reported from Florida. In contrast, exotic BT virus serotypes were isolated from samples collected primarily from the southeastern US. All EHD virus serotypes were widely distributed geographically. Comparisons of changes in the geographic distribution of BT virus isolations for each five-year group showed that California and the Pacific Northwest had a high frequency of virus isolations over the past 35 years; however, there has been a steadily increasing number of BT virus isolations from Florida since 1991. While the overall geographic range of EHD virus isolations has changed little in the past 30 years, the frequency and density of virus isolations has increased progressively. Possible sources and mechanisms for the

introduction of exotic BT viruses into the southeastern US were considered in terms of vector dispersal and animal movement. Wind dispersal of *Culicoides* vectors as aerial plankton has been recognized in the introduction of novel types of BT viruses into Europe. The introduction of exotic BT viruses into the southeastern US appears to coincide temporally with patterns of hurricane and tropical storm activity moving across islands in the Caribbean. Recommendations are provided that would improve the use of BT and EHD virus isolation data in assessing the impacts of climate change on animal health.

Anthropogenic and Environmental Drivers of BTV Infection in California

Christie Mayo and N James Maclachlan
University of California, Davis

Our research team is addressing the critical and unmet need to incorporate biologically informative parameter estimates in epidemiological models to better quantify the risk of *Culicoides* transmitted diseases of livestock, specifically that of BTV infection in California. We are utilizing three key strategies to meet our objectives: 1.) targeted surveillance to define the biology and ecology of BTV infection among *Culicoides sonorensis* (*C. sonorensis*) midges and dairy cattle; 2.) development of practical epidemiological models informed by the parameter estimates collected from the field; and 3.) analysis of potential mitigation strategies through their incorporation into a dynamic model. In the last year we have undertaken targeted surveillance to understand the biology of *C. sonorensis* and BTV infection of dairy cattle. Previously published studies have shown dairy waste-water lagoon ponds to be a major larval habitat for *C.sonorensis* midges. However, the significance of these lagoons in determining midge abundance and subsequent BTV transmission to livestock within ecologically diverse regions such as Northern California remains conjectural. Therefore, two year-long studies were initiated in August, 2012: 1.) An entomological survey of *C. sonorensis* midges collected (using CO_2 – baited traps) along transects centered on dairy waste-water lagoons on individual dairy farms (one of which then drained the major lagoon habitat); and 2.) a spatial BTV seroprevalence survey of adult cattle throughout California. Preliminary data from our entomological studies already suggest that lagoon waste-water infrastructure likely does not serve as the sole, or even major larval habitat on individual dairy farms, meaning that other parameters that estimate/predict vector populations will need to be incorporated into our epidemiological model. Results from these field studies will be used to improve a deterministic ecological model we have constructed to quantify risk of BTV transmission among livestock. The model establishes a quantifiable framework to guide mitigation strategies and has potentially broader application to other emerging *Culicoides* transmitted diseases such as epizootic hemorrhagic disease, and to foreign animal diseases such as African horse sickness

Experimental Infection of Cattle with Epizootic Hemorrhagic Disease Viruses

Mark G. Ruder
USDA-ARS, Arthropod-Borne Animal Diseases Research Unit (ABADRU)

A series of collaborative EHDV-6 and -7 research projects conducted at the University of Georgia were described.

