SAES-422 Multistate Research Activity Accomplishments Report

Project/Activity Number: NC1180
Project/Activity Title: Control of Emerging and Re-emerging Poultry Respiratory Diseases in the United States
Period Covered: October 1, 2014 to September 30, 2015
Date of This Report: January 11, 2015
Annual Meeting Date: October 28, 2015

Brief summary of minutes of annual meeting:

The annual meeting was held on Wednesday, October 28, 2015, in conjunction with the USAHA annual meeting at the Rhode Island Convention Center in Providence, Rhode Island, room 542.

Dr. Laszlo Zsak, Chair of NC-1180, opened the meeting at 8 am with introductions of the participants. This was the first joint meeting of the NC-1180 & PRD-CAP, and the first time meeting in conjunction with USAHA Committee on Transmissible Diseases of Poultry. Dr. Tsang Long Lin was absent as secretary for family reasons, Dr. Tim Johnson is recording in his absence. The minutes from the 2014 meeting were approved. The location of the meeting was discussed. It was proposed that the next meeting continue to be held in conjunction with the USAHA meeting in Greensboro. This was seconded and approved.

Dr. Zsak mentioned on a personal note he will be retiring next year. He suggested to considering a chair elect. Dr. Mary Pantin-Jackwood was nominated by Lee and was seconded by Keeler. She was approved as the chair elect for the next year.

Dr. Chang-Won Lee next discussed the PRD-CAP program. Dr. Lee mentioned that we are fortunate to have $7.2 million over 5 years to support and expand our collaborative work initiated by NC-1180. He mentioned there are 35 investigators, 10 subcontracts, and 20 individual projects. Michael Abundo is the project manager. A website (PRDCAP.com) has been developed and will be used for conveying information.

Dr. Gary Sherman (National Program Leader in Veterinary Science) next presented an overview of perspectives on the NIFA program. There are over 300 active projects on poultry respiratory disease encompassing AFRI, AES, hatch, NHALN, and extension.

Station reports combined with PRD-CAP updates were next presented. Dr. Zsak mentioned that we will still need written reports for each station.

The list below is the attendees:

Present						
Name	Affiliation	Email	NC-1180 participant	PRD-CAP participant	Guest	State Rep

Chang Won Lee	Ohio State University	lee.2854@osu.edu	X	X		OH
Michael Abundo	Ohio State University	abundo.1@osu.edu		X		
Jon Moyle	University of Maryland	jmoyle@umd.edu		X		
Laszlo Zsak	SERPL-USDA-ARS	laszlo.zsak@ars.usda.gov	X			USDA
Mohamed El-Gazzar	Ohio State University	el.gazzar.1@osu.edu		X		
Haroldo Toro	Auburn University	torohar@auburn.edu	X	X		AL
Rodrigo Gallardo	UC-Davis	ragallardo@ucdavis.edu	X			CA
Mazhar Khan	University of Connecticut	mazhar.khan@uconn.edu	X	X		CT
Eric Gingerich	Diamond V	egingerich@diamondv.com				
Brian Jordan	University of Georgia	brian89@uga.edu		X		
Eva Pendelton	Penn State University	eaw10@psu.edu		X		
Calvin Keeler	University of Delaware	ckeeler@udel.edu	X	X		DE
Sanjay Reddy	Texas A&M University	sreddy@cvm.tamu.edu		X		
Jeff LeJeune	Ohio State University	lejeune.3@osu.edu	X			NC advisor
Mark Jackwood	University of Georgia	mjackwoo@uga.edu	X	X		GA
James Grimm	Texas Poultry Federation	jgrimm@texaspoultry.org			X	
Mia Torchetti	NVSL	mia.kim.torchette@aphis.usda.gov	X			
David Suarez	SEPRL-USDA-ARS	david.suarez@ars.usda.gov	X	X		
Geoffrey Lossie	Indiana ADDL/Purdue	glossie@purdue.edu			X	
Naola Ferguson-Noel	PDRC University of Georgia	naolaf@uga.edu	X	X		
Michael Darre	University of Connecticut	michael.darre@uconn.edu		X		
Maricarman	PDRC	mcgarcin@uga.edu	X	X		

Garcia	University of Georgia					
Timothy Johnson	University of Minnesota	joh04207@umn.edu	X	X		MN
Gireesh Rajashekara	Ohio State University	rajashekara.2@osu.edu		X		
Prajwal Regmi	FDA/CVM	prajwal.regmi@fda.uhs.gov			X	
Paul Brennan	IN St. Poultry Assoc. USAHA	pbrennan@purdue.edu			X	
Absent						
Name	State Rep					
Elizabeth Driskell	IL					
Tsang Long Lin	IN					

After the presentations and reports, the participants agreed that next time the meeting needs to be allotted more time in order to properly distinguish the NC1180 Reports and the PRD-CAP presentations, also this will allow for more discussions for the participants. Additional discussion were made on RFP for PRD-CAP and how extension could grow further through social media as suggested by Dr. Gallardo, and Dr. LeJeune suggested a formation of a fact sheet to be posted and distributed by extension.

