Joint Meeting of the Southwestern Branch and North Central Branch ENTOMOLOGICAL SOCIETY OF AMERICA

March 15-18 Oklahoma City, OK

NCB - SWB

ANNUAL MEETING

Presidents Molly Keck (SWB) and Andy Michel (NCB)

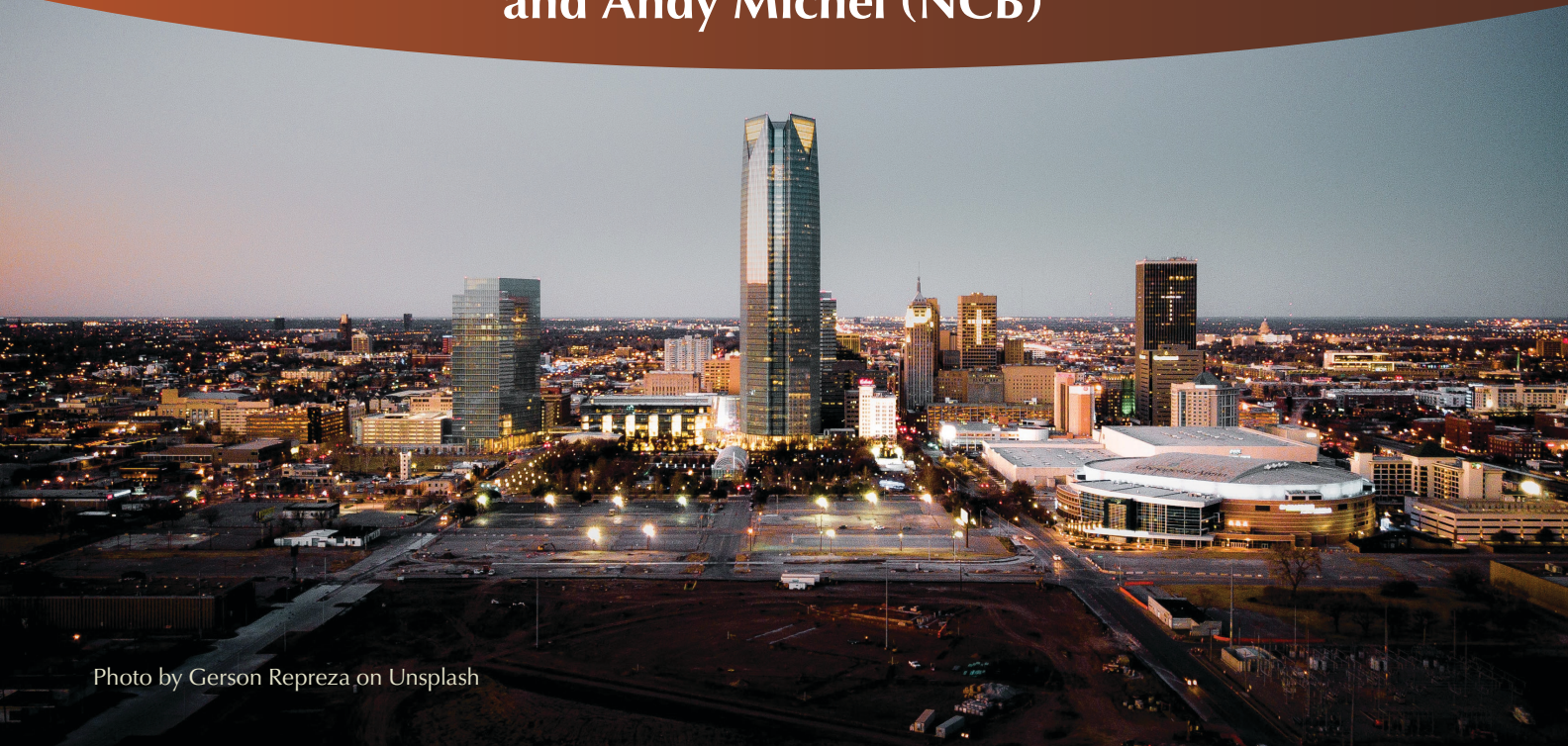


Photo by Gerson Repreza on Unsplash

Table of Contents

Notes

Meeting Information

Registration

All participants must register for the meeting. Registration badges are required for admission to all conference functions. The meeting registration desk is located on the second floor in the atrium near the Centennial and Grand Ballrooms. Registration hours:

Sunday . . . . . .10:00 AM – 6:00 PM
Monday . . . . . .7:30 AM – 4:00 PM
Tuesday . . . . . .7:30 AM – 4:00 PM
Wednesday . . . . . .7:30 AM – 9:00 AM

AV/Upload Room Hours (Balinese Room)

Sunday . . . . . .10:30 AM – 6:00 PM
Monday . . . . . .8:00 AM – 4:00 PM
Tuesday . . . . . .8:00 AM – 4:00 PM
Wednesday . . . . . .8:00 AM – 12:00 PM

Guidelines for Speakers and Moderators

Speakers and moderators will follow standard procedures and practices for ESA meetings. Moderators are responsible for maintaining the printed schedule, by not starting any presentation prior to its scheduled time, and by not allowing a speaker to exceed the allotted time. If a presentation is cancelled, the moderator must wait to begin the next presentation until its scheduled time. If there are problems with the computer/projector, or other equipment, please come to the AV/Upload room (Balinese) to request assistance.

Moderator and Student Competition Judge Training

For questions and instructions regarding student competition judging and moderating please contact Bonnie Pendleton (bpendleton@wtamu.edu) and Mark Asplen (mark.asplen@metrostate.edu).

Ten Minute Paper Presentation Upload

For All Presenters: Presentations should be created in a format compatible with MS Office-PowerPoint (.pptx). All slides should be **formatted in a 4:3 aspect ratio**. Meeting rooms will be equipped with an LCD projector, projector screen, computer and microphone. The Balinese Room will have computers for presenters to load and preview presentations. **All talks must be uploaded a minimum of <u>one hour before</u> the beginning of the scheduled session.** Folders with Session or Symposium Names will be provided—please upload your talk in the appropriate folder. Please name your presentation in the format Presentation# Lastname Firstname [for example: 52 Smith Mary]. All meeting room computers are PCs, so a presenter who creates a presentation using a Macintosh computer should test the file on a PC computer prior to the conference.

For Moderators: Talks should be uploaded for you on the computer in the session room ahead of time. Please check the computer at least 20 minutes before the start of the session and if the talks are not loaded to the desktop check with staff in the AV/Upload room (Balinese).

Poster Presentations

Poster Size and Mounting: Posters must be contained within the 46 x 46 inch (117 cm x 117 cm) space provided. The poster must NOT exceed the size limit. Posters will be mounted by their number in the program according to the signage provided. Organizers will provide materials to secure your display to the poster board.

Set Up: All posters, whether for the student competition or for regular submission, will be displayed concurrently. Posters will be displayed in the Pre-Function space outside of the Grand Ballroom on the second floor. All posters, student competition and regular, should be set up Sunday, March 15 between 3:30 – 6:00 PM and should remain posted until takedown on Tuesday, March 17 between 6:00 – 8:00 PM.

Author Presence: Presenters for Student Competition posters should stand by their poster on Monday, even numbers between 3:00-3:30 and odd number between 3:30-4:00. Submitted poster presenters should be present on Tuesday morning at 10:30 (no distinction between odd and even numbers).

Code of Conduct

By attending the 2020 Southwestern and North Central Branch Annual Meeting, you agree voluntarily to abide by our ethics policy. The full policy may be found online at entsoc.org/conduct. If you need to file a complaint, please contact Rosina Romano at rromano@entsoc.org, 703-593-0222 x 3010.

Statement on Diversity & Inclusion

The Entomological Society of America (ESA) is a professional organization dedicated to furthering the science and awareness of entomology through the advancement and professional development of all its members. ESA acknowledges and values all dimensions of diversity. Therefore, we welcome into our Society and encourage the participation of all individuals who are interested in entomology regardless of age, gender, gender identity, race, cultural background, religion, physical ability, sexual orientation, professional status, geographic location, and all other characteristics that make our members unique. ESA actively promotes inclusion, recruitment, and retention in every aspect of the Society – including but not limited to membership, leadership, committees, and staff. We strive to cultivate a scientific society of excellence built on mentorship, encouragement, tolerance, and mutual respect. ESA is committed to proactively rejecting and denouncing prejudice and stereotyping whenever it is encountered in the Society or the profession.

No Photographs Or Recordings Please

Attendees are requested not take photographs or videos during sessions because they are disruptive to the presenters. If you wish to take photographs of a poster, please contact the poster presenter for permission. The Branches reserve the right to use photographs and videos taken during the meeting for informational and promotional purposes.

Program Changes, Messages, Lost and Found, and Employment Opportunity

Please notify Program Chairs, Sonja Swiger (slswiger@ag.tamu.edu) and Kelley Tilmon (tilmon.1@osu.edu) about any last-minute program changes. Also, notices concerning program changes can be submitted to the Meeting Registration Desk. Announcements, job postings, and CVs can be displayed in the AV/Upload room room (Balinese). Lost and found items may be turned in and retrieved at the Registration Desk.

Internet

The hotel has complimentary wifi in the hotel rooms, common areas, and meeting space – no password required.

Refreshments

Coffee and tea will be available during scheduled breaks each day. Coffee Break Schedule:

Monday morning . . . . . 10:00 AM – 10:30 AM
Monday afternoon . . . . . 3:10 PM – 3:40 PM
Tuesday morning . . . . . 11:00 AM – 11:30 AM
Tuesday afternoon . . . . . 7:30 AM – 9:00 AM

Meals and Mixers

Welcome Reception

The Welcome Reception will be held Sunday evening, 8:30-10:00 PM in the Crystal Room (second floor). Light snacks will be served and a cash bar available.

Student Mixer

The Student Mixer will be held on-site in the Continental Room (14th floor), Monday 8:30-10:00 PM. Light snacks and beverages will be served.

Early Career Professionals Networking Event

Early career professionals (within 5 years after terminal degree) from the SWB and NCB are invited to enjoy company, conversation, drinks and dinner (self-pay) with other early career entomologists at the Deep Deuce Bar & Grill (307 NE 2nd St., 0.4 miles from the Skirvin) on Monday from 8:30-10:00 PM.

Award Dinner Banquet

The Awards Dinner Banquet (Tuesday at 7:00 PM, Grand Ballroom) is included with registration for all participants.

Diversity and Inclusion Breakfast

All students, early career professionals, and interested regular members are cordially invited to join us at the Diversity & Inclusion Breakfast 7:30-8:30 AM on Wednesday, March 18th in the Grand Ballroom. *Free limited breakfast will be available on a first-come basis but all are welcome to attend the program.* An icebreaker asking people to engage with each other as a member of an underrepresented or dominant group will start off our discussion of power dynamics in research. While networking with peers and eating breakfast, you'll have the opportunity to learn about the professional journey of four scientists at different career stages, how their identity has affected that journey, and how we can better support the next generation of diverse entomologists in being successful. Help us continue to move Entomology into the 21st Century and plan to attend!

Joint Linnaean Games

Come to enjoy the Joint Meeting Linnaean Games. Rounds of SWB and NCB competition will alternate with each other during the Preliminary and Final events (Sunday and Monday, 5:30-8:30 PM; Venetian Room 14th Floor). Time permitting, at the end of the event on Monday the top team from each Branch will compete in a Fun Match.

Southwestern Branch Insect Expo

The Insect Expo will be held on Monday from 8:00 AM to 1:00 PM in the Grand Ballroom. The Insect Expo is an activity-oriented learning experience for 3rd-5th graders presented by the Southwestern Branch of the Entomological Society of America that reaches approximately 800 students annually. Students are given opportunities to interact with professional entomologists and entomology students as they participate in a wide variety of lessons and activities designed to educate people about the most widespread and diverse group of organisms on earth: Insects. Through interactive experiments and activities, students learn what adaptations have allowed insects to be so successful, how the vast majority of insects are beneficial, how each insect has its niche in the ecosystem. They also learn about insect life cycles and use models to understand the insect's physical limits.

Silent Auction

Please stop by the silent auction and bid on your favorite items – Located in the Balinese Room and open during the listed AV/Uploading hours.

Bilingual Poster and Papers

Be sure to look out for this year's special collection of bilingual poster and paper presentations in the submitted poster and paper sections.

Hotel, Ground Transportation, Parking, and Things to Do

Hotel

The Skirvin Hilton Oklahoma City (1 Park Avenue; 405-272-3040; https://www.skirvinhilton.com/) is an historic hotel built in 1911 and beautifully restored to Gilded Era glamour. It contains a bar, restaurant, business center, fitness room, and pool.