EHDV-7 Studies

Infection of cattle with epizootic hemorrhagic disease (EHD) viruses (EHDV) is frequently subclinical but reports of EHD in cattle have increased in recent years. In 2006, a widespread EHDV-7 epizootic caused disease and economic loss in the Israeli dairy industry. EHDV-7 is exotic to North America, but previous studies show that white-tailed deer are potential hosts and *Culicoides sonorensis*, a North American vector of EHDV, is a competent vector. Our primary objective was to infect cattle with EHDV-7 and attempt to replicate disease observed in Israel. A sub-objective was to evaluate cattle with low titer viremia ($<10^{2.3}$ $TCID_{50}$/ml) as a source of virus to feeding *C. sonorensis*. Seven, two-month-old Holstein calves were used. The virus was provided by the Institute for Animal Health, Pirbright Laboratory and was originally isolated from a cow in Israel. Three inoculation methods were used (two calves/method): group 1, baby hamster kidney (BHK) cell culture supernatant by intradermal (ID) and subcutaneous (SC) injection (1.5 ml/route; $10^{7.12}$ $TCID_{50}$); group 2: BHK supernatant by ID, SC, and intravenous (IV) injection (0.67 ml/route; $10^{7.12}$ $TCID_{50}$); and group 3: transmission by laboratory infected *C. sonorensis*. A negative control received non-infected BHK supernatant similar to group 2. Animals were monitored daily and blood collected on 0, 3, 5, 7, 10, 13, and 18 days post infection (dpi) for virus isolation and titration, serology, and complete blood count. On dpi 18, *C. sonorensis* were fed on four calves and processed in pools of five for virus isolation 10 days post feeding. All calves had detectable viremia by 3 dpi through 18 dpi (end of study). Peak viremia occurred 7-10 dpi ($10^{2.63}$-$10^{3.5}$ $TCID_{50}$/ml). No differences in virus kinetics were observed between inoculation groups. Calves seroconverted by 10 dpi. Group 2 calves developed a transient fever (103.9 and 104.7 °F) on 1dpi and again 4-9 dpi (103.3-104.4 ° F). No other clinical or hematologic abnormalities were observed. Midges were fed on four calves on 18 dpi (viremia $<10^{2.3}$ $TCID_{50}$/ml). None of the 124 midge pools processed were positive by virus isolation. This study demonstrates US-origin cattle are susceptible to infection with EHDV-7 by multiple inoculation methods; however, similar to other studies, overt disease consistent with field reports was not replicated experimentally. Midges that fed on calves with low-titer viremia did not become infected; however, only 620 midges were processed, so these animals should not be excluded as a potential source of virus to biting midges.

EHDV-6 studies

In 2006, EHDV-6 was isolated from dead white-tailed deer in Indiana and Illinois and now likely represents a third endemic serotype in the US after isolations during each subsequent year over a wide geographic area. To better

understand and characterize this novel virus, a series of experiments were initiated at the University of Georgia. Genetic characterization of the virus indicate the virus is a reassortant, with gene segments from EHDV -2 and -6. Furthermore, a previous experimental infection of white-tailed deer replicated disease observed in field cases. Here we briefly describe two studies, 1.) susceptibility of cattle; and 2.) the susceptibility of *C. sonorensis* to experimental infection with EHDV-6 (Indiana). Four mature Holsteins and a positive control white-tailed deer were inoculated with $10^{6.4}$ $TCID_{50}$ EHDV-6 cell culture (BHK) supernatant via a combination of ID and SC injection. Two of four animals had a detectable viremia: 5-10 dpi in one animal and 7-24 dpi (end of study) in a second. No clinical or hematologic abnormalities were observed. Seroconversion occurred by 10 dpi, although one animal failed to seroconvert. The positive control deer exhibited a typical clinical response

Regarding cattle, for both the EHDV-6 and -7 experimental infections, we observed subclinical infections. This is consistent with the vast majority of experimental EHDV infections in cattle, thus a gap in our understanding remains. However, despite our inability to replicate EHD in cattle experimentally, field reports indicate that disease does occur in cattle and that EHD outbreaks can be associated with significant production loss.

