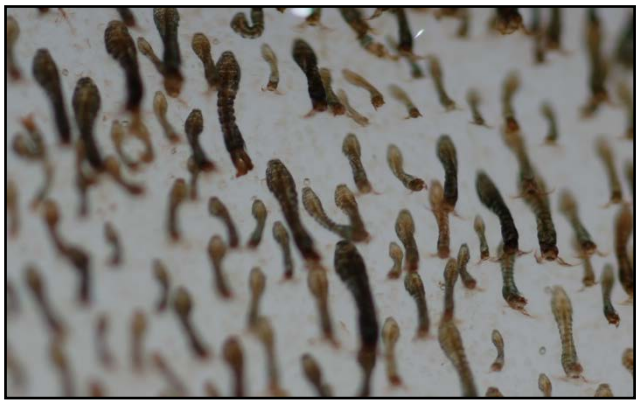
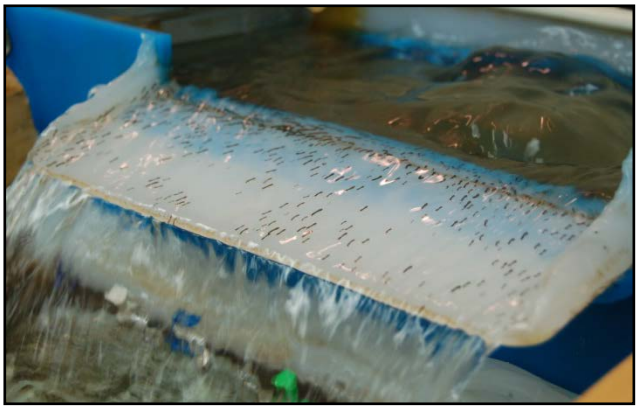
North American Black Fly Association



Ninth Annual Meeting
February 9 – 11, 2011



Program Agenda

University of Georgia · Athens, Georgia

SCHEDULE OF PRESENTATIONS AND EVENTS

WEDNESDAY, FEBRUARY 9

2:00 PM – 2:20 PM **OPENING COMMENTS AND INTRODUCTION/WELCOME TO THE GEORGIA CENTER**
John Walz, Metropolitan Mosquito Control District, St. Paul, MN

2:20 PM – 2:40 PM **PROSPECTING FOR SYMBIOTES IN BLACK FLIES OF THE SOUTHEASTERN COASTAL PLAINS**
Charles E. (Eddie) Beard, Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC

2:40 PM – 3:00 PM **A REMNANT OF AN INCIPIENT SPECIATION EVENT IN THE *SIMULIUM ARCTICUM* COMPLEX, DIPTERA: SIMULIIDAE**
Gerald F. Shields, Department of Natural Sciences, Carroll College, Helena, MT

3:00 PM – 3:30 PM **BREAK**

3:30 PM – 3:50 PM **WEST VIRGINIA BLACK FLY CONTROL PROGRAM HIGHLIGHTS**
Betsy Reeder[1], **James Andrews[2]**, and Stephanie Whitman[2]
[1]WV Department of Agriculture, Charleston, WV [2]Valent Biosciences Corporation, Libertyville, IL

3:50 PM – 4:10 PM **TRANSMISSIBILITY OF VESICULAR STOMATITIS NEW JERSEY VIRUS IN LIVESTOCK: A BLACK FLY PERSPECTIVE**
P.F. Smith[1], E.W. Howerth[2], D. Carter[2], E. Gray[1], R. Noblet[1], and D.G. Mead[3], [1]Department of Entomology, University of Georgia (UGA), Athens, GA, [2]College of Veterinary Medicine, Department of Pathology, UGA, Athens, GA, [3]Southeastern Cooperative Wildlife Disease Study, UGA,. Athens, GA

4:10 PM – 4:30 PM **ASSESSING THE IMPACTS OF HEMLOCK DEATHS ON STREAM MACROINVERTEBRATES IN THE SOUTHERN APPALACHIAN MOUNTAINS**
Daniel B. Pitt, Department of Entomology, University of Georgia, Athens, GA