Ground Transportation/Airport

The Skirvin Hilton does not have shuttle service. The Will Rogers World Airport (OKC) is 11 miles from the hotel. A taxi ride runs in the $40 range and a ride-hail (e.g., Uber or Lyft) typically around $15.

Parking

The hotel does not provide self-parking. Valet parking is $34.76/day. Public parking is available at the Santa Fe Parking Garage next to the Skirvin Hotel with entrance at 101 N E K Gaylord Blvd. for $10 per day.

Visit OKC!

There are a number of restaurants, pubs, and breweries within walking distance of the hotel. Check out places in the nearby Bricktown District https://www.visitokc.com/restaurants/dining-by-district/bricktown/ And for a wealth of information about Okalahoma City visit https://www.visitokc.com/

Notes

Sponsors

Special Thanks to our Meeting Sponsors

PLATINUM LEVEL: $6000

CORTEVA™ agriscience

PLATINUM LEVEL: $1000

FMC An Agricultural Sciences Company

Bayer CropScience

TRÉCÉ INCORPORATED

Society of Southwestern Entomologists 1976

AMVAC

GOLD LEVEL: $500

BASF We create chemistry

DAVEY Proven Solutions for a Growing World

ohp Partners with solutions

VALENT BIOSCIENCES

syngenta

Gowan USA

Bayer Environmental Science

SILVER LEVEL: $300

BioQuip

GROWMARK

NICHINO AMERICA

PERCIVAL

2020 SWB and NCB Meeting Organizers

	Southwestern Branch	North Central Branch
Presidents	Molly Keck	Andy Michel
Secretaries	Wizzie Brown	Erin Hodgson
Treasurers	Bob Davis	Erin Hodgson
Program Chairs	Sonja Swiger	Kelley Tilmon
Student Competition Chairs	Bonnie Pendleton	Mark Asplen
Local Arrangement Chairs	Ali Zarrabi Edmond Bonjour	Rob Morrison
Linnaean Game Masters	Eric Rebek	Deane Jorgenson
Meeting Sponsor Coordinators	Wyatt Hoback	Ana Velez
Student Affairs Chairs	Jocelyn Holt	Christopher Riley

Special Acknowledgements

OUR SPECIAL THANKS TO:

- ESA Central Staff, especially Becky Anthony who was absolutely instrumental in steering this ship
- Confex Staff, especially Amy Coli for program assistance and name for program book assembly
- The Skirvin Hilton staff, especially Erin Wells, Senior Events Manager
- All of our moderators, student competition judges, and student volunteers
- All of our meeting sponsors

SWB-ESA Committee Information

Executive Committee

VICE PRESIDENT
Molly Keck
mekeck@ag.tamu.edu

PAST-PRESIDENT
Eric Rebek
eric.rebek@okstate.edu

VICE PRESIDENT
Wyatt Hoback
whoback@okstate.edu

SECRETARY
Wizzie Brown
ebrown@ag.tamu.edu

SECRETARY-ELECT
Scott Ludwig
scottl@amvac-chemical.com

TREASURER
Bob Davis
robert.davis@basf.com

SWB REPRESENTATIVE TO GOVERNING BOARD
Jesus Esquivel
Jesus.Esquivel@ARS.USDA.GOV

Audit Committee

CHAIR
Scott Armstrong

MEMBERS
Matthew Lee
George Opit

Awards and Honors Committee

CHAIR
Sonja Swiger

MEMBERS
Jesus Esquivel
Kristopher Giles
Ken McPherson
Laura Weiser-Erlandson
Alvaro Romero
Sergio Sanchez-Pena
Robert Puckett
Astri Wayadande

Certification Board

CHAIR
Wizzie Brown

Branch Archivist

CHAIR
Gregory Cronholm

Friends of the Southwestern Branch Committee

CHAIR
Wyatt Hoback

MEMBERS
Molly Keck
Scott Ludwig
Adrin Shufran

In Memoriam Committee

CHAIR
Philip G. Mulder Jr.

MEMBERS
Edmond Bonjour
David Thompson
Allen Dean
Scott Bundy

Insect Detection, Evaluation, and Prediction Committee

CHAIR
Carol Sutherland

MEMBERS
Charlie Konemann

Insect Expo Committee

CHAIR
Andrine Shufran

MEMBERS
Wizzie Brown
Molly Keck
Philip G. Mulder, Jr.
Mo Way

Linnaean Games Committee

CHAIR
Scott Bundy

GAMESMASTER
Eric Rebek

MEMBERS
Cheri Abraham
Wyatt Hoback
Adam Mitchell
Juliana Rangel Posada
Alvaro Romero
Bonnie Pendleton
Joni Blount

Local Arrangements Committee

CO-CHAIRS
Edmond Bonjour
Ali Zarrabi

Membership Committee

CHAIR
Justin Talley

MEMBERS
Manuel Campos
Jesus Esquivel
Bill Ree
Sergio Sanchez-Pena
Astri Wayadande

Nominating Committee

CHAIR
Eric Rebek

MEMBERS
Molly Keck
Justin Talley
Carlos Bogran

Program Committee

CHAIR
Sonja Swiger

Public Information Committee

CHAIR
Carol Sutherland

MEMBERS
Tom Royer

Site Selection Commitee

CHAIR
Wizzie Brown

MEMBERS
Wyatt Hoback
Molly Keck
Eric Rebek

Student Research Paper and Poster Awards Committee

CHAIR
Bonnie Pendleton

MEMBERS
Ali A. Zarrabi
Suhas Vyavhare
Bradon Smythe
Tom Royer
Eric Rebek
Jane Pierce
Bob Davis
Scott Bundy
Joni Blunt
Justin Talley

Youth Science Committee

CHAIR
Mo Way

MEMBERS
Wizzie Brown
Molly Keck
Bonnie Pendleton
Jane Pierce
Andrine Shufran

Committee on Diversity and Inclusion

CHAIR
Alvaro Romero

Early Career Professionals Committee

CHAIR
Tracey Payton Miller

Education and Outreach Committee

CHAIR
Wyatt Hoback

MEMBERS
Abdrine Shufran
Molly Keck
Wizzie Brown

Committee on Diversity and Inclusion

CHAIR
Kristopher Giles

Student Affairs Committee

CHAIR
Jocelyn Holt

MEMBERS
Jacob Farriester
Fabian List
Karen Poh
Tyler Raznick
Jeffrey Yung

NCB-ESA Committee Information

Executive Committee

PRESIDENT
Andy Michel
Michel.70@osu.edu

PRESIDENT-ELECT
Mark Boetel
Mark.Boetel@ndsu.edu

PAST PRESIDENT
Bill Ravlin
Ravlin@msu.edu

SECRETARY / TREASURER
Erin Hodgson
ewh@iastate.e du

STUDENT REPRESENTATIVE
Chris Riley
criley@Bartlett.com

NCB REPRESENTATIVE TO GOVERNING BOARD
Gary Brewer
Gbrewer2@unl.edu

MEMBER-AT-LARGE 1
Clint Pilcher
clint.pilcher@pioneer.com

MEMBER-AT-LARGE 2
Laura Campbell
LACampbell@dow.com

MEMBER-AT-LARGE 3
Ana Maria Vélez
avelezarango2@unl.edu

Local Arrangements Committee

CHAIR
Rob Morrison

COMMITTEE MEMBERS
Hannah Quellhorst

Program Committee

CHAIR
Kelley Tilmon

COMMITTEE MEMBERS
Emily Althoff

Students Affairs Committee

CHAIR
Chris Riley

VICE-CHAIR
Aleksandra Dolezal

IOWA STATE
Kelsey Fisher

MINNESOTA
Anh Tran

MICHIGAN STATE
Zinan Wang

WISCONSIN
Samuel DeGrey

MANITOBA
Crystal Almdal

MISSOURI
Emily Althoff

ILLINOIS
Rachel Skinner

KANSAS STATE
Hannah Quellhorst

PURDUE
Scott Gula

KENTUCKY
Laura Rosenwald

NEBRASKA
Sajjan Grover

COLORADO STATE
Ryan Paul

OHIO STATE
Sarah Scott

Committee Information

Student Awards Committee

CHAIR
Mark Asplen

MEMBERS
Amit Sethi
Mike McCarville
Amy Raudenbush
Laramy Enders
Nick Teets

STUDENT REPRESENTATIVE
Samuel DeGrey

Professional and Honorary Awards Committee

CHAIR
Scott Williams, DNT

MEMBERS
Sajjan Grover
Kayla Perry
Jan Knodel
Louis Hesler
Marlin Rice

STUDENT REPRESENTATIVE
Anh Tran

Nominating Committee

CHAIR
Zsofia Szendrei

MEMBERS
Deane Jorgenson
Marlin Rice

Audit Committee

CHAIR
Matt Carroll

MEMBERS
Alice Harris
Elane Fishilevich

Photo Salon Committee

CHAIR
Tom Myers

MEMBERS
Ric Bessin
Gary Hein
David Voegtlin

Linnaean Games Committee

CHAIR
Dan Young

GAMESMASTER
Deane Jorgenson

MEMBERS
Dan Young

STUDENT REPRESENTATIVE
Laura Rosenwald

ESA Representatives

CEMA PROJECT AWARDS
Dan Moellenbeck

AWARDS AND HONORS COMMITTEE
Jen White

SCIENCE POLICY COMMITTEE
Robert Wright

EARLY CAREER PROFESSIONALS COMMITTEE
Karl Roeder

DIVERSITY AND INCLUSION COMMITTEE
Amanda Skidmore

EDUCATION AND OUTREACH COMMITTEE
Joseph Raczkowski

STUDENT AFFAIRS COMMITTEE
Annie Krueger

Past-Presidents and Chairmen of the Southwestern Branch

President	Year	Meeting Location
Eric Rebek	2018-2019	Tulsa, OK
Justin Talley	2017-2018	Albuquerque, NM
Carlos Bográn	2016-2017	Austin, TX
Jerry Michels	2015-2016	Tyler, TX
Bob Davis	2014-2015	Tulsa (Catoosa), OK
Jesus Esquivel	2013-2014	San Antonio, TX
Scott Bundy	2012-2013	Las Cruces, NM
Allen Knutson	2011-2012	Little Rock, AR
Tom Royer	2010-2011	Amarillo, TX
Carlos Blanco	2009-2010	Cancun, Mexico
Bonnie Pendleton	2008-2009	Stillwater, OK
Greg Cronholm	2007-2008	Ft. Worth, TX
David Thompson	2006-2007	Corpus Christi, TX
Bart Drees	2005-2006	Austin, TX
Phil Mulder	2004-2005	Albuquerque, NM
John D. Burd	2003-2004	Lubbock, TX
Terry Mize	2002-2003	Oklahoma City, OK
W. Pat Morrison	2001-2002	Guanajuato, Mexico
Jim Reinert	2000-2001	San Antonio, TX
James A. Webster	1999-2000	Ft. Worth, TX
Carol Sutherland	1998-1999	Las Cruces, NM
Ann Weise	1997-1998	Corpus Christi, TX
Pete Lingren	1996-1997	Oklahoma City, OK
Charles L. Cole	1995-1996	Austin, TX
J. Terry Pits	1994-1995	Dallas, TX
Sidney E. Kunz	1993-1994	Monterrey, Mexico
John G. Thomas	1992-1993	Albuquerque, NM
Don Bull	1991-1992	Tulsa, OK
Aithel McMahon	1990-1991	College Station, TX
Russel E. Wright	1989-1990	San Antonio, TX
Joyce Devaney	1988-1989	El Paso, TX
Russ Andress	1987-1988	Dallas, TX
Don Rummel	1986-1987	Austin, TX
John E. George	1985-1986	Monterrey, Mexico
Paul D. Sterling	1984-1985	San Antonio, TX
H. Grant Kinzer	1983-1984	Oklahoma City, OK
James R. Coppedge	1982-1983	Corpus Christi, TX
Bill C. Clymer	981-1982	El Paso, TX
Horace W. VanCleave	1980-1981	San Antonio, TX
Robert L. Harris	1979-1980	Brownsiville, TX
Jimmy K. Olson	1978-1979	Houston, TX
J. Pat Rock	1977-1978	Lubbock, TX
Robert A. Hoffman	1976-1977	Guadalajara, Mexico
Weldon H. Newton	1975-1976	Oklahoma City, OK
Harry L. McMenemy	1974-1975	El Paso, TX
Roger O. Drummond	1973-1974	Dallas, TX
Dieter S. Enkerlin	1972-1973	San Antonio, TX
Stanley Coppock	1971-1972	Mexico City, Mexico

