USDA Agricultural Research Service

USDA ARS 4th International
Biosafety & Biocontainment Symposium:
Global Biorisk Challenges – Agriculture and Beyond

One Health Relevance of Agricultural Research: Control & Eradication of Arthropod Pests & Vectors of Emerging & Re-Emerging High-Consequence Animal & Zoonotic Diseases

USDA AGRICULTURAL RESEARCH SERVICE
KNIPLING BUSHLAND U.S. LIVESTOCK INSECTS RESEARCH LABORATORY
Kerrville TX

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USDA United States Department of Agriculture

Topics | Programs and Services | Newsroom | Blog

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The health of animals, people and the environment is connected. The "One Health" approach is the collaborative effort of the human health, veterinary health and environmental health communities. Through this collaboration, USDA achieves optimal health outcomes for both animals and people.

With its partners such as the U.S. Fish and Wildlife Service, U.S. Food and Drug Administration (FDA), the Centers for Disease Control and Prevention (CDC), the National Institutes of Health (NIH), the Environmental Protection Agency, tribal Nations, USDA seeks to maintain or reduce health risks to animals, humans, the environment and society.

USDA serves the nation through its commitment to producing wholesome and nutritious foods; ensuring the safety of plant and animal commodities entering the country; safeguarding the health and welfare food-producing animals; and preventing entry and/or controlling plant and animal pathogens. These cumulative actions ensure the health and safety of humans through these One Health partnerships.

USDA United States Department of Agriculture

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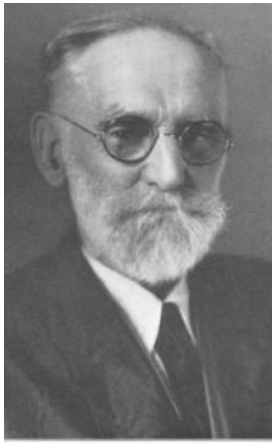
Fact Sheet

USDA "ONE HEALTH" APPROACH – FACT SHEET

June 2016

A Monumental Discovery Driving Crucial Decision



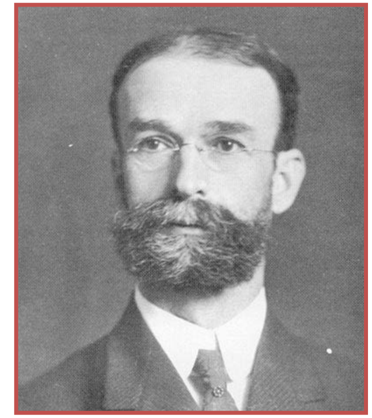
In 1891, **Dr. Cooper Curtice** found evidence of an association between the "cattle tick" or "fever tick" (now *R. annulatus*) and Texas fever.

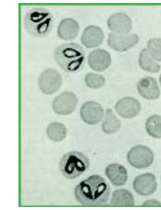
Dr. Cooper Curtice

"Father of Tick Eradication"

Smith: "Eliminate the ticks on cattle and you eradicate the ticks because they cannot live elsewhere"

- In 1896 **Dr. Curtice** began campaign advocating the eradication of the ticks from the U.S.
- In late 1906 Congress appropriated $82,500 for the initiation of the Cattle Fever Tick Eradication Program





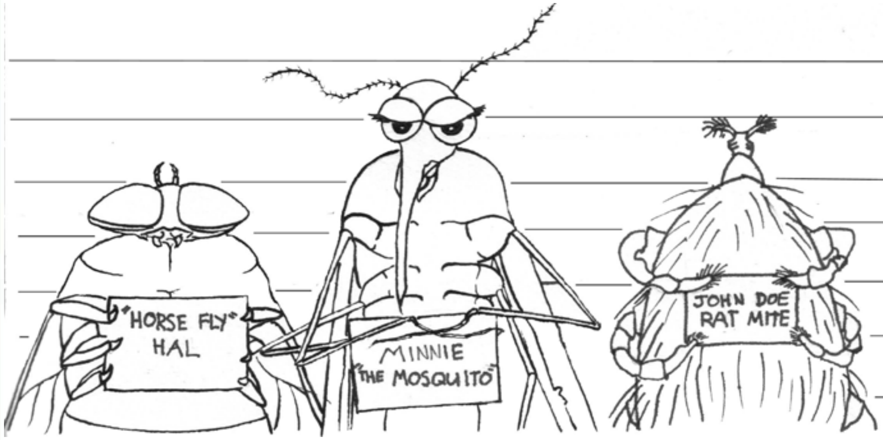
In 1893, nine years after the establishment of USDA's Bureau of Animal Industry (BAI), **Dr. Theobald Smith** & **Dr. Frederick Kilborne**, a veterinarian, published their monumental discovery proving the cattle tick (*R. annulatus*) was the vector of *B. bigemina.*

It demonstrated, for the first time in history, that an arthropod was capable of transmitting a disease agent

Veterinary and Medical Entomology Research at the Agricultural Research Service

USDA-ARS National Program 104

The Mission
2, 4, 6, 8: We perform research that protects 2 and 4-legged creatures from 6 and 8-legged arthropods.