4:30 PM – 4:50 PM **DEVELOPMENT OF IMPROVED BLACK FLY OVIPOSITION CHOICE CHAMBERS AND FIELD TRAPS**
Tommy W. McGaha Jr[1], Ray Noblet[1], and Thomas Unnasch[2]
[1]Department of Entomology, University of Georgia, Athens, GA
[2]Department of Global Health, University of South Florida

6:00 PM **BBQ DINNER AT UGA BEE LAB (SHUTTLE VAN WILL RUN FROM GEORGIA CENTER TO BEE LAB)**

THURSDAY, FEBRUARY 10

9:00 AM – 9:20 AM — **IS *SIMULIUM JENNINGSI* A SPECIES COMPLEX?**
Kyle S. Parks and Peter H. Adler, Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC

9:20 AM – 9:40 AM — **EVOLUTION AND PHYLOGEOGRAPHY OF NORTHERN BITING FLIES**
Patrick Schaefer, Department of Ecology & Evolutionary Biology, University of Toronto, Toronto, Ontario, Canada

9:40 AM – 10:00 AM — **POSSIBLE CRYPTIC SPECIES IN THE *SIMULIUM JOHANNSENI* GROUP AND CONSERVATION IMPLICATIONS**
Katherine L. Gleason and Peter H. Adler, Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC

10:00 AM – 10:30 AM — **BREAK**

10:30 AM – 10:50 AM — **HABITAT PREFERENCE AND ATTACHMENT OF BLACK FLY LARVAE**
Carly Aulicky and M.V.K. Sukhdeo, Rutgers University, New Brunswick, NJ

10:50 AM – 11:10 AM — **THE IMPACT OF ALTERED FEEDING BEHAVIOR ON LARVAL BLACK FLY SUSCEPTIBILITY TO *BTI***
Joseph P. Iburg, Elmer W. Gray, Ray Noblet, and Roger D. Wyatt Department of Entomology, University of Georgia, Athens, GA

11:10 AM – 11:30 AM — **2010 PENNSYLVANIA BLACK FLY SUPPRESSION PROGRAM REVIEW**
Dave Rebuck and William Andrus, Pennsylvania Department of Environmental Protection, Division of Vector Management, Black Fly Suppression Program

12:10 PM – 1:30 PM — **LUNCH (PROVIDED AT GEORGIA CENTER)**

1:30 PM – 1:50 PM — **THE DEVELOPMENT AND USE OF A STREAMSIDE BIOASSAY**
Elmer W. Gray, Joseph P. Iburg, Ray Noblet, and Roger Wyatt Department of Entomology, University of Georgia, Athens, GA

1:50 PM – 2:10 PM — **ENTOMOLOGICAL SURVEILLANCE AND VECTOR CONTROL IN THE END GAME-THE ROLE OF BLACK FLY SURVEILLANCE AND CONTROL IN ONCHOCERCIASIS ELIMINATION**
Thomas R. Unnasch, Global Health Infectious Disease Research Program, College of Public Health, University of South Florida

2:10 PM – 2:30 PM — **TOOLS FOR STEALING BLOOD: PHARMACOLOGICAL AND IMMUNE MODULATING PROPERTIES OF BLACK FLY SALIVA**
Donald E. Champagne, Department of Entomology and Center for Tropical and Emerging Global Diseases, University of Georgia, Athens, GA

THURSDAY, FEBRUARY 10 (CONT.)