Chairman	Year	Meeting Location
C.A. King, Jr.	1970-1971	El Paso, TX
Ted McGregor	1969-1970	Brownsville, TX
Neal M. Randolph	1968-1969	Dallas, TX
Walter McGregor	1967-1968	Oklahoma City, OK
Harvey L. Chada	1966-1967	San Antonio, TX
R.L. Hanna	1965-1966	El Paso, TX
H.E. Meadows	1964-1965	Austin, TX
Dial E. Martin	1963-1964	Monterrey, Mexico
Manning A. Price	1962-1963	Houston, TX
Sherman W. Clark	1961-1962	Oklahoma City, OK
O.H. Graham	1960-1961	San Antonio, TX
Clyde A. Bower	1959-1960	El Paso, TX
Paul Gregg	1958-1959	Dallas, TX
C.R. Parencia	1957-1958	Houston, TX
J.C. Gaines	1956-1957	San Antonio, TX
D.C. Earley	955-1956	Ft. Worth, TX
John M. Landrum	1954-1955	Houston, TX
D.E. Howell	1953-1954	Dallas, TX
P.J. Reno	1952-1953	Galveston, TX
R.C. Bushland	1951-1952	San Antonio, TX
H.G. Johnston*	1950-1951	Dallas, TX

**Southwestern Branch, American Association of Economic Entomologists*

2020 SWB-ESA AWARD WINNERS

J.H. Comstock Graduate Student Award

Xiaotian Tang
Texas A&M University

Xiaotian Tang is an entomologist from China currently studying at Texas A&M University. He is a PhD student working in vector biology and vector-pathogen interactions between the bacterial pathogen, 'Candidatus Liberibacter solanacearum' (Lso), and its vector, the potato psyllid (Bactericera cockerelli). His main research focus areas are: (1) identify key genes involved in the interactions between the vector and the pathogen during acquisition; (2) characterize the immune response of the vectors to the pathogen; and (3) manipulate the immune response of the vectors to disrupt the transmission of the pathogen. Xiaotian has published 23 peer-reviewed papers in top journals (129 citations by over 50 research groups) and has 5 manuscripts that are currently under review. He is the author of 2 patents of kits for rapid identification of quarantine pests authorized by the Chinese government, which allow for rapid identification of species at the molecular level. He has mentored 4 undergraduate students in research, all of them are authors of published or under review papers, participated in 14 scientific meetings and presented 11 oral talks and posters at regional, national and international conferences. Xiaotian has been awarded 7 highly prestigious scholarships, including three times the NATIONAL Scholarship (TOP 0.2%), the highest academic honor for students in China. He has also received the Herb Dean'40 Endowed Scholarship from Department of Entomology at TAMU and twice won the ESA President prize (FIRST place) for excellence, for a Student Ten-Minute Talk in Vancouver 2018 and the Poster Competitions at St. Louis in 2019.

Undergraduate Achievement in Entomology Award

Omar Khan
Texas A&M University

Omar Khan began working in our Entomology after he became interested in the discipline and decided to double major in both Animal Science (his existing major), and Entomology. Shortly after making this decision, Omar became interested in research involving honey bees. In 2018 when Omar was a sophomore, Omar became part of Dr. Rangel's honey bee laboratory in the Department of Entomology at Texas A&M University. Omar worked with a graduate student in Dr. Rangel's laboratory, on a project that required using a microscope camera and new software. The project involved dissecting, fixing, and quantifying ovarioles from honey bee queen ovaries. Omar worked well as an independent researcher, earning A's on all of his research credits in the process of learning about and participating in research efforts. After completing this project, Omar presented his work at the 2019 Southwestern Branch meeting, where he represented our department professionally, displaying his excellent work in his presentation. While at ESA, Omar also participated in the Insect Expo as a volunteer, which is one of several examples of Entomological outreach that Omar has participated in, as he is also a frequent volunteer for the Honey Bee Laboratory's outreach efforts.

Percival Scientific Undergraduate Entomology Student Activity Award

Zachary Royko
Oklahoma State University

Mr. Royko is a junior at Oklahoma State majoring in Entomology with an emphasis in Insect biology and Ecology. He is a leader in our Department and in the community and has volunteered nearly 100 hours of time since he arrived on campus. His volunteer work includes open hours at the Insect Adventure, on-campus events relating to the bee keeping club, and volunteering at the branch meetings in 2018 where he ran the booth highlighting insect feeding.

In addition to his volunteering for entomology-related events, Zach Royko is an eagle scout who has volunteered over 240 hours in the past three years teaching wilderness skills and passing on a love for the environment.

Distinguished Achievement Award in Extension

Dr. Allen Knutson
Texas A&M University

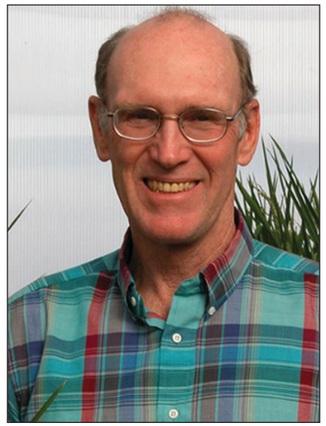
Dr. Allen Knutson, a recently retired Extension Entomologist from Texas A&M AgriLife Extension. Had many areas of responsibilities, one was pecan trees and the management for them. Dr. Knutson's efforts resulted in the most important pecan IPM tool to date, for both producers and researchers through management of the pecan nut casebearer, now a full website, https://pecan.ipmpipe.org/. In the early 1990's Dr. Knutson began working with Dr. Jocelyn Millar, to identify a pheromone for the pecan nut casebearer. The result of this collaboration resulted in the identification of the female mating pheromone. In addition to his role in identifying the pheromone, Dr. Knutson worked with Texas A&M Extension Entomology Specialist Dr. Mark Muegge to develop a prediction model (PNC Forecast) for first generation pecan nut casebearer oviposition. The development of this monitoring system has not only benefited pecan producers across Texas, but also across all states where pecan and pecan nut casebearer exist. This combination of trapping and prediction has been the most important IPM tool for producers. Dr. Knutson was on the front lines when sugar cane aphids were hitting Texas. He spent numerous hours traveling to county programs helping to educate agents and producers about this invasive pest and explaining sound IPM practices. In the summer and fall of 2018, Texas experienced an outbreak of fall armyworms Spodoptera frugiperda that was devastating hay fields and pastures. Dr. Knutson developed The Fall Armyworm – A Pest of Pasture and Hay document is one of the most downloaded documents for Agricultural producers in the south.

Distinguished Achievement Award in Teaching

Adrienne Brundage
Texas A&M University

Dr. Adrienne Brundage is an Instructional Assistant Professor in the Entomology Department of Texas A&M University. Dr. Brundage began teaching as full time faculty in Fall 2013 with a 100% teaching appointment. Adrienne teaches Veterinary Entomology (ENTO 208), Medical Entomology (ENTO 423), and writing intensive undergraduate Seminar (ENTO 481W) and Introduction to Forensic Sciences (FIVS 205) as her primary teaching responsibilities. Enrollment in her courses is well over one hundred students every semester with Veterinary Entomology often approaching 250 students, except for seminar. She does a fantastic job of passing her intense enthusiasm for forensics and entomology to her students every semester and is routinely the person who scores the highest on student evaluations in the department and this past year her student evaluation scores averaged 4.66 (range 4.53 – 4.77) and every course she taught scored above the department average and this is consistent from year to year if not improving each year. She is an exceptionally gifted teacher. Dr. Brundage's teaching philosophy is simple. She gets to know the subject and her students so intimately that she can make the learning time shrink from years to weeks. She cuts through the extraneous information, and presents new and complex knowledge to students in such a way that it not only sticks, but impacts their lives. She does this through innovative and exciting teaching methods, coupled with an attentive, caring, and enthusiastic demeanor.

Award of Excellence in Integrated Pest Management



Dr. Mo Way
Texas A&M University

Dr. Mo Way began employment at the Texas A&M AgriLife Research and Extension Center at Beaumont in 1982. Initially, Dr. Way's formal research responsibilities were developing and implementing IPM programs for insects attacking rice and soybeans, but over the years, Dr. Way also has conducted research on blackbird management in rice and insect management in sugarcane/energy cane, and grain sorghum. These additional responsibilities were at the behest of clientele in SE Texas. Dr. Way has tried to answer practical questions posed by stakeholders throughout his career. He has gained the confidence and respect of farmers, crop consultants, Extension scientists, scientific peers within and outside Texas, agrichemical company representatives/scientists and regulatory officials with the Texas Department of Agriculture and USEPA. A hallmark of Mo's career is his ability and desire to network with a wide audience to help advance the practice of IPM on local, state, national and international levels, and has many "firsts" as an Entomologist. Dr. Way was the 1st rice scientist to discover rice seed midges (RSM) (Order Diptera: Family Chironomidae) as pests of water-seeded rice in Texas. Dr. Way was the 1st rice scientist to detect Mexican rice borer (MRB) (Eoreuma loftini) in the Texas Rice Belt (TRB). This exotic stem-boring pest gradually moved north and east to infest rice in all of Texas, parts of Louisiana and Florida. Dr. Way has worked with USEPA, Texas Department of Agriculture, USA Rice and agrichemical companies to help obtain many Crisis Exemptions, Label Extensions, Section 18 Emergency Exemptions and/or Section 3 labels for major and minor insect pests of rice. He has given countless Extension presentations and served as editor and chapter author for several publications.

Friends of IPM Award - Lifetime Achievement

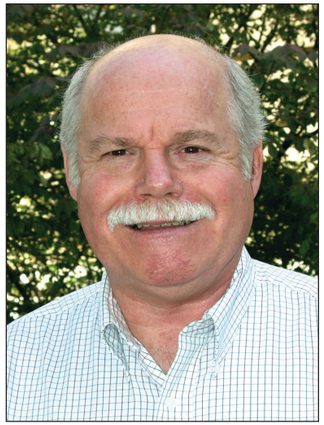
Presented by BCEs of Mid-America

Dr. Mike Merchant
Texas A&M University

Dr. Mike Merchant, BCE has had a distinguished career in Extension for over 30 years. He was hired as the Urban Entomologist in the District 4 offices in 1989. He has engaged in a wide variety of urban entomology projects and challenges: providing education and applied research to deal with new and emerging pests and insect borne, human diseases; developing an IPM in Schools program; teaching master volunteers and county agents about arthropod pests and natural enemies; and creating a pest management training facility for pest management professionals are some of his notable accomplishments. Mike Merchant has made significant contributions through his service to the Entomological Society of America. From 1999-2003, Merchant served on the Entomological Society of America's Certification Board, responsible for the Societies certification programs. The Board-Certified Entomologist program gives entomology graduates the opportunity for recognition of their proficiency in entomology. From 2001-2002, Merchant served as Director of the BCE program during which time he led reorganization of the program committee and the establishment of the Associate Certified Entomologist (ACE) program. The ACE program provides certification which recognizes pest management providers' expertise in the field of entomology. It was the first new certification program since the BCE program. Mike Merchant used innovative educational delivery systems to empower his audiences to deal effectively with change (extant pest populations, invasive pests, pesticide resistance, development of novel control tactics). His focus has been on providing educational experiences in ways most compatible with how people learn. Dr. Merchant has been a leader in adopting modern educational methods to accomplish his educational goals. Since 1995 he has maintained a website - Insects in the City (Citybugs) - which allows users to sign up for insect updates, post questions, and browse factsheets and news releases. The Citybugs website was created for the public is designed to answer many of the commonly asked, pest-related, questions posed by callers to the Texas A&M AgriLife Extension Service. It is one of the most heavily visited AgriLife websites. On average each year this website has at least 1.2 to 1.5 million visitors, with an average pageview of 3.2 million views each year.

2020 NCB-ESA AWARD WINNERS

C.V. Riley Achievement Award



Dr. Bob Wright
University of Nebraska

Wright has been a faculty member in the University of Nebraska-Lincoln Entomology Department since 1988. He has conducted research/extension programs focused on management of agronomic insects, primarily in corn and soybean. Wright has contributed to research and extension teams which have greatly improved our knowledge of corn rootworm, European corn borer, and western bean cutworm biology and management, including addressing several insecticide and Bt trait resistance issues. He has made significant contributions to the USDA IPM Centers, including current service on the Advisory and Steering Committees of the North Central IPM Center. He has provided service to ESA as ESA Program committee chair (2003), NCB Program Chair (2012) and currently serves as NCB representative to the ESA Science Policy Capacity Committee. Significant recent awards include 2015 NCB-ESA Distinguished Achievement Award in Extension, 2016 ESA Distinguished Achievement Award in Extension, and 2018 International IPM Award of Excellence, North Central Soybean Entomology Research and Extension Team, International IPM Symposium.