One Health Implications of ARS Efforts Ensuring Continued Health & Welfare of Our Nation’s Livestock Populations

- Identification of “high-consequence” foreign animal diseases and pests facilitates emergency preparedness
- Ready to respond effectively when faced with a foreign animal disease outbreak or pest infestation
- **If introduced, they pose a severe threat to U.S. animal health and, in some cases, the economy and human health as well**
- Tiered approach according to risk level

APHIS Factsheet
Veterinary Services
April 2013

High-Consequence Foreign Animal Diseases and Pests

In carrying out our safeguarding mission, the U.S. Department of Agriculture’s (USDA) Animal and Plant Health Inspection Service (APHIS) works to ensure the continued health and welfare of our Nation’s livestock and poultry populations. One important aspect of this work is emergency preparedness—making sure we are ready to respond effectively when faced with a foreign animal disease outbreak or pest infestation. As part of these efforts, APHIS’ animal health officials identify “high-consequence” foreign animal diseases and pests. These are serious diseases and pests that do not currently exist in the United States. If introduced here, they pose a severe threat to U.S. animal health and, in some cases, the economy and human health as well.

The list divides diseases and pests into tiers according to risk level, as described below.

Tier 1

Tier 1 diseases are those of national concern. They pose the most significant threat to animal agriculture in the United States, as they have the highest risks and consequences. This category includes:

- African swine fever*
- classical swine fever*
- foot-and-mouth disease*
- notifiable avian influenza (H5 and H7 strains that need to be reported to the World Organization for Animal Health, or OIE)*
- virulent Newcastle disease*

Tier 2

Tier 2 diseases are transmitted primarily by pests. How quickly these diseases spread and APHIS’ ability to control or eradicate an outbreak depends largely on whether these pests are present in the environment and whether they can transmit the disease between animals. This category includes:

- heartwater
- New World screwworm
- Rift Valley fever*
- Venezuelan equine encephalitis*

Tier 3

Tier 3 diseases and pests pose less risk and fewer consequences than those in Tiers 1 and 2, but still rise to the level of inclusion because of their potential negative impact on animal or human health. This category includes:

- African horse sickness
- contagious bovine pleuropneumonia and contagious caprine pleuropneumonia
- glanders and melioidiosis
- henipaviruses (hendra and nipah)*
- rinderpest* and peste des petits ruminants*
- tropical bont tick

What the List Means

These high-consequence foreign animal diseases and pests are of primary importance to APHIS’ emergency preparedness officials, guiding many of our program priorities. For example, the list will help inform decisions on how we procure countermeasures to address a disease outbreak and, potentially, funding for research and response activities. The diseases marked with an asterisk are those APHIS has identified as biological threats that need to be considered in program priorities and countermeasure stockpile requirements.

How We Developed the List

APHIS developed this list after carefully considering all foreign animal diseases and pests that could negatively affect livestock or poultry. We also took into account disease agents that are identified in the agricultural select agent program, as well as those that can severely threaten public health and animal health (zoonotic diseases) or the safety of animal products. We did not include diseases and pests that are endemic, or common, in the United States or any disease APHIS already manages through one of our animal health

High-Consequence Foreign Animal Diseases & Pests

Tier 1

- **African swine fever**
- Classical swine fever
- Foot-and-mouth disease
- Avian influenza (any strain that is highly pathogenic or zoonotic)
- Virulent Newcastle disease

Tier 2

- **Heartwater**
- **New World screwworm**
- **Rift Valley fever**
- **Venezuelan equine encephalitis**

Tier 3

- **African horse sickness**
- Contagious bovine and caprine contagious pleuropneumonia
- Glanders and melioidiosis
- Henipaviruses (Hendra and Nipah)
- Rinderpest and peste des petits ruminants
- **Tropical bont tick**