2:30 PM – 3:00 PM	**PRESENTATION OF STUDENT AWARD AND GROUP PICTURE**
3:00 PM – 3:30 PM	**BREAK**
3:30 PM – 5:30 PM	**TOUR OF UGA BLACK FLY COLONY + TOUR OF UGA FIRE ANT LAB AND COLONY (OPTIONAL)**
	DINNER (ON YOUR OWN)

FRIDAY, FEBRUARY 11

9:00 AM – 9:40 AM	**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES): PERMIT APPLICATION GUIDELINES FOR BLACK FLY CONTROL** **John Walz[1]/Elmer Gray[2]**, [1]Metropolitan Mosquito Control District, St. Paul, MN, [2]Department of Entomology, University of Georgia, Athens, GA
9:40 AM – 10:00 AM	**THE EFFECT OF LARVAL CONTROL OF BLACK FLY (*SIMULIUM VITTATUM* SPECIES COMPLEX) CONDUCTED IN WINTER HARBORAGES** **Kirk Tubbs**, Twin Falls County Pest Abatement District, Twin Falls, ID
10:00 AM – 10:30 AM	**BREAK**
10:30 AM – 10:50 AM	**SIMULIID EGG BIOLOGY, POORLY UNDERSTOOD BUT CRITICAL FOR UNDERSTANDING THE DISTRIBUTION OF MANY SPECIES** **Murray H. Colbo**, Department of Biology, ACER, Acadia University, Wolfville, Nova Scotia, Canada
10:50 AM – 11:10 AM	**VIDEO OF CLARK COUNTY VECTOR CONTROL OPERATIONS** **Chris Bramley**, Clark County Vector Control, Las Vegas, NV
11:10 AM – 11:40 AM	**GENERAL DISCUSSION AND BUSINESS MEETING**
	LUNCH (ON YOUR OWN)

Thank You

Thanks to The University of Georgia for allowing NABFA to host our meeting at their facility.
Front Cover: UGA Black Fly Colony pictures courtesy of Elmer Gray
Program Editor: Carey LaMere

NABFA website: http://entweb.clemson.edu/biomia/nabfa/

PRESENTATIONS TITLES WITH ABSTRACTS
9TH ANNUAL NABFA MEETING

FEBRUARY 9 – 11, 2011
ATHENS, GEORGIA

(In alphabetical order by presenter)

WEST VIRGINIA BLACK FLY CONTROL PROGRAM HIGHLIGHTS

Betsy Reeder[1], **James Andrews[2]**, and Stephanie Whitman[2]
[1]WV Department of Agriculture, Charleston, WV [2]Valent Biosciences Corporation, Libertyville, IL

The West Virginia Black Fly Control Program has been in place since 1986 in the southern part of the state. The treated area encompasses parts of the New, Greenbrier, and Bluestone Rivers. Recent expansion of the area treated has extended suppression efforts far up the Greenbrier River, into Monongahela National Forest. From the outset, use of *Bti* has been controversial in West Virginia. This brief presentation gives a program overview and a summary of some of the triumphs and headaches of recent years.

HABITAT PREFERENCE AND ATTACHMENT OF BLACK FLY LARVAE

Carly Aulicky and M.V.K. Sukhdeo, Rutgers University, New Brunswick, NJ

Colonization of artificial substrates by black fly larvae was investigated in Capoolong Creek, a tributary of the South Branch of the Raritan River in New Jersey. Paired substrates (n=6) represented vegetated versus stone substrates, and were examined three times a week for 12 weeks to determine patterns of colonization by black fly larvae. Depth and water velocity were monitored at each site to determine factors present during larvae colonization. Larvae demonstrated a significant preference for vegetated substrates over stone substrates ($p<0.05$). The gut fullness (ratio of full to empty gut) was similar on both substrate types, suggesting that feeding rates did not differ. Our current working hypothesis is that larvae prefer to colonize vegetated substrate because it is easier to attach to vegetated surfaces. A histological examination of larvae is underway to determine if less silk is used in attachment to vegetation when compared to stone substrates. [supported by the Hunterdon County Mosquito and Vector Control Commission]