Award of Merit

Gary. J Brewer
University of Nebraska-Lincoln

Gary Brewer has been a member of the Entomological Society of America since 1977 and has served on many ESA committees and was Secretary and Chair of section Fa, Host Plant Resistance to Insects. His service to the North Central Branch has included committees, often as chair, symposia organizer, twice as local arrangements Co-Chair, and NCB President in 2004-05. He is the current North Central Branch Representative to the ESA Governing Board. Other professional service has included Secretary and Chair of CEDA, Council of Entomology Department Administrators, serving on the Board of Representatives of the Council for Agricultural Science and Technology and President of the Kansas Entomological Society in 2018 and the UNL Chapter of Gamma Sigma Delta in 2019. He stepped down as Department Head of the Entomology Department at UNL after 12 years and rejoined the faculty in 2019 as Professor of Insect Management with research and teaching responsibilities. He is currently teaching an online, graduate/undergraduate integrated pest management class and undergraduate crops entomology. His major research thrust has shifted from crops to livestock IPM with one emphasis on developing a push-pull tactic to manage stables on pasture cattle in the Great Plains. Smaller efforts include collaborations in crop IPM systems and conservation of the federally endangered Salt Creek tiger beetle. A recent international activity, was leading a design team developing and implementing an experiential-based, major in Conservation Agriculture for the Rwandan Institute for Conservation Agriculture (RICA). RICA, a Bachelor of Science degree awarding institution, inaugurated its first class in the fall of 2019.

Legacy Contribution Award

Dr. Daniel A. Potter
University of Kentucky

Daniel A. Potter, Professor of Entomology, has been on the faculty of the University of Kentucky since 1979. He is an authority on pest and beneficial insects affecting urban landscapes, recognized in particular for applying ecological principles in developing sustainable pest management practices. Dr. Potter has served as Major Professor for 48 graduate students. He and students in his program have published 215 refereed scientific papers, 25 invited book chapters, three Annual Reviews, and many dozens of trade journal articles. His book "Destructive Turfgrass Insects" is a widely used reference. Potter has been an invited speaker at scientific conferences throughout the world, and is a frequent Keynote Speaker at horticulture industry conferences. A University of Kentucky Distinguished Research Professor and elected Fellow of the Entomological Society of America, he has received ESA's National Distinguished Achievement Awards for Teaching, Urban Entomology, and Horticultural Entomology, as well as national leadership and service awards from the professional land care industries.

Dr. Potter received his B.S. degree from Cornell University in 1974 and a Ph.D. in entomology from the Ohio State University in 1978. He teaches undergraduate and graduate courses in Horticultural Entomology and Insect-Plant Relationships, and has taught graduate seminars on various topics including professional development for young scientists.

Distinguished Achievement Award in Extension

Dr. Christina DiFonzo
Michigan State University

Dr. DiFonzo received both an MS and PhD in entomology at the University of Minnesota, working on epidemiology of aphid-vectored viruses in potato. She had a a postdoctoral fellowship in plant virology at the Volcani Ag Research Center in Bet Dagan, Israel. In 1996 she joined the faculty at Michigan State University as the the extension specialist for field crops entomology with responsibilities in corn, soybean, small grains, dry beans, sugar beets, and specialty field crops, as well as pesticide education.

In addition to extension, she teaches the general entomology and a course on pesticides, and has served as an undergraduate advisor and study abroad coordinator.

Award of Excellence in Integrated Pest Management

Dr. William D. Hutchison
University of Minnesota

Bill Hutchison is a Professor and Extension Entomologist in the Department of Entomology, University of Minnesota, and has served in this role since 1989. He was Dept. Head of Entomology from 2010-2015, and currently serves as Coordinator of the MN Extension Integrated Pest Management (IPM) Program. Bill is a native of Arizona, where he received his B.S. in Agronomy from the University of Arizona. He earned his Ph.D. in Entomology from the University of Wisconsin-Madison. Throughout his career, Bill has been active in seeking grower input to develop sustainable IPM programs for invasive insect pests of fruit, vegetable and field crops. He emphasizes economic and environmental benefits of IPM. Selected IPM achievements include development of: a) sequential sampling software, Resampling for Validation of Sampling Plans (RVSP), to expedite practical pest sampling for IPM decision-making (~100 sampling plans published globally), b) a rapid-response IPM program to minimize the risk of multicolored Asian lady beetle "taint" in Midwest wine grapes, c) early research to confirm Bt pollen drift, and variable expression of Bt proteins in "refuge-in-the-bag (RIB)" ears that may facilitate Bt resistance in corn earworm, and d) a 5-state analysis to document a $6.9 billion benefit of Bt corn for areawide suppression of European corn borer (ECB) in the Midwest corn belt. In 2007, he received ESA's Distinguished Achievement Award in Extension. In 2011, he received the ESA Foundation's IPM Team award for the ECB suppression project. With graduate students and colleagues, Bill has published over 160 referred journal articles, 20 book chapters, an IPM textbook (Radcliffe et al. 2009), and numerous extension articles. For Extension, he maintains the VegEdge and FruitEdge web sites.

Excellence in Early Career Award

Dr. Brock Harpur
University of Purdue

Brock Harpur is an Assistant Professor in the Entomology Department of Purdue. Brock arrived at Purdue after completing a National Science and Engineering Research Council Postdoctoral Fellow at the Donnelley Centre, University of Toronto. His work explores the evolution and genetics of honey bees. Brock completed his Ph.D. on population genomics of honey bees at York University. Brock has been awarded the prestigious Julie Payette Research Scholarship from the National Science and Engineering Research Council, an Ontario Graduate Scholarship, the Entomological Society of Canada's President's Prize, and was an Elia Research Scholar during his time at York University.

J.H. Comstock Graduate Student Award

Dr. Débora Montezano
University of Nebraska-Lincoln

Débora Montezano studies pest behavior, interactions, and biology in field crops to provide critical data for improved Integrated Pest Management and Resistance Management strategies. Débora received her Ph.D. in May 2019 from the University of Nebraska-Lincoln, her dissertation focused on the management of western bean cutworm. Previously, she earned a Masters in Brazil, where she conducted research on insect rearing methods to develop management techniques for pests. Débora has published 17 peer-reviewed papers, including on the topics of Noctuidae biology and intraguild interactions. Her long-term career goal is to continue research in the area of IPM to improve agricultural practices that allow for effective pest control with minimal environment impact. Débora is currently a Postdoctoral Researcher at the University of Nebraska-Lincoln studying the soybean gall midge, a challenging new pest.

Graduate Student Scholarship Award

Kelsey E. Fisher
Iowa State University

Kelsey E. Fisher graduated with a B.S. in Biology from Widener University in 2013. While there, she discovered her passion for entomology by working with a lab group studying host plant preferences of a larval Geomtridae species. She earned her M.S. in Entomology from the University of Delaware under Dr. Charles Mason in 2015. Her work explored the relationship between O. nubilalis and some of its lesser known host plants. Kelsey is currently in the 5th year of her PhD in Entomology at Iowa State University under Dr. Steven Bradbury. She aims to increase confidence in monarch butterfly conservation plans by understanding biological requirements. Improved understanding of movement ecology at all life stages and establishing future habitat patches in accordance with movement abilities will ensure conservation efforts are successful.

Educational Project Award

Presented by BCEs of Mid-America

Dr. Erin Hodgson
Iowa State University

and

Adam Sisson
Iowa State University

Erin Hodgson received her B.S. (Biology) and M.S. (Entomology) from North Dakota State University in Fargo. She got her Ph.D. (Entomology) in 2005 from the University of Minnesota in St. Paul. Erin started at Iowa State University in 2009. Currently, she is an extension entomologist and associate professor at ISU, with a specialty in field crop insects. Her extension and research programs are focused on improving profitability, sustainability and environmental stewardship of agriculture. Adam Sisson is an extension specialist with the Iowa State University Integrated Pest Management (IPM) program and a Certified Crop Adviser. Sisson focuses on the development of publications and other educational resources for farmers, agribusiness, and students. He received his bachelor's degree in agronomy and environmental studies in 2006 and a master's degree in sustainable agriculture in 2009, both from Iowa State University. Be a bug catcher! is a field guide to help both children and adults become experts at identifying and collecting insects. It is a s a practical, easy-to-follow booklet with nine chapters, covering topics like the importance of insects, insect biology and anatomy, collecting supplies and techniques, preserving insects and a list of useful insect terminology and references. The goal was to produce a useful, practical guide that uses a limited amount of jargon, but still provides a scientific, technical foundation for the bug collector.

Educational Project Award

Presented by BCEs of Mid-America

Dr. Christina DiFonzo
Michigan State University

Dr. DiFonzo is the extension specialist for field crops entomology at Michigan State University with responsibilities in corn, soybean, small grains, dry beans, sugar beets, and specialty field crops, as well as pesticide education.

The Handy Bt Trait Table is a simple document which provides information on all Bt corn trait packages from different companies. This information is public, but difficult and time-consuming to ferret out. The table is a dynamic word document, edited as needed when trait packages or requirements change. It has its own website (https://www.texasinsects.org/bt-corn-trait-table.html) maintained by Dr. Porter at Texas A&M, with supporting materials: a list of citations for Bt resistance, a 'how-to-use-the-table' slide set for extension and teaching, and a new sweet corn edition. The table has become the 'go-to' document to keep track of Bt traits in the U.S., and it is always free to view, print, copy, distribute, and incorporate into extension materials.

Teaching Award

Dr. Shannon Murphy
The Ohio State University

I have been at the University of Denver since 2010 and am an Associate Professor of Biology. I graduated from the University of Colorado at Boulder in Ecology and Evolutionary Biology. I received my PhD from Cornell University, also in Ecology and Evolutionary Biology, before completing two postdocs, one at the University of Maryland in Entomology and the other at the George Washington University in Biology. The parts of my job that I love are teaching and conducting research with undergraduate and graduate students in order to discover new information and then teaching these students how to disseminate our new knowledge to wider audiences. My students and I study how human-caused global change affects interactions between insects and plants; some of the many human disturbances we study are light pollution, wildfire, nutrient pollution, and habitat fragmentation. To engage students who are not already interested in STEM I have started to create labs where non-major students collect real data about bees as part of a Course-based Undergraduate Research Experience (CURE). I love doing outreach with K-12 students and co-direct DU SciTech, which is a summer STEM camp for middle-school girls from low-income and minoritized backgrounds. I am passionate about increasing diversity in STEM, particularly in entomology.

Program Schedule

SUNDAY, MARCH 15, 2020		
Program	**Time**	**Location**
NCERA220 Biological Control Working Group	8:00 AM - 12:00 PM	Perle Mesta Suite
SSWE Executive Committee Meeting	9:00 AM - 10:30 AM	Henry Overholser Suite
Joint NCB/SWB Executive Committee Meeting	9:30 AM - 10:30 AM	Continental Room (14th Floor)
Registration	10:00 AM - 6:00 PM	Coat Room
Presentation Upload & Preview Room	10:30 AM - 6:00 PM	Balinese Room
NCB Executive Committee Meeting	10:30 AM - 12:00 PM	W. B. Skirvin Suite
SSWE Member Meeting	11:00 AM - 12:00 PM	Crystal Room
Insect Expo Setup	12:00 PM - 6:00 PM	Grand Ballroom
NCAC-15 Meeting	1:00 PM - 4:00 PM	Henry Overholser Suite
Silent Auction	2:00 PM - 6:00 PM	Balinese Room
Student Ten Minute Paper Competition: Undergrad - MUVE, P-IE, & SysEB	3:00 PM - 4:30 PM	Centennial 1
Student Ten Minute Paper Competition: Master's - PBT, SysEB, & MUVE	3:00 PM - 4:00 PM	Centennial 2
Student Ten Minute Paper Competition: Master's - P-IE Session I	3:00 PM - 4:40 PM	Crystal Room
Student Ten Minute Paper Competition: Master's - P-IE- Session II	3:00 PM - 4:40 PM	Centennial 3
Poster Set Up	3:30 PM - 6:00 PM	Grand Ballroom Prefunction
Student Three-Minute Presentations	4:00 PM - 4:15 PM	Centennial 2
Joint Prelim Linnaean Games	5:30 PM - 8:30 PM	Venetian Room (14th Floor)
Welcome Reception	8:30 PM - 10:00 PM	Continental Room (14th Floor)