Criteria guiding designation of animal disease or pest as of high, negative consequence:

epidemic potential; economic impact; trade impact; morbidity, mortality; species infectivity; speed of detection; vaccine availability; zoonotic potential

Parasites & Vectors

MEETING REPORT Open Access

One Health approach to identify research needs in bovine and human babesioses: workshop report

Background: *Babesia* are emerging health threats to humans and animals in the US

One Health approach applied to identify gaps in scientific knowledge regarding babesioses

Driven by increased risk for outbreaks of bovine babesiosis associated with increased cattle fever tick outbreaks

Results: Involvement of wildlife in ecology of cattle fever ticks jeopardizes efforts to keep US bovine babesiosis-free

Emergence of human babesiosis apparently linked to increase in the white-tailed deer population

Research needs for human and bovine babesioses were identified and are presented herein

Conclusions: Translation of this research expected to provide veterinary and public health systems with tools to mitigate impact of bovine and human babesioses

Economic, political, and social commitments are urgently required, including increased national funding for animal and human *Babesia* research, to prevent the re-establishment of cattle fever ticks and the increasing problem of human babesiosis in the US

One Health Nexus:

Global Change, Arthropod Pests & Vectors, Livestock-Wildlife Interface, & Disease Ecology

Wapiti

Baseline Susceptibility to Pyrethroid and Organophosphate Insecticides in Two Old World Sand Fly Species (Diptera: Psychodidae)

THE UNITED STATES ARMY MEDICAL DEPARTMENT JOURNAL
FORCE HEALTH PROTECTION: EVOLVING CHALLENGES AND SOLUTIONS

Andrew Y. Li, PhD
Adalberto A. Pérez de León, DVM, PhD, MS
Kenneth J. Linthicum, PhD
Seth C. Britch, PhD
MAJ Joshua D. Bast, MS, USA
Mustapha Debboun, PhD

Veterinary Parasitology 233 (2017) 9–13

Contents lists available at ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

ELSEVIER

Research paper

First documentation of ivermectin resistance in *Rhipicephalus sanguineus* sensu lato (Acari: Ixodidae)

R.I. Rodriguez-Vivas[a,*], M.M. Ojeda-Chi[a], I. Trinidad-Martinez[a], A.A. Pérez de León[b]

Veterinary Parasitology 228 (2016) 60–64

Contents lists available at ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

ELSEVIER

Research paper

Acaricidal efficacies of *Lippia gracilis* essential oil and its phytochemicals against organophosphate-resistant and susceptible strains of *Rhipicephalus* (*Boophilus*) *microplus*

Livio M. Costa-Júnior[a,*], Robert J. Miller[b], Péricles B. Alves[c], Arie F. Blank[d], Andrew Y. Li[e], Adalberto A. Pérez de León[f]

Chemico-Biological Interactions 263 (2017) 1–6

Contents lists available at ScienceDirect

Chemico-Biological Interactions

journal homepage: www.elsevier.com/locate/chembioint

/IER

Interaction of plant essential oil terpenoids with the southern cattle tick tyramine receptor: A potential biopesticide target

Aaron D. Gross[a,b,1], Kevin B. Temeyer[c], Tim A. Day[b], Adalberto A. Pérez de León[c], Michael J. Kimber[b,2], Joel R. Coats[a,2,*]