In our second study, we aimed to determine if *C. sonorensis* is susceptible to oral infection with EHDV-6 (Indiana). Colonized *C. sonorensis* from Arthropod-Borne Animal Diseases Research Unit (ABADRU) (USDA-ARS, Manhattan, KS) were used. To compare the results with those of historically endemic EHDV serotypes, we similarly infected other groups of midges with EHDV-1 or -2. To infect midges, we used and artificial feeding device containing white-tailed deer blood spiked with EHDV-6, -1, or -2. The virus titer of these blood meals ranged from 10^6 – 10^7 $TCID_{50}$/ml. Midges were then held at 25°C and periodically sampled for virus isolation and titration over 14 days. Based on previous research with bluetongue virus (BTV) in sheep, we considered midges with a titer of ≥ $10^{2.7}$ $TCID_{50}$ to be potentially competent vectors. From 4-14 days post feeding, the percent of virus-positive midges was 11% (17/156), 85% (70/82), and 75% (87/116) for EHDV-6, -1, and -2, respectively. The percent of midges with a virus titer of ≥$10^{2.7}$ $TCID_{50}$ was 4% (6/156), 60% (49/82), and 36% (42/116) for EHDV-6, -1, and -2, respectively. These results indicate that while *C. sonorensis* is susceptible to infection with EHDV-6, the rate of infection and replication to high titer is low compared to EHDV-1 and -2. The possibility that other *Culicoides* species are involved in EHDV-6 transmission should be explored. Additionally, transmission studies are needed to fully evaluate the ability of *C. sonorensis* to transmit EHDV-6.

Epizootic Hemorrhagic Disease (EHD) Outbreak in Cattle in Nebraska

Roger Dudley
Nebraska Department of Veterinary Services Agriculture

In August 2012, the Nebraska Game and Parks announced they were seeing numerous deer deaths due to EHD. The Nebraska State Veterinarian's office discussed the possibility of EHD showing up in cattle as oral lesions and salivation; therefore, we were not surprised when on August 14, 2012, the first call from a veterinarian who was examining a cow with oral lesions was received. This started a three month stretch that resulted in 50 Foreign Animal Disease investigations. Out of the 50 investigations, we had 44 PCR positive EHD cases, three PCR positive Bluetongue cases, and two cases unrelated to arbovirus disease. The investigations mainly occurred in the north central and northeast Nebraska, but there were investigations across the state. We continue to have investigations as of October 16 and hope the cold weather that has recently occurred will eliminate the EHD investigations.

A typical investigation started with producers calling their veterinarian when they saw excessive salivation, stiff and reluctant to move, and reluctance to eat or drink in a cow. The veterinarian would then call the Veterinary Field Officer (VFO), State Veterinarians office, or USDA Veterinary Services (VS) area office to report the cases. Once a report came in from the field, the investigation was initiated with a foreign animal disease (FAD) referral number and Emergency Management Response System record. The VFO would go out to the clinic or farm to investigate the animals and collect red, purple, and green top tubes of blood and swabs of oral lesions. These samples were sent to Plum Island for evaluation. Once laboratory results were available the USDA-VS office would enter the results, classify the case status, and closeout the investigation.

Compared to other years, the cases of EHD in Nebraska this summer seemed more severe, as there was death loss associated with several of the herds. There was a buffalo herd that lost eight animals and several cow herds lost animals. We feel that the increased severity may have been due to extreme weather, which included high temperatures resulting in possible severe dehydration.

There has been some concern with anecdotal evidence of reproductive problems associated with a fall calving herd that was diagnosed with EHD. This herd has both fall and spring calving cows, and excellent records, so the local veterinarian hopes to be able to monitor the records to determine if the herd has reproductive issues with the spring calving cows as well.

With help from producers, private practitioners, VFOs, State Veterinarians office, Plum Island Foreign Animal Disease Diagnostic Laboratory, and USDA-VS area office, we were able to ensure that the oral lesions associated with EHD were not a FAD that could have devastated the livestock industry of Nebraska.