PROSPECTING FOR SYMBIOTES IN BLACK FLIES OF THE SOUTHEASTERN COASTAL PLAINS

Charles E. (Eddie) Beard, Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC

Southeastern coastal plain streams often have low velocity, low dissolved oxygen, and high organic material including phenolic compounds. The Diptera of these streams are not well-investigated although some species differ from other areas; for example, the black fly *Simulium slossonae* is common in coastal plain streams, and has become a pest in some areas, but is not found in other ecoregions. In coastal plain streams, we have documented the fungal trichomycetes (Harpellales) *Harpella melusinae, Pennella* sp. and *Simuliomyces microsporus* in black flies (Simuliidae). A new species of microsporidian, *Caudospora palustris*, from *Cnephia ornithophilia* has been described from habitats unique to coastal plains. The microsporidian *Janacekia debaisieuxi* was collected in other hosts. The symbiote *Coelomycidium simulii* has been documented in *S. slossonae*. The non-fungal trichomycete *Paramoebidium* sp. has been observed. Another non-fungal symbiote in coastal plains is

Tetrahymena sp.; this protozoan was found in collections from the Alapaha River and Satilla River in Florida and Georgia. The chemistry of these streams including phenolic compounds might affect the free-living stages of the symbiotes. Chemistry, flow, and lower oxygen levels alter the food availability to host and symbiotes compared to other streams. The occurrence of these symbiotes in the coastal plains illustrates the success of symbiote dispersal and growth even in the challenges of coastal plain aquatic environments.

VIDEO OF CLARK COUNTY VECTOR CONTROL OPERATIONS

Chris Bramley, Clark County Vector Control, Las Vegas, NV

No abstract submitted

TOOLS FOR STEALING BLOOD: PHARMACOLOGICAL AND IMMUNE MODULATING PROPERTIES OF BLACK FLY SALIVA

Donald E. Champagne, Department of Entomology and Center for Tropical and Emerging Global Diseases, University of Georgia, Athens, GA

Vertebrate hosts defend against blood loss with a sophisticated complex of interacting hemostatic responses, which include platelet aggregation, vasoconstriction, and coagulation (clotting). These responses further generate signals which influence inflammatory and immune responses at the injury site. Blood-feeding arthropods, including black flies, facilitate blood feeding by secreting antagonists of hemostasis in their saliva. The black fly *Simulium vittatum* produces a potent vasodilator, an inhibitor of ADP-mediated platelet aggregation (apyrase), and a diversity of anticoagulants including antagonists of thrombin, Factor Xa, and Factor V. The vasodilator was characterized as a novel protein, SVEP, almost ten years ago, but the molecular nature of the apyrase and anticoagulants had not been determined. We analyzed the transcriptome and proteome of *S. vittatum* salivary glands, to generate a database that could be used to support characterization of pharmacologically active saliva components. A family of SVEP-like proteins was found; the function of family members other than SVEP itself is unknown. An orthologue of the mosquito apyrase accounts for the ADPase activity of black fly saliva. Homologues of the D7 protein family, also found in mosquitoes, suggest that saliva may inhibit vasoconstriction and inflammation by binding biogenic amines such as serotonin. Two members of the Kunitz family of serine protease inhibitors were found; as most elements of the coagulation cascade are serine proteases, these proteins were logical candidates to account for the anticoagulant activity of black fly saliva. These proteins were expressed and assayed, and one of them, SV66, had potent anticoagulant activity. Screening against a panel of proteases, and studies using Surface Plasmon Resonance, established that SV66 strongly inhibits Factor Xa, and it does not interact with Factor X, accounting for one of the known anticoagulant activities of saliva. Surprisingly, SV66 is also a potent inhibitor of Cathepsin G and Elastase, major proteases of neutrophils and macrophages, suggesting an effect on inflammatory and immune responses. Indeed, we showed that *S. vittatum* saliva is a potent inhibitor of T-cell proliferation, affecting both CD4 and CD8 T-cells by a mechanism that involves induction of apoptosis. In addition, saliva potently synergizes secretion of nitric oxide (NO) by LPS-stimulated macrophages. The effect of *S. vittatum* saliva on the host is therefore complex, inhibiting all aspects of hemostasis, and several aspects of the local immune response, but possibly enhancing other immune responses including NO secretion. These effects facilitate blood feeding, and may also help account for some of the dermatological effects of black fly bites and pathology of black fly-vectored pathogens.