The meeting was adjourned by Dr. Laszlo Zsak at 5:00 PM EDT.

Accomplishments:

Objective I: Identify reservoirs of infectious respiratory disease agents in wild birds and poultry.

The infectious dose and pathogenesis of A/Anhui/1/2013 H7N9 was evaluated in two common breeds of chickens, White Leghorns (table-egg layers) and White Plymouth Rocks (meat chickens). No morbidity or mortality were observed with doses of 10(6) or 10(8)EID50/bird when administered by the upper-respiratory route, and the mean infectious dose (10(6) EID50) was higher than expected, suggesting that the virus is poorly adapted to chickens (SEPRL).

Identification of new sub-genotypes of virulent Newcastle disease virus with potential panzootic features (SEPRL).

Avian influenza subtype H5 and H7 were negative from the LBM and domestic poultry birds in New England states (CT).

A newly developed H10-RT-LAMP assay was demonstrated to be a rapid clinical diagnostic tool, that requires no specialized equipment and is fast, simple, low cost, and easy to apply (CT).

Objective II. Develop improved diagnostic capabilities including real time PCR as well as other rapid on-farm tests for economically important respiratory diseases.
A new test was developed and evaluated using type specific primers and probes to accurately and quickly detect the GA07, GA08, and GA13 types of IBV. The GA07, GA08, and GA13 primer and probe combinations were found to be very sensitive (UGA).

Brain heart infusion (BHI) broth, water, PBS and mycoplasma media were evaluated for the effect on sensitivity of mycoplasma real time PCR. It was determined that mycoplasma media was the worst performing and is not suitable for transport or preparation of swabs for PCR (UGA).

In comparison with other complete ILTV genomes in GenBank, a diagnostic assay was developed to differentiate the 27 strains based on single nucleotide polymorphisms (SNPs) in the loci encoding ORFA and ORFB (UGA, SEPRL).

Objective III. Investigate the pathogenesis and polymicrobial interactions of specific infectious agents associated with poultry respiratory diseases (this includes interactions with underlying immunosuppressive agents).

Investigated the rate of egg transmission and virulence of the live MG ts-11 vaccine and two ts-11-like isolates K6216D and K6222B both induced respiratory signs, and significantly more tracheal colonization and more severe tracheal and air sac lesions than ts-11 vaccine ($P \leq 0.05$) (UGA).

Domestic ducks were infected with a virulent NDV virus (vNDV) and either a LPAIV or a HPAIV by giving the viruses individually, simultaneously, or sequentially two days apart. No clinical signs were observed in ducks infected or co-infected with vNDV and LPAIV, but co-infection decreased the number of ducks shedding vNDV and the amount of virus shed ($P<0.01$) at 4 days post inoculation (SEPRL).

Pathogenicity of IBDV is important with regard to the disease and degree of immune suppression. Immune suppression caused by IBDV infections can be an underlying cause of respiratory disease in poultry. Control of this disease is accomplished using vaccination. Thus, antigenic drift can confound these control efforts (OSU).

Identification of genes that are associated with resistance to heat stress and Newcastle disease virus and can be used to genetic enhancement of disease resistance of chicken in adaption to hot climate (CA).

Due to its importance in many diseases, chicken lines that theoretically vary only in the MHC or B locus have been developed. All tested lines inbred and commercial were susceptible to the initial IBV M41 infection but mortality was only associated with groups B17, B19 and white leghorn (CA).

Objective IV. Develop new prevention and control strategies for poultry respiratory diseases.

It appears that a 10X dose of the Ark-DPI vaccine given to the chicks by hatchery spray cabinet does not provide an adequate infectious dose of the minor virus subpopulation in the vaccine, whereas when a 100X dose of vaccine was used, an infectious dose of the minor virus subpopulation was delivered to most of the chicks resulting in a high percentage of chicks infected with the vaccine (UGA).

Infectious bronchitis virus (IBV) vaccines are applied by mass spray in the hatchery. The technique was modified with a new commercial spray cabinet by removing the syringes entirely. Vaccine is delivered under constant pressure through an “always off” solenoid controlled valve, which is activated by the chick basket passing underneath the spray nozzle (UGA).

Arkansas-DelMarVa Poultry Industry (Ark-DPI) infectious bronchitis virus (IBV) has been used as a vaccine for the past 25 years. Sequencing of field isolates has shown that specific amino acid changes are selected when the Ark-DPI vaccine replicates in birds as compared to the predominant virus sequence in the vaccine bottle (UGA).