Development and Performance Evaluation of a Simple Streamlined Method for Bluetongue Virus and Epizootic Hemorrhagic Disease Virus Nucleic Acid Purification, Denaturation, and Detection

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Bluetongue virus (BTV) and Epizootic hemorrhagic disease virus (EHDV) are members of the *Reoviridae* family and are transmitted by biting *Culicoides* midges. BTV causes disease in cattle and other ruminants resulting in significant economic loss due to treatment costs, production losses, and trade restrictions of infected animals. EHDV associated disease in cattle is less prominent, however, it has emerged as a major economic threat to the white-tailed deer (WTD) industry in many states, often causing severe debilitation and death in affected animals. The incursion of a new serotype of the virus (EHDV-6) into United States is raising additional concerns about the future economic impact of this virus on the WTD industry. The potential emergence of exotic serotypes of BTV and EHDV emphasizes the need for robust detection of all known strains and differential diagnosis. For this purpose, a streamlined workflow consisting of an automated nucleic acid purification and denaturation method and multiplex one-step RT-qPCR for the simultaneous detection of all serotypes of BTV and EHDV was developed using previously published BTV[1] and EHDV[2] signatures. The denaturation of double stranded (ds) BTV and EHDV RNA was incorporated into the automated nucleic acid purification process thus eliminating the separate step of dsRNA denaturation (i.e., DMSO, MMOH, or betaine, or high temperature) commonly used for enhanced PCR sensitivity. The workflow analytical sensitivity, based on Probit analysis, was < 200 BTV and EHDV target copies per reaction. The performance of this workflow was assessed by comparison with nested RT-PCR assays for BTV and EHDV conducted at the NVSL using 125 samples (originated from TVMDL). NVSL and TVMDL results showed high agreement (Cohen's Kappa 0.86-0.89, using NVSL method as the reference standard) and support the use of this workflow for concurrent detection of BTV and EHDV in the same reaction. Approximately 1850 samples consisting of bovine, ovine, caprine, cervine blood, tissue, and semen have been tested and 251 positives (~13.5% positive rate) were identified, specifically, 72 BTV only positives, 119 EHDV only positives, and 60 BTV&EHDV positives. Interestingly, BTV & EHDV co-infections were observed at a significant rate (24% (60/251) of all positives); this observation may indicate opportunities for potential interaction between closely related orbiviruses and may be important for understanding disease clinical presentations.

References

1. Hofmann, M. et al. (2008). Bluetongue disease reaches Switzerland. Schweiz Arch Tierheilkd. 2008 Feb;150(2):49-56.
2. Clavijo, A. et al. 2010. An improved real-time polymerase chain reaction for the simultaneous detection of all serotypes of Epizootic hemorrhagic disease virus. J Vet Diagn Invest. 2010 Jul;22(4):588-93.

Bluetongue Virus (BTV) and Epizootic Hemorrhagic Disease Virus (EHDV) Isolations/PCR Positives

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Calendar year 2011: Bluetongue virus or RNA was detected in 30 samples submitted during calendar year 2011. The positive bluetongue virus isolation and polymerase chain reaction (PCR) test results from submissions to the National Veterinary Services Laboratories (NVSL) in 2011 are listed in Table 1.

Table 1. BT virus isolation (VI) / PCR positives, Calendar year 2011

State	*No.*	*Species*	*PCR*	*VI*
CA	1	Cattle	Positive	BTV-17
KY	1	Deer Isolate	--	BTV-17
MO	1	Sheep	Positive	BTV-17
NC	1	*Deer	Positive	BTV-11
OK	1	**Deer Isolate	--	BTV-17
PA	1	Deer isolate	--	BTV-17
TX	1, 5	Deer isolate, deer	--, Positive	BTV-11
TX	3, 12, 1	Deer isolate, deer, sheep	--, Positive, Positive	BTV-17
TX	1	Cattle	Positive	†BTV-13
WY	1	Pronghorn Isolate	--	BTV-17

*Also positive for EHDV by RT-PCR; **Also positive for EHD-2 & 6

†Typed direct on blood

During calendar year 2011, 23 samples tested positive for EHDV by virus isolation and/or PCR. The positive EHDV isolation and PCR test results from submissions to NVSL in 2011 are listed in Table 2.