SIMULIID EGG BIOLOGY, POORLY UNDERSTOOD BUT CRITICAL FOR UNDERSTANDING THE DISTRIBUTION OF MANY SPECIES

Murray H. Colbo, Department of Biology, ACER, Acadia University, Wolfville, Nova Scotia, Canada

For many species of Simuliidae it is the stage within the eggshell that survives the period unsuitable for larval development. This period maybe spent as an undifferentiated egg, developing embryo or a fully developed first instar larva. A summary review of these various strategies will be outlined and how they relate to the environmental conditions within the area the species is found. However, detailed experimental research testing the role of various factors on development and survival is minimal or nonexistent for most species. Given the developments in molecular techniques for identification and in molecular biology in general, research on egg biology could great enhance our understanding of factors controlling the spatial and temporal distribution of many species.

POSSIBLE CRYPTIC SPECIES IN THE *SIMULIUM JOHANNSENI* GROUP AND CONSERVATION IMPLICATIONS

Katherine L. Gleason and Peter H. Adler, Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC

The *Simulium johannseni* species group currently includes three described species. Morphological and ecological variation in members of the *S. johannseni* group, including its tendency to feed on endangered birds, raises the possibility that cryptic species might be involved. Chromosomal analysis of members of the *S. johannseni* group will allow discovery of any cryptic species and inferences of evolutionary relationships.

THE DEVELOPMENT AND USE OF A STREAMSIDE BIOASSAY

Elmer W. Gray, Joseph P. Iburg, Ray Noblet, and Roger Wyatt, Department of Entomology, University of Georgia, Athens, GA

The University of Georgia, Black Fly Rearing and Bioassay Laboratory has developed a novel streamside bioassay. This technique has been used to determine larval susceptibility to *Bacillus thuringiensis* subsp. *israelensis* (*Bti*) insecticidal proteins and evaluate larval feeding rates using fluorescent particles. The effectiveness of this technique was demonstrated during the summer of 2010 in the Susquehanna River in Pennsylvania. Larval mortalities of 21-24% were observed in water from the North Branch of the Susquehanna River while mortality of 83% was observed in water from the West Branch using the same *Bti* insecticidal protein exposure rate. In addition, exposure to fluorescent particles demonstrated that that 30% of the larvae from the North Branch did not feed during the 10 minute exposure and those that did feed only passed the material through 45% of their mid-gut. In the West Branch, 5% of the larvae did not feed and those that did feed passed the fluorescent particles through 70% of their mid-gut. This data corresponded to field observations conducted that day after operational treatments which recorded <10% mortality in the North Branch and >95% mortality in the West Branch. Future work will involve using this technique to predict when operational applications should be conducted.

THE IMPACT OF ALTERED FEEDING BEHAVIOR ON LARVAL BLACK FLY SUSCEPTIBILITY TO *BTI*

Joseph P. Iburg, Elmer W. Gray, Ray Noblet, and Roger D. Wyatt, Department of Entomology, University of Georgia, Athens, GA

Proteins produced by *Bacillus thuringiensis* subsp. *israelensis* are highly toxic against black fly larvae. These proteins must be ingested by the larvae after application in order for mortality to ensue. Occasional control problems in the North Branch of the Susquehanna River in Pennsylvania are most

likely occurring due to the poor ingestion of the *Bti* proteins. Experiments conducted in 2009 and 2010 with water from problem areas have determined that suspended material is responsible for the reduction in larval mortality. Sediment from sites exhibiting different larval mortalities was analyzed using scanning electron microscopy. An abundance of diatoms and frustules were observed in sediment from problem sites as compared to sediment from sites that have had historically optimum control. Larvae from The University of Georgia Black Fly Colony have exhibited ingestion rate reductions after exposure to diatoms as well as other materials. The ingestion rate is determined by the percentage of the mid-gut containing fluorescent particles after a given amount of time. This method of determining ingestion rate will be useful in trying to identify the mechanism that causes altered feeding behavior.