Trends in Entomology

Vol. 11, 2015

Review

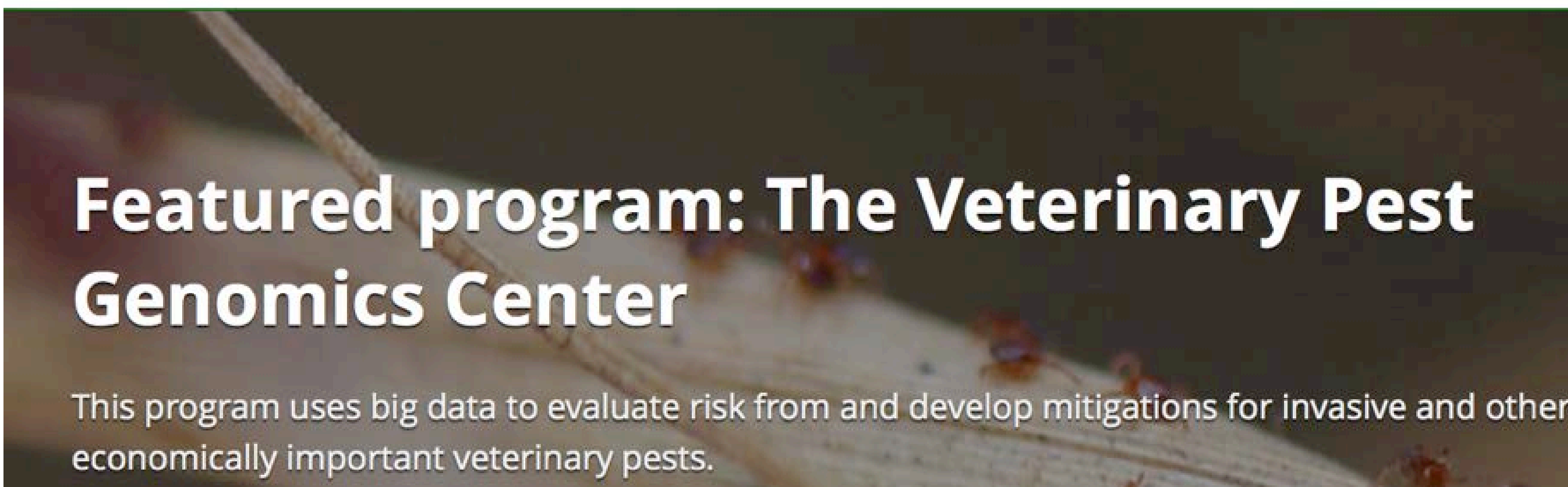
Arthropod genomics research in the United States Department of Agriculture-Agricultural Research Service: Current impacts and future prospects

Brad S. Coates[1,*], Monica Poelchau[2], Christopher Childers[2], Jay D. Evans[3], Alfred Handler[4], Felix Guerrero[5], Steve Skoda[5], Keith Hopper[6], William M. Wintermantel[7], Kai-Shu Ling[8], Wayne B. Hunter[9], Brenda S. Oppert[10], Adalberto A. Pérez De León[5], Kevin Hackett[11] and DeWayne Shoemaker[12]

USDA

Ag Data Commons Beta

ARS National Agricultural Library



Concha *et al. BMC Biology* (2016) 14:72
DOI 10.1186/s12915-016-0296-8

BMC Biology

RESEARCH ARTICLE Open Access

A transgenic male-only strain of the New World screwworm for an improved control program using the sterile insect technique

Carolina Concha[1,2,3], Azhahianambi Palavesam[4,10], Felix D. Guerrero[4], Agustin Sagel[5], Fang Li[1], Jason A. Osborne[6], Yillian Hernandez[2], Trinidad Pardo[5], Gladys Quintero[5], Mario Vasquez[5], Gwen P. Keller[7], Pamela L. Phillips[5,8], John B. Welch[9], W. Owen McMillan[3], Steven R. Skoda[5,8] and Maxwell J. Scott[1*]

GUSANO BARRENADOR DEL GANADO
MIDA-USDA
COPEG

Barrenoticias
Boletín Informativo de la Comisión Panamá – Estados Unidos para la Erradicación y Prevención del Gusano Barrenador del Ganado - COPEG
Año 16, No.176
Septiembre de 2015

LÍNEA TRANSGÉNICA DE GBG (SOLO MACHOS) ES UNA REALIDAD

La obtención de una cepa estéril de Gusano Barrenador del Ganado que solo obtenga descendencia de machos (los cuales tienen la capacidad de copular con varias hembras a lo largo de su ciclo de vida), ya es una realidad: se trata de la línea transgénica FL12#56, de Gusano Barrenador del Ganado (solo macho) la cual llena de satisfacción al equipo de ARS (el Servicio de Investigación Agrícola, por sus siglas en inglés) que por años ha puesto su empeño en esta meta.

Momentos en que los Directores Generales de COPEG por Panamá y Estados Unidos, Dres. Francisco Pinilla y Antonio Arroyave realizan el traslado, a pie, del material genéticamente modificado desde la PPME hasta el Laboratorio de ARS Cushing, ambas instalaciones, están ubicadas dentro del Complejo Técnico - Administrativo de Pacora.

Fever Tick Vaccine Fact Sheet

About the Fever Tick Vaccine

Bm86 immunomodulator by Zoetis is a new vaccine that is being used in the Cattle Fever Tick Eradication Program. The vaccine targets and kills both species of cattle fever ticks: *Rhipicephalus* (formerly *Boophilus*) *annulatus* and *R. microplus*.

How the Vaccine Works

After cattle have been vaccinated, their immune system will produce antibodies in the blood that will fight against a protein found in the lining of the tick's gut. The tick will take in the antibodies when it consumes the blood of vaccinated cattle.