MONDAY, MARCH 16, 2020		
Program	Time	Location
Registration	7:30 AM - 4:00 PM	Coat Room
NCB Preliminary Business Meeting	7:30 AM - 8:15 AM	Crystal Room
Presentation Upload & Preview Room	8:00 AM - 4:00 PM	Balinese Room
Silent Auction	8:00 AM - 4:00 PM	Balinese Room
Insect Expo	8:00 AM - 1:00 PM	Grand Ballroom
Student Poster Competition: Undergrad Session I - MUVE & PBT	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Student Poster Competition: Undergrad Session II - SysEB & P-IE	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Student Poster Competition: Undergrad Session III - P-IE	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Student Poster Competition: Master's Session I - PBT & SysEB	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Student Poster Competition: Master's Session II - P-IE	8:00 AM - 6:00 PM	Grand Ballroom Prefunction

Student Poster Competition: PhD	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Regular Poster Session	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Regular Ten Minute Papers Session I - PBT & SysEB	8:30 AM - 9:30 AM	Centennial 3
Regular Ten Minute Paper Session II - MUVE	8:30 AM - 10:00 AM	Centennial 2
Regular Ten Minute Paper Session III - P-IE	8:30 AM - 10:00 AM	Venetian Room (14th Floor)
Enhancing Ecosystem Services with Sustainable Pest Management	9:00 AM - 12:30 PM	Crystal Room
Regular Ten Minute Paper Session IV - P-IE	9:30 AM - 12:00 PM	Centennial 3
Break	10:00 AM - 10:30 AM	Grand Ballroom Prefunction
Regular Ten Minute Paper Session V - P-IE	10:30 AM - 12:00 PM	Venetian Room (14th Floor)
SWB Student Affairs Committee Meeting	12:00 PM - 1:30 PM	Perle Mesta Suite
Insect Expo Breakdown	1:30 PM - 3:30 PM	Grand Ballroom
Student Ten Minute Paper Competition: Ph.D - MUVE	2:30 PM - 4:20 PM	Centennial 3
Student Ten Minute Paper Competition: Ph.D - PBT & SysEB	2:30 PM - 4:20 PM	Centennial 2
Student Ten Minute Paper Competition: Ph.D - P-IE - Session I	2:30 PM - 4:40 PM	Centennial 1
Student Ten Minute Paper Competition: Ph.D - P-IE - Session II	2:30 PM - 4:30 PM	Crystal Room
Break	3:10 PM - 3:40 PM	Grand Ballroom Prefunction
Joint Linnaean Games	5:30 PM - 8:30 PM	Venetian Room (14th Floor)
ECP Mixer	8:30 PM - 10:00 PM	
Student Mixer	8:30 PM - 10:00 PM	Continental Room (14th Floor)

TUESDAY, MARCH 17, 2020

Program	Time	Location
Registration	7:30 AM - 4:00 PM	Coat Room
Presentation Upload & Preview Room	8:00 AM - 4:00 PM	Balinese Room
Silent Auction	8:00 AM - 4:00 PM	Balinese Room
Joint Plenary Session	8:00 AM - 9:30 AM	Grand Ballroom
Student Poster Competition: Undergrad Session I - MUVE & PBT	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Student Poster Competition: Undergrad Session II - SysEB & P-IE	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Student Poster Competition: Undergrad Session III - P-IE	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Student Poster Competition: Master's Session I - PBT & SysEB	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Student Poster Competition: Master's Session II - P-IE	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Student Poster Competition: PhD	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Regular Poster Session	8:00 AM - 6:00 PM	Grand Ballroom Prefunction
Ecology and Management of Sucking Bugs in Cotton Agroecosystems	9:45 AM - 12:30 PM	Crystal Room
On the Road Again: Management and Conservation of Migratory Insects	9:45 AM - 12:30 PM	Centennial 2

Things They Don't Teach You in Grad School: We are planning for 6 talks at 20 minutes each.	9:45 AM - 12:30 PM	Centennial 1
From Molecules to Ecosystems: A Survey of Data Management and Analytical Strategies in Entomological Research: co-organized by the Student Affairs Committees of the NCB and SWB.	9:45 AM - 12:35 PM	Centennial 3
Break	11:00 AM - 11:30 AM	Grand Ballroom Prefunction
Extension Delivers: Showcasing Successful Program Delivery Methods for Insects	1:30 PM - 5:10 PM	Centennial 2
Frontiers in Risk Assessment and Management of Flies: We will organize the symposia to include longer talks (15-20 minute) and 10 minute student presentations.	1:30 PM - 5:15 PM	Centennial 3
Biological Control in Agroecosystems and Natural Areas: Highlighting the Work of a New Generation of Biocontrol Scientists	1:30 PM - 5:30 PM	Crystal Room
Urban Entomology Challenges in Midwestern and Southwestern United States	1:30 PM - 5:30 PM	Centennial 1
The Latest Advances in Pollinator Health Research	1:30 PM - 5:45 PM	Venetian Room (14th Floor)
Break	3:10 PM - 3:40 PM	Grand Ballroom Prefunction
NC1205: Monarch Butterfly Conservation in the Midwest Committee	5:30 PM - 6:30 PM	W. B. Skirvin Suite
Poster Takedown	6:00 PM - 8:00 PM	Grand Ballroom Prefunction
Joint Awards Banquet	7:00 PM - 10:00 PM	Grand Ballroom

WEDNESDAY, MARCH 18, 2020

Program	Time	Location
Registration	7:30 AM - 9:00 AM	Coat Room
NCB Final Business Meeting	7:30 AM - 8:30 AM	Centennial 1
SWB Final Business Meeting	7:30 AM - 8:30 AM	Centennial 3
Diversity & Inclusion Breakfast	7:30 AM - 8:30 AM	Grand Ballroom
Presentation Upload & Preview Room	8:00 AM - 12:00 PM	Balinese Room
Silent Auction	8:00 AM - 12:00 PM	Balinese Room
Plant Responses to Insect Herbivory: Molecular Mechanisms and Ecological Interactions	9:00 AM - 11:35 AM	Centennial 1
New Technologies and Applications for Stored Product Insect Management	9:00 AM - 12:00 PM	Centennial 2
Plant-Insect Ecosystems Symposium: Integrated Pest Management of Arthropod Pests in Large Scale Agroecosystems	9:00 AM - 12:00 PM	Crystal Room
Highlights of Successful Entomology Research and Education at Small Colleges and Universities	9:00 AM - 12:35 PM	Centennial 3
NCB Final Executive Committee Meeting/2021 NCB PLanning Committee Meeting	12:30 PM - 1:30 PM	W. B. Skirvin Suite
SWB Executive Committee Meeting	2:00 PM - 3:00 PM	Henry Overholser Suite

Oral & Poster Presentation Schedule

SUNDAY, MARCH 15, 2020, AFTERNOON

Student Ten Minute Paper Competition: Undergrad - MUVE, P-IE, & SysEB

Centennial 1 (Skirvin Hilton)

Moderator: John Ruberson, Univ. of Nebraska-Lincoln, Lincoln, NE

3:00 PM **1** **Toxicity effects of formic acid on the lone star tick.** *Bailee Dorsey (BNDors5434@schreiner.edu)[1], Allan T. Showler[2] and Ryan Caesar[1], [1]Schreiner Univ., Kerrville, TX, [2]USDA - ARS, Kerrville, TX*

3:10 PM **2** **The effect of nicotine and cotinine on survival and duration of development of *Cochliomyia macellaria* (Fabricius) (Diptera:Calliphoridae).** *Zoe Narvaez (znarvaez@ou.edu), Gautham Gautham, Heather Ketchum and Eric Bright, Univ. of Oklahoma, Norman, OK*

3:20 PM **3** **Evaluating and comparing techniques used to assess horn fly susceptibility to permethrin and abamectin.** *Halee Fincher (fincherh@nmsu.edu) and Brandon Smythe, New Mexico State Univ., Las Cruces, NM*

3:30 PM **4** **The lethal effects of CimeXa and Drione on *Amblyomma americanum* (lone star tick) populations.** *Allan Showler[1], Ryan Caesar[2] and Abigail Garcia (argarcia098@gmail.com)[3], [1]USDA - ARS, Kerrville, TX, [2]Schreiner Univ., Kerrville, TX, [3]Student, Kerrville, TX*

3:40 PM **5** **Assessing horn fly (Diptera: Muscidae) susceptibility to permethrin under different levels of induced starvation.** *Jovy Ramirez (zerimarj@nmsu.edu) and Brandon Smythe, New Mexico State Univ., Las Cruces, NM*

3:50 PM **6** **Honey bee (*Apis mellifera*) macronutrient regulation: Nurse bee nutritional preferences for proteins and lipids.** *Cora Garcia (coragarcia1999@gmail.com), Pierre Lau, Alexandria Payne, Jordan Gomez, Pierre Lesne, Spence Behmer and Juliana Rangel, Texas A&M Univ., College Station, TX*

4:00 PM **7** **Improving inclinations around insects through imagination and ingenuity.** *Morgan Partin-Topper (morpart@ostatemail.okstate.edu), Andrine A. Shufran and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK*

4:10 PM **8** **Comparison of male and female probing activities of the planthopper, *Peregrinus maidis* .** *Alexis Coles (alexis.coles@okstate.edu) and Astri Wayadande, Oklahoma State Univ., Stillwater, OK*

4:20 PM **9** **Using social media to promote entomology.** *Bailee Posey (baposey@ostatemail.okstate.edu), W. Wyatt Hoback and Andrine A. Shufran, Oklahoma State Univ., Stillwater, OK*

Student Ten Minute Paper Competition: Master's - PBT, SysEB, & MUVE

Centennial 2 (Skirvin Hilton)

Moderators: Raul T. Villanueva, Univ. of Kentucky, Princeton, KY and Sarah Zukoff, Univ. of Missouri, Columbia, MO

3:00 PM **10** **Identifying small RNAs of exosomes isolated from a *Diabrotica* cell line.** *Kyah Featherston (kyahf@ksu.edu)[1], Yoonseong Park[2], Kun Yan Zhu[1] and Kristopher Silver[1], [1]Kansas State Univ., Manhattan, KS, [2]Dept. of Entomology/Kansas State Univ., Manhattan, KS*

3:10 PM **11** **Spotted-wing drosophila (*Drosophila suzukii* Matsumura) cold tolerance physiology and population genetics.** *Samuel DeGrey (degrey@wisc.edu), Christelle Guédot and Sean Schoville, Univ. of Wisconsin, Madison, WI*

3:30 PM **13** **A field deployable Rapid *Anaplasma* Detection (RAD) kit for screening three *Anaplasma* species infecting livestock.** *Andrea Salazar (andrsa@okstate.edu), Francisco Ochoa-Corona, Justin Talley and Bruce Noden, Oklahoma State Univ., Stillwater, OK*

3:40 PM **14** **The timing of winter survival in *Culex pipiens* mosquitoes.** *Caitlin Peffers (peffers.2@buckeyemail.osu.edu) and Megan Meuti, The Ohio State Univ., Columbus, OH*

3:50 PM **15** **Artificial Light at Night (ALAN) induces abnormal seasonal responses in *Culex pipiens* mosquitoes.** *Lydia Fyie (fyie.1@osu.edu), Mary Gardiner and Megan Meuti, The Ohio State Univ., Columbus, OH*

Student Ten Minute Paper Competition: Master's - P-IE Session I

Crystal Room (Skirvin Hilton)

Moderator: J. Scott Armstrong, USDA - ARS, Stillwater, OK

3:00 PM **16** **Assessing asparagus beetle overwintering habitats and survival in an agroecosystem.** *Jennifer Zavalnitskaya (zavalnit@msu.edu) and Zsofia Szendrei, Michigan State Univ., East Lansing, MI*

3:10 PM **17** **Does the creation of pocket prairies improve the conservation value of urban vacant land for ant communities?** *Alex Tyrpak (tyrpak.3@buckeyemail.osu.edu), Kayla I. Perry, Joe Raczkowski, Christopher Riley and Mary Gardiner, The Ohio State Univ., Columbus, OH*

3:20 PM **18** **On the move: Attract-and-kill tactic for Japanese beetles (Coleoptera: Scarabaeidae).** *Kelsey Benthall (kjbhnd@mail.missouri.edu) and Kevin Rice, Univ. of Missouri, Columbia, MO*

3:30 PM **19** **Effects of fungus volatiles on the consumption and growth of tobacco hornworms (*Manduca sexta*).** *Alyssa Lucas (alyssa.l.lucas@gmail.com) and Kevin Rice, Univ. of Missouri, Columbia, MO*