DEVELOPMENT OF IMPROVED BLACK FLY OVIPOSITION CHOICE CHAMBERS AND FIELD TRAPS

Tommy W. McGaha Jr[1], Ray Noblet[1], and Thomas Unnasch[2]
[1]Department of Entomology, University of Georgia, Athens, GA
[2]Department of Global Health, University of South Florida

Pheromones have been a topic of discussion in insects since the first discovery of bombykol, a pheromone produced by *Bombyx mori*, by Adolf Butenandt in 1959. Research with mosquito pheromones has led to the development of unique traps to study mosquito populations in relation to disease transmission and distribution. Based on success in mosquitoes and other insect taxa, we are investigating black flies and their pheromones as an attractant in development of more attractive traps. Previous studies showing attraction of gravid female black flies to an oviposition pheromone have led to the current initiative to develop a black fly trap incorporating an oviposition pheromone and visual cues. The University of Georgia, Black Fly Rearing and Bioassay Laboratory has replicated the oviposition choice chamber used previously and we are currently working on a more efficient prototype. Even though our findings demonstrate that fresh black fly eggs will attract gravid female black flies to an oviposition site, it appears that the attractant is not a highly volatile pheromone as is the case with the mosquito oviposition pheromone. A design incorporating air flow that demonstrates attractiveness more conclusively is needed to help evaluate attraction of gravid female black flies to oviposition sites.

IS *SIMULIUM JENNINGSI* A SPECIES COMPLEX?

Kyle S. Parks and Peter H. Adler, Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC

Evidence gathered from the literature suggests that *Simulium jenningsi* is a species complex. This hypothesis is being tested by cytological screening of larval samples from streams throughout the eastern United States. A standard chromosomal map is being constructed from specimens collected in South Carolina. Ecological data (pH, dissolved O_2, conductivity, water temperature, water velocity, stream width, dominant stream bed composition, riparian vegetation, and canopy cover) recorded at each site will be associated with the distributions of any cytotypes or sibling species to determine ecological patterns.

ASSESSING THE IMPACTS OF HEMLOCK DEATHS ON STREAM MACROINVERTEBRATES IN THE SOUTHERN APPALACHIAN MOUNTAINS

Daniel B. Pitt, Department of Entomology, University of Georgia, Athens, GA

Adelges tsugae (Hemlock woolly adelgid), a hemlock parasite native to Asia, has invaded the eastern United States where it is currently threatening *Tsuga canadensis* (Eastern Hemlock) with ecological

extinction, which is expected to bring about major changes to ecosystem structure and function. Because *T. canadensis* is a dominant species and its loss would mean replacement by other species, the ecological extinction of *T. canadensis* could have serious ecological consequences. Because these trees are or were dominant around Appalachian streams, their impact on forest stream ecology is of particular concern. We are testing three sources of potential impacts of hemlock deaths on stream macroinvertebrates: impact of pesticide entering the stream, changes in light levels due to canopy changes, and coarse woody debris (CWD) entering the stream. We predict that only the latter will have a significant impact. To test these hypotheses, we are taking sediment samples with a T-sampler, measuring canopy cover, and have initiated a hemlock CWD introduction study. Research is being done in 21 riffle habitats of Billingsley Creek, a third-order stream in the Chattooga River watershed of Northeast Georgia. Three sets of samples were taken in Oct., Apr., and Jul. the year before the wood additions and will be taken again three times per year for two years. Current data suggests no significant impact of canopy changes or pesticide introduction. Data have not been analyzed yet for the CWD aspect of the study.