A new vaccine candidate was developed and evaluated the potential of an ILTV strain attenuated by deletion of the open reading frame (ORF) C gene as an ILTV vaccine for in ovo administration (UGA).

Expression of H5 hemagglutinin vaccine antigen in common duckweed (Lemna minor) protects against H5N1 high pathogenicity avian influenza virus challenge in immunized chickens (SEPRL).

It was demonstrated that accelerated antibody induction and protective efficacy of NS1-truncated LAIV correlates well with upregulation of IFN-stimulated genes (OSU).

Results suggest that the self-assembling polypeptide nanoparticle shows promise as a potential platform for a development of a vaccine against AI (CT).

Infectious bronchitis virus (IBV) cross-protection trials were performed in healthy chickens maintained under controlled environmental conditions. Prime and booster vaccination with Mass protected against GA13 and improved protection against Ark when compared with Mass single vaccination (AL).

CEK adaptation of embryo-attenuated Ark vaccines reduces population heterogeneity and that changes do not revert after one replication cycle in ECE or in chickens provides an opportunity to improve commercial ArkDPI-derived vaccines (AL).

IBV S1 sequences differing from the predominant in the challenge virus were detected in chickens vaccinated with the commercial Ark attenuated vaccine (AL).

Impacts

Objective I.

The role of chickens in the ecology of the H7N9 lineage, at least early on (as the virus has continued to circulate it may have changed), may not have been efficient.

The co-evolution of at least three different sub-genotypes reported here and the apparent close relationship of some of those genotypes from ND viruses isolated from wild birds, suggests that identifying wild life reservoirs may help predict new panzootics.

There is a need to perform avian influenza virus isolation studies to confirm and identify other subtypes in LBM, domestic and wild birds.

A newly developed H10-RT-LAMP assay requires no specialized equipment and is fast, simple, low cost, and easy to apply.

Objective II.

Having a specific assay to detect the newest serotypes circulating in the field is important and will provide timely information that can be used to make informed decisions on IBV vaccination programs.

Information allows the poultry industry to maximize the benefits of these costly diagnostic assays and set scientifically based standards in different laboratories for sample submission and handling for MG and MS real-time PCR.

A new diagnostic assay for ILTV will be useful to quickly identify non-vaccinal revertants in order to develop new vaccines against circulating field viruses.

Objective III.

Results provide the first conclusive evidence of transovarian transmission of a mycoplasma isolate genotyped as ts-11, and indicate that ts-11-like isolates vary in their virulence and ability to transmit via the egg.

Findings indicate that infection of ducks with AIV and NDV can interfere with replication of either viruses, modifying the pathogenesis and transmission of the viruses.

Data suggest that amino acids in the hvVP2 projection structures continue to change and contribute to antigenic drift among IBDV strains.

Knowledge of genes associated with enhanced immune response may inform further information on vaccine efficacy in poultry production.

Understanding the effects of the MHC in infectious bronchitis resistance will provide an additional mechanism to control this endemic infection and improve productive parameters.

Objective IV.

It was found that a 100 X dose of Ark-DPI vaccine given by spray was required to obtain the same level of infection and immunity obtained when the vaccine is given by eyedrop. A critical dose of a minor subpopulation in the vaccine is needed to suitably vaccinate the birds.

A novel spray cabinet assembly holds many advantages over the traditional syringe based design, and provides innovation for the application of any mass sprayed vaccine.

The differences in binding to chicken tracheal tissue and embryonic tissues were observed, which have implications for vaccine development particularly when subpopulations of vaccine virus are considered.

ILTV gene deleted strains for in ovo vaccination and provides the framework for further study the development of life attenuated ILTV vaccines for in ovo administration.

Studies provide support for the use of HVT vector vaccines expressing HA to protect poultry against multiple lineages of HPAI, and that both humoral and cellular immunity induced by live vaccines likely contributes to protection.

Direct evidence that oral administration of recombinant chicken IFN alpha in drinking water is required for rapid induction of adaptive immune responses and protective efficacy of influenza vaccine in chickens.

A Self-Adjuvanted M2e/HelC-SAPN is an excellent universal avian influenza vaccine.

Controls are of distinct importance in experiments supporting the introduction of attenuated IBV vaccine strains exotic to regions as these exotic strains may provide new genetic material for recombination and emergence of novel IBV strains.

The CEK-adapted IBV ArkDPI-derived vaccine is an improved and effective vaccine candidate to protect chickens against virulent Ark-type strains.

There are a number of stains of IBDV, which are not adequately covered by existing vaccines. Development of a peptide vaccine against IBDV has the potential for broadly protective vaccines effective against many strains of a pathogen.

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