3:40 PM **20** **Are females better listeners? Interactions between herbivore bioacoustics and chemical defenses in dioecious plants** *Layne Leake (lblc8c@mail.missouri.edu)[1], Reginald Cocroft[1], Eric Yip[2], John Tooker[2], Sabrina Michael[1] and Kevin Rice[1], [1]Univ. of Missouri, Columbia, MO, [2]Pennsylvania State Univ., Univ. Park, PA*

3:50 PM **21** **Temporal changes in olfactory cues from plant roots influence foraging by entomopathogenic nematodes.** *John Grunseich (johngrunseich@tamu.edu) and Anjel Helms, Texas A&M Univ., College Station, TX*

4:00 PM **22** **New host plant identified for wheat stem maggot.** *Julia Campos (julia.nog.campos@gmail.com)[1], Anthony McMechan[2] and Robert Wright[1], [1]Univ. of Nebraska, Lincoln, NE, [2]Univ. of Nebraska-Lincoln, Ithaca, NE*

4:10 PM **23** **Egg-laying monarchs do not discriminate oviposition based on the presence of a neonicotinoid insecticide.** *Alex Mullins (mullinsan8@gmail.com), Iowa State Univ., Ames, IA*

4:20 PM **24** **Improving trap design and placement for overwintering *Drosophila suzukii*.** *Ariana Hernandez (herna403@msu.edu), Juan Huang, Larry Gut and Matthew Grieshop, Michigan State Univ., East Lansing, MI*

4:30 PM **25** **Using high throughput sequencing to link cotton fleahopper gut content to host plants.** *Kristin Hamons (kritlee@tamu.edu)[1], Lindsey Perkin[2], Charles Suh[2] and Gregory Sword[1], [1]Texas A&M Univ., College Station, TX, [2]USDA - ARS, College Station, TX*

Student Ten Minute Paper Competition: Master's - P-IE- Session II

Centennial 3 (Skirvin Hilton)

Moderator: Dol Dhakal, NA, NA, TX

3:00 PM **26** **Assessment of plastic mulches for managing spotted-wing drosophila, fruit quality and yield, and soil health in raspberry.** *Hanna McIntosh (hrmcintosh@wisc.edu), Amaya Atucha, Beth Ann Workmaster and Christelle Guédot, Univ. of Wisconsin, Madison, WI*

3:10 PM **27** **Evaluating volatile organic compounds emitted from male and female pecan weevils, *Curculio caryae* Horn (Coleoptera: Curculionidae).** *Katherine Arnold (arnoldk@nmsu.edu)[1], David C. Thompson[1], Ikju Park[2] and Larry Blackwell[1], [1]New Mexico State Univ., Las Cruces, NM, [2]Univ. of California, Davis, Davis, CA*

3:20 PM **28** **Deployment of long-lasting insecticide-incorporated netting in pilot-scale warehouses effectively prevents dispersal and reduces infestation by stored product insects in commodities.** *Rachel Wilkins (rachwilk15@gmail.com)[1], Kun Yan Zhu[1] and Rob Morrison[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS*

3:40 PM **30** **Do small patches of prairie conserve pollinators, including native bees and pollinating flies, in an agricultural setting?** *Caroline Murray (cjmurray@iastate.edu), Matthew O'Neal and John Tyndall, Iowa State Univ., Ames, IA*

3:50 PM **31** **Combining COI and simple morphometric analysis to inform billbug (*Sphenophorus* spp.) management.** *Marian Rodriguez-Soto (rodri561@purdue.edu)[1], Laramy Enders[1], Ricardo Ramirez[2] and Douglas Richmond[1], [1]Purdue Univ., West Lafayette, IN, [2]Utah State Univ., Logan, UT*

4:00 PM **32** **Insecticide efficacy evaluation and emergence observations for soybean gall midge.** *Mitchell Helton (mhelton@iastate.edu)[1], Erin Hodgson[1], Anthony McMechan[2] and Nick Tinsley[3], [1]Iowa State Univ., Ames, IA, [2]Univ. of Nebraska-Lincoln, Ithaca, NE, [3]Bayer Crop Science, White Heath, IL*

4:10 PM **33** **Hymenoptera feeders: Sugarcane aphid (*Melanaphis sacchari*) honeydew as a resource in sorghum (*Sorghum bicolor*) and Johnson grass (*Sorghum halepnense*) fields.** *Michael Caballero (michaelcaballero9@gmail.com)[1], W. Wyatt Hoback[1] and J. Scott Armstrong[2], [1]Oklahoma State Univ., Stillwater, OK, [2]USDA - ARS, Stillwater, OK*

4:20 PM **34** **The effects of fire and grazing on pollinator abundance and diversity.** *Jessica Butters (jbutters@ksu.edu), Tania N. Kim and Brian Spiesman, Kansas State Univ., Manhattan, KS*

4:30 PM **35** **Optimizing RNA interference in fall armyworm *Spodoptera frugiperda* using improved nanoparticles.** *Ana Trabanino (trabaninopino.1@buckeyemail.osu.edu), Yosra Helmy, Gireesh Rajashekara and Andy Michel, The Ohio State Univ., Wooster, OH*

Student Three-Minute Presentations

Centennial 2 (Skirvin Hilton)

4:00 PM **36** **Best way to spray: Spray volume and application frequency determine insecticide efficacy against western flower thrips.** *Devin Radosevich (devinrados@earthlink.net) and Ray Cloyd, Kansas State Univ., Manhattan, KS*

4:03 PM **37** **Host preference in *Lygus lineolaris*, what makes scents?** *Matthew Hetherington (mhetheringto@wisc.edu), Univ. of Wisconsin, Madison, WI*

MONDAY, MARCH 16, 2020, POSTERS

Student Poster Competition: Undergrad Session I - MUVE & PBT / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D1 **Let the worms eat *Tenebrio/T. molitor*.** *Kalli Baumgardner (kallibeth2020@gmail.com), Northwest Technology Center, Fairview, OK*

D2 **Prevalence of *Plasmodium* sp. in mosquitoes collected in urban areas of southern Oklahoma.** *Brandon Henriquez (brandon.henriquez@okstate.edu), Jordan Sanders and Bruce Noden, Oklahoma State Univ., Stillwater, OK*

D3 **Mutations in the voltage-gated sodium channel gene of pyrethroid-resistant *Amblyomma mixtum* (Acari: Ixodidae) from Mexico.** *Odessa A. Mata (odessa.mata01@utrgv.edu)[1], Guilherme M. Klafke[2], Jason P. Tidwell[2], Francisco T. Barradas-Piña[3], Teresa Feria[1] and Adalberto A. Pérez de León[4], [1]The Univ. of Texas Rio Grande Valley, Edinburg, TX, [2]USDA - ARS, Edinburg, TX, [3]INIFAP, Medellin de Bravo, VL, Mexico, [4]USDA - ARS, Kerrville, TX*

D4 **Effect of bluetongue virus infection on blood meal feeding behavior in female *Culicoides sonorensis*.** *Brandon Hall (Brandon.Hall@usda.gov)[1,2], Paula Rozo-Lopez[1,2], Barbara Drolet[1] and Dana Nayduch[1], [1]USDA-ARS, Manhattan, KS, [2]Kansas State Univ., Manhattan, KS*

D5 **Gas chromatography – mass spectrometry analyses of pesticide treated honey bee (*Apis mellifera*) brood pheromones.** *Omar Khan (omarikhan@tamu.edu), Juliana Rangel and Elizabeth Walsh, Texas A&M Univ., College Station, TX*

D6 **Evaluation of the temperature tolerance of the predatory mite *Stratiolaelaps scimitus* for biological control of the honey bee ectoparasitic mite *Varroa destructor*.** *Travis Trimm (travistrimm501@gmail.com) and Juliana Rangel, Texas A&M Univ., College Station, TX*

D7 **Evidence of pheromone production in an orb weaver (Genus *Metepeira)*.** *Bryan Lara (larabryan20@gmail.com)[1] and David Thompson[2], [1]Student, El Paso, TX, [2]New Mexico State Univ., Las Cruces, NM*

D8 **Determining the effects of nutrition on honey bee (*Apis mellifera*) pathogen defense against deformed wing virus.** *Jordan Gomez (jordangomez363@gmail.com), Pierre Lau, Alexandria Payne, Cora Garcia, Pierre Lesne, Spence Behmer and Juliana Rangel, Texas A&M Univ., College Station, TX*

D9 **Improvements to RNAi in mosquitoes through nanoparticle mediated delivery.** *Rachel Brown (r.brown@uky.edu), Dhandapani Ramesh, Laura Ruberg and Reddy Palli, Univ. of Kentucky, Lexington, KY*

Student Poster Competition: Undergrad Session II - SysEB & P-IE / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D10 **Does predation prevent or promote the evolution of virulence in soybean aphids?** *Kelsey Shepherd (kelshep@iastate.edu), Jessica Hohenstein, Matthew O'Neal and Matthew Kaiser, Iowa State Univ., Ames, IA*

D11 **Chemical and foraging ecology of *Theocolax elegans (Westwood) (Hymenoptera: Pteromalidae)* on two alternate hosts.** *Chloe Albin (albinc@ksu.edu)[1] and Rob Morrison[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS*

D12 **Feeding performance and preference of the Asiatic garden beetle, *Maladera castanea*, in field crops.** *Matthew Lorentz (mlorentz1@luc.edu), Adrian Pekarcik, Amy Raudenbush and Kelley Tilmon, The Ohio State Univ., Wooster, OH*

D13 **Effect of Asiatic garden beetle, *Maladera castanea*, grub density on corn and soybean seedlings.** *Madeleine Ferguson (mferguson20@wooster.edu), Adrian Pekarcik, Amy Raudenbush and Kelley Tilmon, The Ohio State Univ., Wooster, OH*

D14 **Geographical distribution of Western bean cutworm, *Striacosta albicosta*, in Ohio.** *Kimberley Gault (kagault06@gmail.com), Adrian Pekarcik, Amy Raudenbush and Kelley Tilmon, The Ohio State Univ., Wooster, OH*

D15 **The effect of *Apis mellifera* on the nesting habits of solitary cavity nesting insects.** *Sierra Rach (sierrarach@yahoo.com)[1], Jessica Beckham[2] and Jeffrey Jackson[1], [1]Univ. of Texas at San Antonio, San Antonio, TX, [2]Univ. of North Texas, Denton, TX*

D16 **Secondary plant metabolites in a novel oilseed crop, *Silphium integrifolium* and chemotaxis by its main insect pest, *Eucosma giganteana* (Lepidoptera: Pyralidae).** *Kaitlyn Ruiz (kpruiz@ksu.edu)[1], Damián Ravetta[2], Chase Stratton[3], Ebony Murrell[3] and Rob Morrison[4], [1]Kansas State Univ., Manhattan, KS, [2]Museo Paleontológico Egidio Feruglio, Buenos Aries, Argentina, [3]The Land Institute, Salina, KS, [4]USDA - ARS, Manhattan, KS*

Student Poster Competition: Undergrad Session III - P-IE / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D17 **Do food and egg density levels have an effect on intraspecific interactions that could lead to cannibalism among monarch (*Danaus plexippus*) larvae?** *Kayla Shepherd (kaylas2@iastate.edu) and Nancy Shryock, Iowa State Univ., Ames, IA*

D18 **Evaluation of different bowl trap colors for sampling bees.** *Haider Ibrahim (haider.ibrahim@okstate.edu) and Eric Rebek, Oklahoma State Univ., Stillwater, OK*

D19 **Indirect interaction between mammalian and insect herbivores mediated by a nurse plant.** *Shadley Grove, Chaneka Lightbourne (chatlig@email.ecok.edu) and George Wang, East Central Univ., Ada, OK*

D20 **Feeding on glandular and non-glandular leaf trichomes negatively affect growth and development in tobacco hornworm (*Manduca sexta*) caterpillars.** *Cristina Raya Vaca (cristina.raya01@utrgv.edu)[1] and Rupesh Kariyat[2], [1]Student, Edinburg, TX, [2]Univ. of Texas Rio Grande Valley, Edinburg, TX*

D21 **Diversity of insects in the Central Plains.** *Taylor Coles (taylor.ann.coles@okstate.edu) and Astri Wayadande, Oklahoma State Univ., Stillwater, OK*

D22 **Physiological responses of sorghum to sugarcane aphid feeding.** *Juan Raya Vaca (juan.raya01@utrgv.edu)[1], Adryenna Perez[1], Rupesh Kariyat[1], Sajjan Grover[2] and Joe Louis[2], [1]Univ. of Texas Rio Grande Valley, Edinburg, TX, [2]Univ. of Nebraska, Lincoln, NE*