The antibodies bind to the lining of the intestines in the tick, which prevent the tick from absorbing nutrients. The vaccine will kill or weaken ticks as they feed on vaccinated cattle and weak surviving ticks will not be able to reproduce.

Vaccine Use

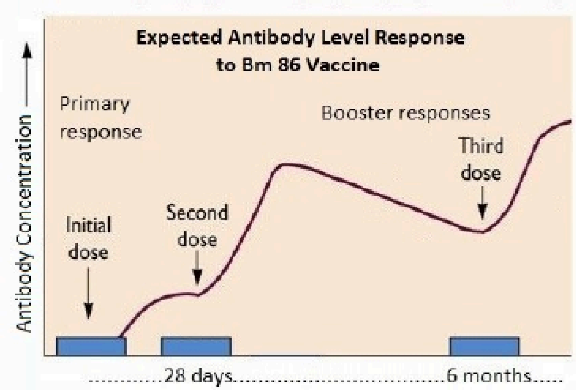
The vaccine will be used in addition to eradication practices already in place for the Cattle Fever Tick Eradication Program. **It will not replace systematic treatments.** Vaccines will only be administered by USDA/APHIS/Veterinary Services, Texas Animal Health Commission employees or authorized agents.

Cattle That Should be Vaccinated

- **Cattle in Permanent Quarantine:** Beef cattle over two months of age are required to be vaccinated at least once a year.
- **Cattle in Temporary Preventative and Control Quarantine Areas:** Beef cattle over two months of age may be required to be vaccinated if there is an elevated risk determined by USDA/TAHC epidemiologists.
- **Cattle in the Free Area:** Cattle should not be vaccinated at this time.

Vaccination Schedule

Cattle should receive an initial dose, a booster four weeks later, followed by additional boosters every six months. This schedule is important because one dose will not produce enough antibodies to be effective. Vaccination every six months after the initial dose and booster is needed to keep the concentration of antibodies in the blood high enough to be effective.