Table 2. EHDV isolation (VI)/ PCR positives, Calendar year 2011

State	*No.*	*Species*	*PCR*	*VI*
DC	1	Deer	Positive	EHDV-2
FL	3, 1	Deer, Key Deer	Positive, Positive	EHDV-2
NC	4	*Deer	Positive	EHDV-2
ND	1	Cattle	Positive	EHDV-2 (typing on blood; neg VI)
NY	3	Deer	Positive	EHDV-2 (2)
OK	1	Deer	Positive	EHDV-2
State	*No.*	*Species*	*PCR*	*VI*
OK	1	Deer isolate	--	**EHDV-2 & 6
SD	6	Deer	Positive	EHDV-2
SD	1	Mule deer	Positive	EHDV-6
TX	1	Deer isolate	--	EHDV-1

***One deer also positive for BTV by PCR and VI (BTV-11)**
****Also positive for BTV-17**

Calendar year 2012 (January 1– October 15)

As of October 15, 2012, bluetongue virus has been identified in twenty-five samples: BTV-13 was identified from two deer samples from Illinois, one cattle sample from Nebraska and a mule deer sample from South Dakota; BTV-11 was identified from two dog isolates from Kansas and Texas; BTV-9 was identified in one sheep blood from Florida; and one cattle sample from Puerto Rico yielded an isolate that was positive for BTV-22. Serotype identification is pending on one additional BTV isolated from a South Dakota deer. BTV has also been identified by PCR in six cattle samples and seven boer goat samples from Florida; one cattle sample from North Dakota, and two cattle samples from Oklahoma. In the same time period, EHDV-1 was identified in one deer from Florida and one cattle sample from South Dakota. EHDV-2 was identified in 108 samples from the following: one cattle from Illinois; eight deer, six cattle, and one bison from Iowa; six deer and nine cattle from Nebraska; twenty deer, fifty-three cattle, two bison, and one elk from South Dakota; and one cattle from Virginia. EHDV-6 was identified in six deer and two cattle samples from Illinois, three deer samples from Iowa, two deer samples from Nebraska and one South Dakota deer.

2011 Bluetongue Serology Proficiency Test

Fifty-two laboratories participated in the 2012 bluetongue (BT) proficiency test. The panel consisted of 20 ruminant serum samples. The passing score was zero or one sample missed. Of the 52 laboratories participating in the 2012 BT proficiency test, 43 agreed with each other and with NVSL on the positive/negative bluetongue antibody status of all 20 samples. Laboratories approved to conduct official (export) bluetongue serology are listed on the website: http://www.aphis.usda.gov/animal_health/lab_info_services/approved_labs.shtml

SCWDS Update: Hemorrhagic Disease and *Culicoides* sp. Surveillance

Daniel Mead, David Stallknecht, Jamie Phillips-Brantley, Stacey Vigil, and Joseph Corn
Southeastern Cooperative Wildlife Disease Study, University of Georgia

An overview of epizootic hemorrhagic disease viruses (EHDV) and bluetongue viruses (BTV) isolated by SCWDS during the 2011 and 2012 transmission seasons was presented. During 2011, 44 viruses were isolated from white-tailed deer samples submitted from 14 states. Viruses isolated were EHDV-2 (42), BTV-11 (1) and BTV-17 (1). So far this year, we have isolated 154 viruses from animals suspected of having HD. EHDV-2 accounts for the majority of these isolates (101) and was isolated from WTD, cattle, and alpaca. EHDV-6 was isolated from 41 WTD and EHDV-1 was isolated from seven WTD. Of the bluetongue viruses isolated, BTV-10 was isolated from a pronghorn, BTV 11 was isolated from a WTD, and BTV-13 was isolated from WTD and a bighorn sheep.