2010 Pennsylvania Black Fly Suppression Program review

Dave Rebuck and William Andrus, Pennsylvania Department of Environmental Protection, Division of Vector Management, Black Fly Suppression Program

More than three million Pennsylvania residents and tourists benefit from The Pennsylvania Black Fly Suppression Program each year. Thirty-three of Pennsylvania's sixty-seven counties in the Delaware, Ohio and Susquehanna River Basins participated in the 2010 program, including one new county. All 2010 aerial treatment operations were conducted under a new statewide contract. Program staff collected and identified 2,657 larval/pupal samples and 4,151 adult samples, for a total of 6,808 black fly samples. The PA-DEP Vector Management laboratory identified 289,924 total black flies (229,535 larvae, 20,403 pupae, 39,986 adults) in 16 taxa to provide critical data for treatment decisions. Targeted black flies included four human pest species in the *Simulium jenningsi* group. Approximately 2,432 kilometers (1,511 miles) of forty rivers and streams were treated from April 16 to August 20, with treatments ending several weeks earlier than past seasons. Nine pilots logged 341 rotor hours with nine different helicopters on 95 treatment operations. 404,430 liters (106,839 gallons) of *Bacillus thuringiensis israelensis* (*Bti*) were aerially applied at a total cost of more than $5.2 million. Treatments effectively controlled target black fly populations, except for some re-occurring problem areas, primarily in the Susquehanna River Basin. The statewide average *S. jenningsi* adult count per sample was 4.88 during the treatment season, but the sample average rebounded to 12.17 adults per sample during post season monitoring.

Evolution and Phylogeography of northern biting flies

Patrick Schaefer, Department of Ecology & Evolutionary Biology, University of Toronto, Toronto, Ontario, Canada

Northern ecosystems are sensitive to environmental influences and are particularly vulnerable to the effects of global climate change. The **Northern Biodiversity Program (NBP)** is an integrated and strategic approach to understanding how biodiversity adapts to changing environments in northern Canada. We focus on using terrestrial and aquatic arthropods to understand how biodiversity **has adapted** and **is adapting** to changing climates. The NBP will be visiting 12 northern sites over 2 years, collecting arthropods using standardized collecting techniques. This program aims to capitalize on the extensive collections from the 1947-1962 Northern Insect Survey, which sampled biodiversity at 72 northern sites. We have four specific objectives as follows: (1) to test how and to what degree the structure of arthropod communities change between the Boreal, Subarctic, and Arctic ecoclimatic

zones, (2) to assess how northern arthropod communities have adapted to contemporary (50-60 yr.) changes to their environment, (3) to use molecular genetic techniques to aid species identification and to help elucidate longer-term patterns, and (4) to provide a sound foundation from which to launch future studies, including the participation of northern stakeholders through education and training opportunities. As part of the NBP, my research will focus on goals 1-3 above, with particular reference to the biting flies in the families: the Culicidae, Tabanidae and Simuliidae. An important aspect of northern biodiversity research is to account for how historical climate change and glacial cycles have impacted evolutionary paths of extant northern taxa. I will use molecular phylogeographic techniques to investigate hypotheses concerning the origins and diversity of biting flies. Ultimately, this research program will contribute to our understanding of the ecological factors limiting the distribution of species, address long-standing species identity problems, elucidate glacial influences on the speciation process and monitor the effects of climate change.