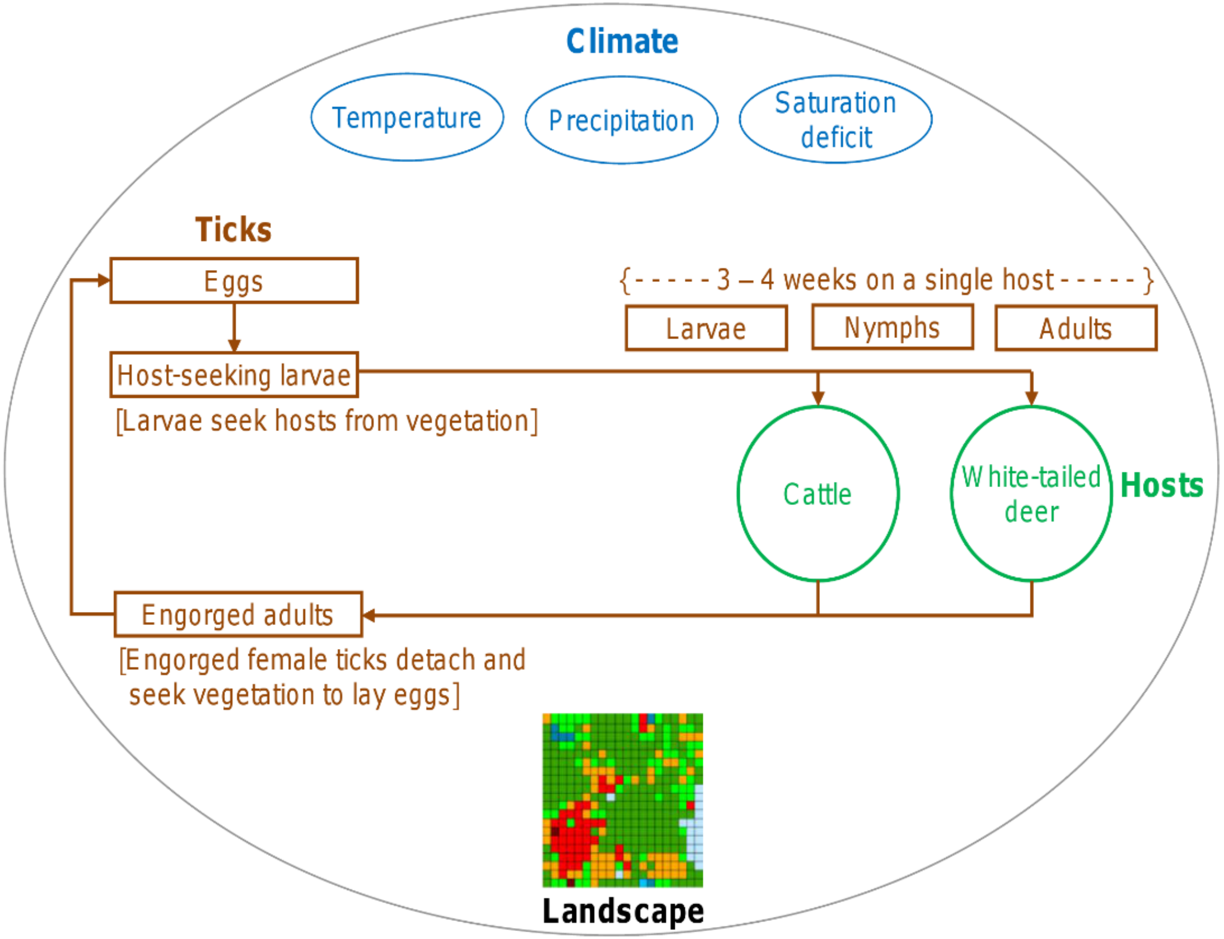


Ecological Modelling 342 (2016) 82–96

Simulated interactions of white-tailed deer (*Odocoileus virginianus*), climate variation and habitat heterogeneity on southern cattle tick (*Rhipicephalus* (*Boophilus*) *microplus*) eradication methods in south Texas, USA

Hsiao-Hsuan Wang[a,*], Pete D. Teel[b], William E. Grant[a], Greta Schuster[c], A.A. Pérez de León[d]

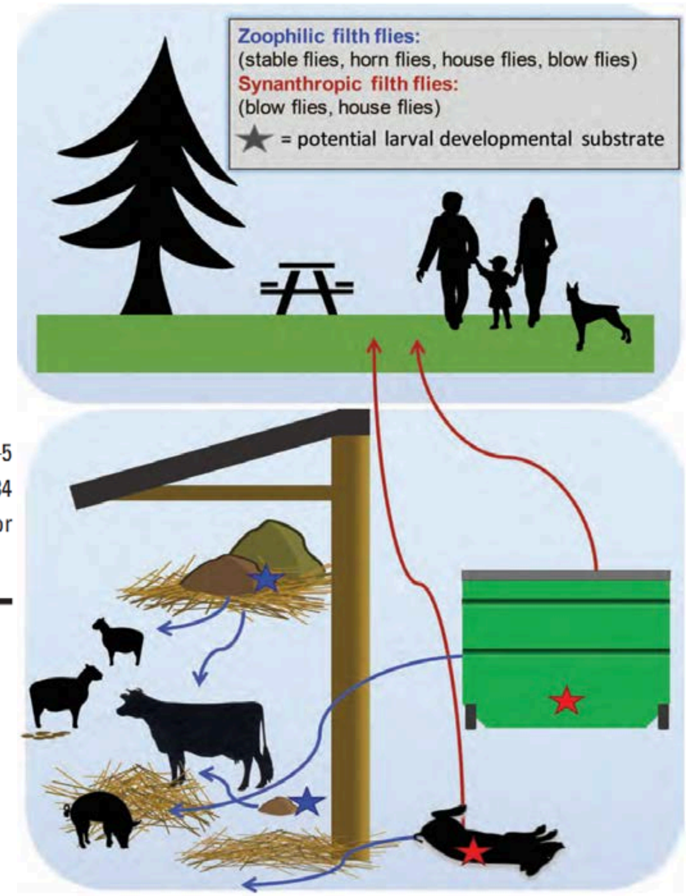
- Help assess CFT outbreak dynamics & spatial attributes in tick-host-landscape systems involving diverse hosts
- Allow testing treatment efficacy & integration of strategies for sustainable eradication



Survival and Fate of *Salmonella enterica* serovar Montevideo in Adult Horn Flies (Diptera: Muscidae)

PIA UNTALAN OLAFSON,[1,2] KIMBERLY H. LOHMEYER,[1] THOMAS S. EDRINGTON,[3] AND GUY H. LONERAGAN[4]

J. Med. Entomol. 51(5): 993–1001 (2014); DOI: http://dx.doi.org/10.1603/ME13217



Annals of the Entomological Society of America, 2017, 2–5
doi: 10.1093/aesa/saw084
Letter to Editor