D23 **Evaluation of row covers for exclusion of squash bug, *Anasa tristis* (DeGeer) (Hemiptera:Coreidae), from squash.** *Hollie Thorne (hollie.thorne@okstate.edu)[1], Eric Rebek[1], James Shrefler[1], Tracey Peyton-Miller[2] and Lynda Carrier[1], [1]Oklahoma State Univ., Stillwater, OK, [2]Langston Univ., Langston, OK*

Student Poster Competition: Master's Session I - PBT & SysEB / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D24 **Characterization of microbial communities in American burying beetle (*Nicrophorus americanus*) secretions through gram staining and MALDI-TOF analysis.** *Carrie J. Pratt (carrie.pratt@okstate.edu), John E. Gustafson and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK*

D25 **Risk assessment of genetically modified cotton against *Thrips tabaci* (thrips) and indirect resistance assessment in *Pectinophora gossypiella* (pink bollworm) against different insecticides.** *Majid Muhammad (majidento07@snnu.edu.cn), Shaanxi Normal Univ., Xian, China*

D26 **Transcriptomic analysis of the honey bee (*Apis mellifera*) queen brain in response to pesticide exposure during development.** *Myra Dickey (mdickey2@tamu.edu)[1], Tonya Shepherd[2], Raul F. Medina[3], Aaron Tarone[3] and Juliana Rangel[3], [1]Texas A&M, College Station, TX, [2]Texas A&M, College station, TX, [3]Texas A&M Univ., College Station, TX*

D27 **Comparing grasshopper species richness in Oklahoma's cross timbers and mixed-grass prairie regions.** *Alexander Harman (aleharm@okstate.edu) and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK*

D28 **Determining *Nicrophorus americanus* months of reproduction in Oklahoma.** *Leonardo Vieira Santos (leonardo.santos@okstate.edu) and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK*

D29 **A survey of the polypore fungus beetles of Wisconsin (Coleoptera: Tetratomidae).** *Jacquelyn Whisenant (jacki.whisenant@gmail.com)[1] and Dan Young[2], [1]Wisconsin Insect Research Collection, Madison, WI, [2]Univ. of Wisconsin, Madison, WI*

D30 **Forage plants and associated native bees of Parker County, Texas.** *Camille Carey (camille.carey@okstate.edu)[1], David H. Kattes[2] and W. Wyatt Hoback[1], [1]Oklahoma State Univ., Stillwater, OK, [2]Tarleton State Univ., Stephenville, TX*

D31 **A survey of Wisconsin *Ischnosoma* (Coleoptera: Staphylinidae: Tachyporinae).** *Ann Marsh (amarsh3@wisc.edu) and Dan Young, Univ. of Wisconsin, Madison, WI*

Student Poster Competition: Master's Session II - P-IE / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D32 **Insect-plant interactions in native but invasive silver leaf nightshade (*Solanum elaeagnifolium* Cav.).** *Jesus Chavana (jesus.chavana01@utrgv.edu), Univ. of Texas RIo Grande Valley, Edinburg, TX*

D33 **The effects of caffeine on the activity levels of honey bees, *Apis mellifera*.** *Johana Castro (johana.castro01@utrgv.edu) and Julie Mustard, Univ. of Texas Rio Grande Valley, Brownsville, TX*

D34 **Re-designing agricultural landscapes: The effect of habitat on arthropod communities.** *Aleksandra Dolezal (adolezal@uoguelph.ca), Andrew MacDougall and Ellen Esch, Univ. of Guelph, Guelph, ON, Canada*

D35 **Efficacy of insecticides for control of grasshoppers in Bermuda grass pasture in Oklahoma.** *Grace Levy (gracej67@gmail.com), Ali Zarrabi, Tom Royer, S. Seuhs, Kristopher Giles and Jacquie Pruit, Oklahoma State Univ., Stillwater, OK*

D36 **Eating your greenbugs with a side of veggies: A diverse diet improves reproductive performance and life history in *Hippodamia convergens* (Coleoptera: Coccinellidae).** *Hannah Stowe (hstowe@ksu.edu)[1], J. P. Michaud[2] and Tania N. Kim[1], [1]Kansas State Univ., Manhattan, KS, [2]Kansas State Univ., Hays, KS*

D37 **Soybean gall midge: Evaluating the efficacy of insecticide timing relative to adult emergence.** *Vilma Montenegro (vilma.montenegro.c@gmail.com), Anthony McMechan, Robert Wright and Débora Montezano, Univ. of Nebraska, Lincoln, NE*

D38 **Change in mesquite organic volatile profile and natural herbivore response after herbicide application.** *Lovely Adhikary (lovely_a@nmsu.edu) and David C Thompson, New Mexico State Univ., Las Cruces, NM*

Student Poster Competition: PhD / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D39 **Using front-end evaluation to identify audiences for science communication.** *Joan King (joanie_king@tamu.edu), Edward Vargo and Rhonda Struminger, Texas A&M Univ., College Station, TX*

D40 **Analysis of Bryan/College Station *Solenopsis invicta* (Hymenoptera: Formicidae) colonies to evaluate presence of *Solenopsis invicta* Viruses -1 and -3.** *Valerie Holmes (vrh0933406@tamu.edu), Texas A&M Univ., College Station, TX*

D41 **Investigating stress driven altruistic self-removal of honey bee (*Apis mellifera*) workers from the colony.** *Jordan Twombly Ellis (jt574@tamu.edu) and Juliana Rangel, Texas A&M Univ., College Station, TX*

D42 **Interspecies virus transmission between ants and honey bees (*Apis mellifera*).** *Alexandria Payne (alexnpayne@gmail.com) and Juliana Rangel, Texas A&M Univ., College Station, TX*

D43 **Interaction between defoliation and stink bug economic thresholds in soybean.** *Rafael Hayashida (hayashidarafael@gmail.com)[1], Adeney Bueno[2] and W. Wyatt Hoback[3], [1]Federal Univ. of Paraná, Curitiba, Brazil, [2]Embrapa Pesquisa e Desenvolvimento, Londrina, Brazil, [3]Oklahoma State Univ., Stillwater, OK*

D44 **Reciprocal benefits to cotton and bee pollinators in a cotton agroecosystem.** *Isaac Esquivel (iesqu002@tamu.edu)[1], Michael Brewer[2] and Robert Coulson[1], [1]Texas A&M Univ., College Station, TX, [2]Texas A&M AgriLife Research, Corpus Christi, TX*

D45 **The first record of *Halictophagus acutus* Bohart (Strepsiptera: Halictophagidae) from Wisconsin with COI barcode.** *Bonnie Ohler (bjohler@wisc.edu)[1], Samuel DeGrey[1], Matthew Kamiyama[2] and Dan Young[1], [1]Univ. of Wisconsin, Madison, WI, [2]Kyoto Univ., Kyoto, Japan*

Regular Poster Session / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D46 **Don't let the bed bugs bite! *¡No deje que los chinches de cama le piquen!*.** *Amanda Skidmore (amanda.skidmore@gmail.com)[1], Alvaro Romero[2] and Carol Sutherland[3], [1]New Mexico State Univ., Los Lunas, NM, [2]New Mexico State Univ., Las Cruces, NM, [3]New Mexico Dept. of Agriculture, Las Cruces, NM*

D47 **Interactions between the microbial and insect community affect grain quality in the post-harvest environment / Las interacciones entre las comunidad de insectos y microbios afectan la cualidad del grano en el ambiente de poscosecha.** *Marco Ponce (marco26@k-state.edu)[1], Tania N. Kim[1] and William Morrison III[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS*

D48 **Sugarcane aphid *Melanaphis sacchari*, (Hemiptera: Aphididae) development over temperature ranges with thresholds for fecundity.** *J. Scott Armstrong (scott.armstrong@ars.usda.gov)[1], Misael de Souza[2], W. Wyatt Hoback[3], Sulochana Paudyal[3] and Phil Mulder[3], [1]USDA - ARS, Stillwater, OK, [2]Oklahoma State Univ., STILLWATER, OK, [3]Oklahoma State Univ., Stillwater, OK*

D49 **Evaluating sivanto in-furrow at planting for season long control of the sugar cane aphid, *Melanaphis sacchari*, in grain sorghum and impacts for silage and hay sorghums.** *Blayne Reed (blayne.reed@ag.tamu.edu)[1], Suhas Vyavhare[2], Patrick Porter[3] and Russ Perkins[4], [1]Texas A&M Univ., Plainview, TX, [2]Texas A&M AgriLife Research and Extension Center, Lubbock, TX, [3]Texas A&M AgriLife Extension, Lubbock, TX, [4]Bayer, Idalou, TX*

D50 **Identifying efficient attractants for overwintering *Drosophila suzukii*.** *Ariana Hernandez (herna403@msu.edu), Juan Huang, Larry Gut and Matthew Grieshop, Michigan State Univ., East Lansing, MI*

D51 **Diversity of floral visitors in *Bursera linanoe* and *B. copallifera* in a protected natural area, Mexico.** *Rubén Hernández Tapia (ruben.hernandezt@uaem.edu.mx)[1], Ma. Rosas Echeverría[2] and Concepción Martínez Peralta[2], [1]Universidad Autónoma del Estado de Morelos, Cuernavaca, MR, Mexico, [2]Universidad Autónoma del Estado de Morelos, Jojutla, MR, Mexico*

D52 **Insecticide efficacy for controlling pecan aphids, 2018.** *Phil Mulder (phil.mulder@okstate.edu) and S. Seuhs, Oklahoma State Univ., Stillwater, OK*

D53 **Stored product insects.** *Erin Scully (erin.scully@ars.usda.gov), USDA - ARS, Manhattan, KS*

D54 **The aggregation pheromone of *Tribolium castaneum* (Coleoptera: Tenebrionidae), but not food kairomones, modulates its foraging behavior.** *Alexander Bruce (alexander.bruce@ars.usda.gov)[1], James Campbell[1], Rachel Wilkins[2] and Rob Morrison[1], [1]USDA - ARS, Manhattan, KS, [2]Kansas State Univ., Manhattan, KS*

D55 **Efficacy of insecticides for control of pecan weevil in Oklahoma, 2019.** *S. Seuhs (k.seuhs@okstate.edu) and Phil Mulder, Oklahoma State Univ., Stillwater, OK*

D56 **Addressing knowledge gaps in sensory biology of stored product insects to improve behaviorally-based management practices.** *Jacqueline Maille (jmaille@ksu.edu)[1], Rob Morrison[2] and Erin Scully[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS*

D57 **New geographic distribution records of the gall midge, *Cystiphora sonchi*, in the United States.** *Louis Hesler (louis.hesler@usda.gov), USDA-ARS, North Central Agricultural Research Laboratory, Brookings, SD*

D58 **Impact of variable water levels on *Lygus* infestation in Texas High Plains cotton.** *Dol P. Dhakal (dol.dhakal@ag.tamu.edu), Abdul Hakeem, Megha N. Parajulee and Ziyan NanGong, Texas A&M AgriLife Research and Extension Center, Lubbock, TX*

D59 **Impact of early and late season pests on fiber yield and quality on Texas cotton.** *Abdul Hakeem (abdul.hakeem@ag.tamu.edu), Megha N. Parajulee, Dol P. Dhakal and Ziyan NanGong, Texas A&M AgriLife Research and Extension Center, Lubbock, TX*

D60 **Assessment of distribution of Turbocide® inside a building by measuring aerosol concentration in conjunction with bioassay data on *Tribolium confusum*.** *Srinivas Lanka (slanka@ksu.edu)[1], Fei Asuncion[1], Aminu Owonikoko[1], Daniel Brabec[2], James Campbell[3], Frank Arthur[3] and Kun Yan Zhu[1], [1]Kansas State Univ., Manhattan, KS, [2]USDA-ARS Center for Grain and Animal Health Research Center, Manhattan, KS, [3]USDA - ARS, Manhattan, KS*

D62 **Maintaining biodiversity of ant communities in the Crocker Range, Malaysian Borneo.** *Lilly Germeroth (lgm9d@mst.edu), Missouri Univ. of Science and Technology, Rolla, MO*

D63 **The ecology of ants (Hymenoptera: Formicidae): urban versus rural assemblages of eastern New Mexico.** *Dennis Tinucci (dennis.tinucci@gmail.com), Eastern New Mexico Univ., Portales, NM*

D64 **Bexar County bees: An assessment of family richness of bees using citizen science and bee bowls.** *Sally Lent (sallylent@yahoo.es)[1], Jessica Beckham[2] and Jeff Jackson[1], [1]Univ. of Texas at San Antonio, San Antonio, TX, [2]Univ. of North Texas, Denton, TX*

D65 **Meet them where they think: Engaging business majors in an undergraduate entomology course.** *Bruce Noden (bruce.noden@okstate.edu), Oklahoma State Univ., Stillwater, OK*