In addition, an update on surveys for *Culicoides* species in the Southeastern United States was provided. These surveys have been conducted since 2007 as part of a Cooperative Agreement for Exotic Arthropod Surveillance with USDA-APHIS-VS. Between July 2011 and June 2012, surveys were conducted at 43 sites in nine states. 17,198 Culicoides representing 35 species were collected. Surveys are ongoing inAlabama, Florida, Georgia, Louisiana, and Mississippi.

The Arthropod-Borne Animal Diseases Research Unit: Research Program Update and Current Status

William C. Wilson, D. Scott McVey, Lee W. Cohnstaedt, Barbara S. Drolet, Robert Pfannenstiel, Dana Nayduch and Mark G. Ruder

USDA-ARS, Arthropod-Borne Animal Diseases Research Unit

The Arthropod Borne Animal Diseases Research Unit's (ABADRU) research mission is to solve major endemic, emerging, and exotic arthropod-borne disease problems in livestock. The Unit completed the move to Manhattan, Kansas in 2010 and is in the final stages of renovating and permitting additional laboratory space to more efficiently accomplish this mission. The ABADRU is located at the Center for Grain and Animal Health Research (CGAHR) that now has USDA-APHIS approved laboratories, an insectary, small animal vivarium and facilities for research with Biosafety Level (BSL)-2 viruses. The ABADRU also has initiated BSL-3 laboratory-based studies and BSL-2 animal-based studies at the new Biosecurity Research Institute (BRI) at Kansas State University. A BSL-3 arthropod-containment laboratory (ACL-3) has been constructed within the BRI for future arbovirus research, and USDA-APHIS permitting is presently pending. Five new scientists were hired to replace the scientific staff that did not relocate to Kansas. The ABADRU has three 5-year project plans under two ARS National Research Programs: NP103, Animal Health and NP104, Veterinary, Medical, and Urban Entomology. These plans include research on bluetongue virus (BTV; exotic and domestic), epizootic hemorrhagic disease virus (EHDV) and Rift Valley fever virus (RVFV). To date, exotic BTV research progress includes testing the susceptibility of white-tailed deer and North American domestic sheep with a BTV- 8 strain originally isolated in The Netherlands. In order to determine the potential origin of the new BTV serotypes recently detected in the Southeastern USA, molecular epidemiology studies using whole viral genomes are ongoing. There also have been several recent occurrences of EHDV causing disease in cattle in multiple parts of the world. One of these outbreaks occurred in Israel during 2006 and was associated with EHDV-7. More recently, EHD has been reported in numerous cattle herds throughout the Midwestern US during 2012. Full genome sequencing of recent EHDV isolates from cattle, along with 21 endemic strains, is underway to determine if changes in the viral genetics could be contributing to recent observed increased pathogenicity. The ABADRU is also actively expanding its entomology program to better understand the biology of both midges and mosquitoes that serve as vectors for the arboviral diseases listed above. Current studies include risk modeling and pesticide susceptibility experiments, which will provide alternative strategies for insect vector control. Related to this, the North American Deer Farmer's are collaborating with ABADRU to develop tools to reduce biting midge populations. In addition, ABADRU scientists are examining vectors on a molecular level, including investigations of the population genetics of two important mosquito species, several transcriptome projects for *Culicoides* midges, and a secretome project to identify secreted salivary proteins of midges. The ABADRU continues to be well supported, thanks to additional funding sources, such as Department of Homeland Security Science and Technology Directorate, ARS Office of International Research Projects, and the Department of State Biosecurity Engagement Program. Additionally, the unit continues to have a large number of national and international collaborations resulting in a productive research program addressing the needs of our stakeholders.

Committee Business

The Committee reviewed two resolutions as follows:

1. Vaccine for The Various Strains of Epizootic Hemorrhagic Disease In Cervids.

This resolution was moved, seconded and passed with one negative vote.

2. National Review of Research Needs for Blue Tongue and Related Orbiviruses

This resolution was moved, seconded and passed unanimously.

With no further business, the meeting was adjourned.