Special Collection: Filth Fly–Microbe Interactions

Special Collection: Filth Fly–Microbe Interactions

Dana Nayduch

High-consequence Vector-borne Diseases and Vectors: Revisiting the Biology and Vector-host-pathogen Interactions of Soft Ticks in Eastern Europe

S. Filatov[1], A. Pérez de León[2], J. Lopez[3], P. Teel[4], D. Scott McVey[5] & A. Gerilovych[1]

[1]National Scientific Center Institute of Experimental and Clinical Veterinary Medicine, Kharkiv, Ukraine.
[2]United States Department of Agriculture, Agricultural Research Service, Knipling-Bushland U.S. Livestock Insects Research Laboratory and Veterinary Pest Gen
[3]Dept. of Pediatrics, National School of Tropical Medicine, Baylor College of Medicine, Houston, Texas, U.S.A.
[4]Dept. of Entomology, Texas A&M University, College Station, Texas, U.S.A.
[5] United States Department of Agriculture, Agricultural Research Service, Arthropod-borne Animal Diseases Research Unit, Manhattan, Kansas U.S.A.

2017 ASM BIOTHREATS
Research, Response, and Policy
FEBRUARY 6–8, 2017 | WASHINGTON, DC

Why it is important to study soft ticks?

Ticks (Acari: Ixodida) are notorious parasites of animals and vectors for many pathogens including nematodes, bacteria and viruses. While diseases transmitted by hard ticks are well recognized, much less known about soft tick-transmitted diseases and possible threats they may pose to humans and livestock. According to the extensive literature review we have performed, Argasidae can harbor and transmit a wide range of viruses (73 known species and varieties) belonging to three major arboviral families, some of which are known to cause disease in humans, as well as a number of uncharacterized and suspected arboviruses. Considerable part of these viral agents have been isolated from representatives of the subfamily Ornithodorinae (Fig. 1). Notably, certain *Ornithodoros* spp. are biological vectors and reservoirs of African swine fever – a viral disease that threatens modern pig farming globally. However, there are number of other bacterial and viral agents, which represent potential threat to human welfare that can be transmitted by *Ornithodoros* ticks. Progress in identifying and understanding these potential threats is often hampered by gaps in our knowledge regarding the distribution and ecology of soft ticks in a specific area. This is particularly true in Eastern European countries where studies on *Ornithodoros* ticks were almost abandoned in the 1980s.

Out of the 7 soft tick species previously reported from the territory of Ukraine (Filippova 1966), *Ornithodoros verrucosus* (Fig. 2) seems to be of a greater importance because the species is a confirmed vector of a severe form of relapsing fever (Gromashevsky et al. 1956) and more recently, considered as a suspected vector of African swine fever virus (ASFV) in the Caucasus and Eastern Europe (Sanchez Vizcaino et al. 2009). Moreover, Geran virus and Artashat virus (Bunyaviridae: Nairovirus) were isolated from the Caucasian populations of *O. verrucosus* in the past (Lvov et al. 2014; Alkhovskiĭ et al. 2013). However, no information regarding the species current distribution, ecology and possible epidemiological role in Ukraine existed before the start of our project.

Figure 2. O. verrucosus ticks collected in the Kherson region of Ukraine

Figure 3. Soft tick surveillance in Ukraine 2014-2016

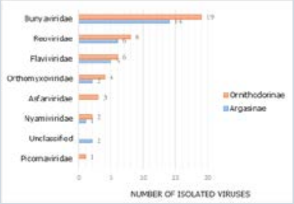


Figure 1. Viruses isolated from soft ticks (Filatov 2017*)

Figure 4. Laboratory colony of *O. verrucosus* at the NSC IECVM

What was done?

This knowledge gap was addressed through the collaborative research project titled "African Swine Fever Threat Reduction through Surveillance in Ukraine" between the National Scientific Center "IECVM" & USDA-ARS. During realization of the project, Ukrainian scientists developed research capacity in soft tick biology, collection methods, rearing and colonization techniques, and vector-host-pathogen interactions at USDA-ARS locations, and collaborating universities in Texas.

We re-evaluated decades old data on distribution of *O. verrucosus* and conducted field surveys in southern Ukraine. As the result of these efforts, for the first time in the XXI century, the species' distributional data in Ukraine has been updated (Fig. 3). From specimens collected in the field, a laboratory colony of this suspected ASFV vector has been established at the NSC "IECVM" (Fig.4).

What we would like to do next?