A REMNANT OF AN INCIPIENT SPECIATION EVENT IN THE *SIMULIUM ARCTICUM* COMPLEX, DIPTERA: SIMULIIDAE

Gerald F. Shields, Department of Natural Sciences, Carroll College, Helena, MT

Initial cytogenetic analysis of larval polytene chromosomes in 2004 and 2005 from the Coeur d'Alene River in northern Idaho indicated the presence of sex chromosomes of *S. saxosum*, X_2X_2, X_2Y_0, *S. arcticum* s. s. , X_0X_0, X_0Y_3 AND combinations of both (X_0X_2,X_0Y_0 and X_2Y_3). This rare event could be explained by: 1) sex chromosomes of *S. saxosum* operating autosomally in *S. arcticum* s. s. and vice-versa, 2) hybridization between *S. saxosum* and *S. arcticum* s. s. or 3) a population characterized by an X chromosome that is either standard or 2 and a Y chromosome that is either standard or 3. We returned to the Coeur d'Alene in 2009 and 2010 and made more extensive collections. We scored for the frequency of sex chromosome types, tested for genetic equilibrium among sex chromosome types and the IS-1 autosomal polymorphism, and determined if there were differences in chromosome pairing and chromocenter morphology between *S. saxosum*, *S. arcticum* s. s. and combinational types. Populations in 2009 and in 2010 are each in genetic equilibrium for both sex chromosomes and for IS-1 and there is no difference in chromosome pairing and chromocenters among all types. Therefore, we suggest that the Coeur d'Alene population of the *S. arcticum* complex is the remnant of an incipient speciation event which may still involve coadaptational "mating trials" followed by reinforcement through assortative mating and slight selective advantage as was hypothesized by Rothfels long ago. Comparisons to polytenes from seven near-by sites indicate that putative mating trials may be restricted only to the Coeur d'Alene. Analysis of μ satellites and additional sites to the north and south of the Coeur d'Alene are ongoing.

TRANSMISSIBILITY OF VESICULAR STOMATITIS NEW JERSEY VIRUS IN LIVESTOCK: A BLACK FLY PERSPECTIVE

P.F. Smith[1], E.W. Howerth[2], D. Carter[2], E. Gray[1], R. Noblet[1], D.G. Mead[3], [1]Department of Entomology, University of Georgia (UGA), Athens, GA, [2]College of Veterinary Medicine, Department of Pathology, UGA, Athens, GA, [3]Southeastern Cooperative Wildlife Disease Study, UGA,. Athens, GA

Vesicular stomatitis (VS) has been recognized as a disease of livestock and other animals for over a century, and while the causative agents have been studied intensively in the laboratory, we are only recently beginning to understand transmission routes associated with the vesicular stomatitis New Jersey virus (VSNJV), a causative agent of vesicular stomatitis in domestic animal populations. The work presented here summarizes a series of experimental studies investigating transmission dynamics of VSNJV in a black fly-livestock model system. Biological and mechanical transmission of VSNJV by black flies to livestock hosts was demonstrated, resulting in clinical disease depending on bite site. Black fly-to-black fly transmission via co-feeding on naive livestock hosts was also demonstrated.

THE EFFECT OF LARVAL CONTROL OF BLACK FLY (*SIMULIUM VITTATUM* SPECIES COMPLEX) CONDUCTED IN WINTER HARBORAGES

Kirk Tubbs, Twin Falls County Pest Abatement District, Twin Falls, ID

This study compares two seasons of treatments for black flies in Twin Falls County, ID. Between the first and second season, treatments targeting overwintering larva were conducted. Much of the black fly production in southern Idaho results from the colonization of the irrigation canal systems. Past abatement work only targeted canals for treatment. Treatments of winter harborages resulted in a significant early season drop in black flies and improved control through most of the summer season.

ENTOMOLOGICAL SURVEILLANCE AND VECTOR CONTROL IN THE END GAME - THE ROLE OF BLACK FLY SURVEILLANCE AND CONTROL IN ONCHOCERCIASIS ELIMINATION

Thomas R. Unnasch, Global Health Infectious Disease Research Program, College of Public Health, University of South Florida

Onchocerciasis, or river blindness, represents the most important human infectious agent vectored by black flies. Onchocerciasis represents a potent obstacle to socio-economic development throughout sub-Saharan Africa, and as such has been the target of several internationally supported large disease control programs. Recent evidence has suggested that onchocerciasis may be susceptible to elimination throughout most of its range worldwide. In this talk, the current status of onchocerciasis control and elimination worldwide will be presented. The current tools employed to monitor parasite transmission and their limitations when applied to an elimination scenario will be discussed. Translational research priorities for the study of the vector black flies most relevant to current international programs as they move into elimination and post-elimination certification phases will be presented.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES): PERMIT APPLICATION GUIDELINES FOR BLACK FLY CONTROL

John Walz[1]/Elmer Gray[2], [1]Metropolitan Mosquito Control District, St. Paul, MN, [2]Department of Entomology, University of Georgia, Athens, GA

No abstract submitted