- To assess taxonomic status of *O. verrucosus* and its evolutionary relationships with other *Ornithodoros spp.*
- To conduct ASFV vector competence studies with *O. verrucosus*
- To develop specific molecular tools for assessment of the tick-host interactions (such as ELISA test for detection of *Ornithodoros*-specific anti-tick antibodies, Western Blot antigenic assay, etc.)
- To explore field ecology and possible range of pathogens that can be transmitted by *O. verrucosus*
- To conduct surveillance for other soft tick species and in the neighboring countries (Southeast Europe, The Caucasus)

Acknowledgments

This work was supported by the Defense Threat Reduction Agency Project (CBEP Agreement IAA# U.S.C. 3318(b) – 15217). The contents of this poster are the responsibility of the authors and do not necessarily reflect the views of DTRA or the United States Government.

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- Filippova N.A., 1966. Argasid ticks (Argasidae). Fauna USSR 4 (3), Nauka, Zoological Institute of the Academy of Sciences of USSR, Moscow, Leningrad, 96, 255 pp.
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Blacklegged tick (Deer tick)

Vector of pathogens that cause Lyme disease

United States
Department of Agriculture
Agricultural Research Service

Areawide Tick Control Project

Contact: (301) 504-5401

Training in the development of a surveillance system for *Aedes aegypti* in the Mexico-United States border

Date: February 6-10th 2017; **Location:** U. of Texas Rio Grande Valley

Objectives: To facilitate binational cooperation & strengthening of the surveillance & control of vectors in the US-Mexico border, the binational exchange of vector surveillance information, & the development of a pilot project of a participative entomological surveillance tool to be used in both countries

Participants: Representatives of US-Mexico border (Texas, Arizona, Nuevo Mexico & California), state authorities of the Mexican border (Baja California N & S, Coahuila, Chihuahua, Sonora, Nuevo León & Tamaulipas), federal officials from National Center of Preventive Programs & Control of Diseases (CENAPRECE), representatives from the Mexican National Institute of Public Health, CDC, representatives from Hidalgo county, TX, UTRGV, USDA-ARS & other academic institutions & public health agencies from the US border states

Holistic Research Required to Solve Problem with Complex V&VBD Systems Exacerbated by Global Change

USDA

Agricultural Research Service

frontiers in PHYSIOLOGY

ORIGINAL RESEARCH ARTICLE
published: xx June 2012
doi: 10.3389/fphys.2012.00195

Integrated strategy for sustainable cattle fever tick eradication in USA is required to mitigate the impact of global change

Adalberto A. Pérez de León[1]†, Pete D. Teel[2]†, Allan N. Auclair[3], Matthew T. Messenger[4], Felix D. Guerrero[1], Greta Schuster[5] and Robert J. Miller[6]*

Feria-Arroyo *et al. Parasites & Vectors* 2014, **7**:199
http://www.parasitesandvectors.com/content/7/1/199

Parasites & Vectors

RESEARCH Open Access

Implications of climate change on the distribution of the tick vector *Ixodes scapularis* and risk for Lyme disease in the Texas-Mexico transboundary region

Teresa P Feria-Arroyo[1†], Ivan Castro-Arellano[2†], Guadalupe Gordillo-Perez[3†], Ana L Cavazos[1], Margarita Vargas-Sandoval[4], Abha Grover[5], Javier Torres[3], Raul F Medina[6], Adalberto A Pérez de León[7] and Maria D Esteve-Gassent[5*]

frontiers in PUBLIC HEALTH

REVIEW ARTICLE
published: 17 November 2014
doi: 10.3389/fpubh.2014.00177

Pathogenic landscape of transboundary zoonotic diseases in the Mexico–US border along the Rio Grande

Maria Dolores Esteve-Gassent[1]*†, Adalberto A. Pérez de León[2]†, Dora Romero-Salas[3], Teresa P. Feria-Arroyo[4], Ramiro Patino[4], Ivan Castro-Arellano[5], Guadalupe Gordillo-Pérez[6], Allan Auclair[7], John Goolsby[8], Roger Ivan Rodriguez-Vivas[9] and Jose Guillermo Estrada-Franco[10]

TRANSLATING ECOLOGY, PHYSIOLOGY, BIOCHEMISTRY, AND POPULATION GENETICS RESEARCH TO MEET THE CHALLENGE OF TICK AND TICK-BORNE DISEASES IN NORTH AMERICA

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ADVANCING INTEGRATED TICK MANAGEMENT

ADVANCING INTEGRATED TICK MANAGEMENT TO MITIGATE BURDEN OF TICK-BORNE DISEASES*

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