TUESDAY, MARCH 17, 2020, POSTERS

Student Poster Competition: Undergrad Session I - MUVE & PBT / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D1 **Let the worms eat *Tenebrio/T. molitor*.** *Kalli Baumgardner (kallibeth2020@gmail.com), Northwest Technology Center, Fairview, OK*

D2 **Prevalence of *Plasmodium* sp. in mosquitoes collected in urban areas of southern Oklahoma.** *Brandon Henriquez (brandon.henriquez@okstate.edu), Jordan Sanders and Bruce Noden, Oklahoma State Univ., Stillwater, OK*

D3 **Mutations in the voltage-gated sodium channel gene of pyrethroid-resistant *Amblyomma mixtum* (Acari: Ixodidae) from Mexico.** *Odessa A. Mata (odessa.mata01@utrgv.edu)[1], Guilherme M. Klafke[2], Jason P. Tidwell[2], Francisco T. Barradas-Piña[3], Teresa Feria[1] and Adalberto A. Pérez de León[4], [1]The Univ. of Texas Rio Grande Valley, Edinburg, TX, [2]USDA - ARS, Edinburg, TX, [3]INIFAP, Medellin de Bravo, VL, Mexico, [4]USDA - ARS, Kerrville, TX*

D4 **Effect of bluetongue virus infection on blood meal feeding behavior in female *Culicoides sonorensis*.** *Brandon Hall (Brandon.Hall@usda.gov)[1,2], Paula Rozo-Lopez[1,2], Barbara Drolet[1] and Dana Nayduch[1], [1]USDA-ARS, Manhattan, KS, [2]Kansas State Univ., Manhattan, KS*

D5 **Gas chromatography – mass spectrometry analyses of pesticide treated honey bee (*Apis mellifera*) brood pheromones.** *Omar Khan (omarikhan@tamu.edu), Juliana Rangel and Elizabeth Walsh, Texas A&M Univ., College Station, TX*

D6 **Evaluation of the temperature tolerance of the predatory mite *Stratiolaelaps scimitus* for biological control of the honey bee ectoparasitic mite *Varroa destructor*.** *Travis Trimm (travistrimm501@gmail.com) and Juliana Rangel, Texas A&M Univ., College Station, TX*

D7 **Evidence of pheromone production in an orb weaver (Genus *Metepeira*).** *Bryan Lara (larabryan20@gmail.com)[1] and David Thompson[2], [1]Student, El Paso, TX, [2]New Mexico State Univ., Las Cruces, NM*

D8 **Determining the effects of nutrition on honey bee (*Apis mellifera*) pathogen defense against deformed wing virus.** *Jordan Gomez (jordangomez363@gmail.com), Pierre Lau, Alexandria Payne, Cora Garcia, Pierre Lesne, Spence Behmer and Juliana Rangel, Texas A&M Univ., College Station, TX*

D9 **Improvements to RNAi in mosquitoes through nanoparticle mediated delivery.** *Rachel Brown (r.brown@uky.edu), Dhandapani Ramesh, Laura Ruberg and Reddy Palli, Univ. of Kentucky, Lexington, KY*

Student Poster Competition: Undergrad Session II - SysEB & P-IE / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D10 **Does predation prevent or promote the evolution of virulence in soybean aphids?** *Kelsey Shepherd (kelshep@iastate.edu), Jessica Hohenstein, Matthew O'Neal and Matthew Kaiser, Iowa State Univ., Ames, IA*

D11 **Chemical and foraging ecology of *Theocolax elegans (Westwood) (Hymenoptera: Pteromalidae)* on two alternate hosts.** *Chloe Albin (albinc@ksu.edu)[1] and Rob Morrison[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS*

D12 **Feeding performance and preference of the Asiatic garden beetle, *Maladera castanea*, in field crops.** *Matthew Lorentz (mlorentz1@luc.edu), Adrian Pekarcik, Amy Raudenbush and Kelley Tilmon, The Ohio State Univ., Wooster, OH*

D13 **Effect of Asiatic garden beetle, *Maladera castanea*, grub density on corn and soybean seedlings.** *Madeleine Ferguson (mferguson20@wooster.edu), Adrian Pekarcik, Amy Raudenbush and Kelley Tilmon, The Ohio State Univ., Wooster, OH*

D14 **Geographical distribution of Western bean cutworm, *Striacosta albicosta*, in Ohio.** *Kimberley Gault (kagault06@gmail.com), Adrian Pekarcik, Amy Raudenbush and Kelley Tilmon, The Ohio State Univ., Wooster, OH*

D15 **The effect of *Apis mellifera* on the nesting habits of solitary cavity nesting insects.** *Sierra Rach (sierrarach@yahoo.com)[1], Jessica Beckham[2] and Jeffrey Jackson[1], [1]Univ. of Texas at San Antonio, San Antonio, TX, [2]Univ. of North Texas, Denton, TX*

D16 **Secondary plant metabolites in a novel oilseed crop, *Silphium integrifolium* and chemotaxis by its main insect pest, *Eucosma giganteana* (Lepidoptera: Pyralidae).** *Kaitlyn Ruiz (kpruiz@ksu.edu)[1], Damián Ravetta[2], Chase Stratton[3], Ebony Murrell[3] and Rob Morrison[4], [1]Kansas State Univ., Manhattan, KS, [2]Museo Paleontológico Egidio Feruglio, Buenos Aries, Argentina, [3]The Land Institute, Salina, KS, [4]USDA - ARS, Manhattan, KS*

Student Poster Competition: Undergrad Session III - P-IE / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D17 **Do food and egg density levels have an effect on intraspecific interactions that could lead to cannibalism among monarch (*Danaus plexippus*) larvae?** *Kayla Shepherd (kaylas2@iastate.edu) and Nancy Shryock, Iowa State Univ., Ames, IA*

D18 **Evaluation of different bowl trap colors for sampling bees.** *Haider Ibrahim (haider.ibrahim@okstate.edu) and Eric Rebek, Oklahoma State Univ., Stillwater, OK*

D19 **Indirect interaction between mammalian and insect herbivores mediated by a nurse plant.** *Shadley Grove, Chaneka Lightbourne (chatlig@email.ecok.edu) and George Wang, East Central Univ., Ada, OK*

D20 **Feeding on glandular and non-glandular leaf trichomes negatively affect growth and development in tobacco hornworm (*Manduca sexta*) caterpillars.** *Cristina Raya Vaca (cristina.raya01@utrgv.edu)[1] and Rupesh Kariyat[2], [1]Student, Edinburg, TX, [2]Univ. of Texas Rio Grande Valley, Edinburg, TX*

D21 **Diversity of insects in the Central Plains.** *Taylor Coles (taylor.ann.coles@okstate.edu) and Astri Wayadande, Oklahoma State Univ., Stillwater, OK*

D22 **Physiological responses of sorghum to sugarcane aphid feeding.** *Juan Raya Vaca (juan.raya01@utrgv.edu)[1], Adryenna Perez[1], Rupesh Kariyat[1], Sajjan Grover[2] and Joe Louis[2], [1]Univ. of Texas Rio Grande Valley, Edinburg, TX, [2]Univ. of Nebraska, Lincoln, NE*

D23 **Evaluation of row covers for exclusion of squash bug, *Anasa tristis* (DeGeer) (Hemiptera:Coreidae), from squash.** *Hollie Thorne (hollie.thorne@okstate.edu)[1], Eric Rebek[1], James Shrefler[1], Tracey Peyton-Miller[2] and Lynda Carrier[1], [1]Oklahoma State Univ., Stillwater, OK, [2]Langston Univ., Langston, OK*

Student Poster Competition: Master's Session I - PBT & SysEB / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D24 **Characterization of microbial communities in American burying beetle (*Nicrophorus americanus*) secretions through gram staining and MALDI-TOF analysis.** *Carrie J. Pratt (carrie.pratt@okstate.edu), John E. Gustafson and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK*

D25 **Risk assessment of genetically modified cotton against *Thrips tabaci* (thrips) and indirect resistance assessment in *Pectinophora gossypiella* (pink bollworm) against different insecticides.** *Majid Muhammad (majidento07@snnu.edu.cn), Shaanxi Normal Univ., Xian, China*

D26 **Transcriptomic analysis of the honey bee (*Apis mellifera*) queen brain in response to pesticide exposure during development.** *Myra Dickey (mdickey2@tamu.edu)[1], Tonya Shepherd[2], Raul F. Medina[3], Aaron Tarone[3] and Juliana Rangel[3], [1]Texas A&M, College Station, TX, [2]Texas A&M, College station, TX, [3]Texas A&M Univ., College Station, TX*

D27 **Comparing grasshopper species richness in Oklahoma's cross timbers and mixed-grass prairie regions.** *Alexander Harman (aleharm@okstate.edu) and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK*

D28 **Determining *Nicrophorus americanus* months of reproduction in Oklahoma.** *Leonardo Vieira Santos (leonardo.santos@okstate.edu) and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK*

D29 **A survey of the polypore fungus beetles of Wisconsin (Coleoptera: Tetratomidae).** *Jacquelyn Whisenant (jacki.whisenant@gmail.com)[1] and Dan Young[2], [1]Wisconsin Insect Research Collection, Madison, WI, [2]Univ. of Wisconsin, Madison, WI*

D30 **Forage plants and associated native bees of Parker County, Texas.** *Camille Carey (camille.carey@okstate.edu)[1], David H. Kattes[2] and W. Wyatt Hoback[1], [1]Oklahoma State Univ., Stillwater, OK, [2]Tarleton State Univ., Stephenville, TX*

D31 **A survey of Wisconsin *Ischnosoma* (Coleoptera: Staphylinidae: Tachyporinae).** *Ann Marsh (amarsh3@wisc.edu) and Dan Young, Univ. of Wisconsin, Madison, WI*

Student Poster Competition: Master's Session II - P-IE / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D32 **Insect-plant interactions in native but invasive silver leaf nightshade (*Solanum elaeagnifolium* Cav.).** *Jesus Chavana (jesus.chavana01@utrgv.edu), Univ. of Texas RIo Grande Valley, Edinburg, TX*

D33 **The effects of caffeine on the activity levels of honey bees, *Apis mellifera*.** *Johana Castro (johana.castro01@utrgv.edu) and Julie Mustard, Univ. of Texas Rio Grande Valley, Brownsville, TX*

D34 **Re-designing agricultural landscapes: The effect of habitat on arthropod communities.** *Aleksandra Dolezal (adolezal@uoguelph.ca), Andrew MacDougall and Ellen Esch, Univ. of Guelph, Guelph, ON, Canada*

D35 **Efficacy of insecticides for control of grasshoppers in Bermuda grass pasture in Oklahoma.** *Grace Levy (gracej67@gmail.com), Ali Zarrabi, Tom Royer, S. Seuhs, Kristopher Giles and Jacquie Pruit, Oklahoma State Univ., Stillwater, OK*

D36 **Eating your greenbugs with a side of veggies: A diverse diet improves reproductive performance and life history in *Hippodamia convergens* (Coleoptera: Coccinellidae).** *Hannah Stowe (hstowe@ksu.edu)[1], J. P. Michaud[2] and Tania N. Kim[1], [1]Kansas State Univ., Manhattan, KS, [2]Kansas State Univ., Hays, KS*

D37 **Soybean gall midge: Evaluating the efficacy of insecticide timing relative to adult emergence.** *Vilma Montenegro (vilma.montenegro.c@gmail.com), Anthony McMechan, Robert Wright and Débora Montezano, Univ. of Nebraska, Lincoln, NE*

D38 **Change in mesquite organic volatile profile and natural herbivore response after herbicide application.** *Lovely Adhikary (lovely_a@nmsu.edu) and David C Thompson, New Mexico State Univ., Las Cruces, NM*

Student Poster Competition: PhD / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D39 **Using front-end evaluation to identify audiences for science communication.** *Joan King (joanie_king@tamu.edu), Edward Vargo and Rhonda Struminger, Texas A&M Univ., College Station, TX*

D40 **Analysis of Bryan/College Station *Solenopsis invicta* (Hymenoptera: Formicidae) colonies to evaluate presence of *Solenopsis invicta* Viruses -1 and -3.** *Valerie Holmes (vrh0933406@tamu.edu), Texas A&M Univ., College Station, TX*

D41 **Investigating stress driven altruistic self-removal of honey bee (*Apis mellifera*) workers from the colony.** *Jordan Twombly Ellis (jt574@tamu.edu) and Juliana Rangel, Texas A&M Univ., College Station, TX*

D42 **Interspecies virus transmission between ants and honey bees (*Apis mellifera*).** *Alexandria Payne (alexnpayne@gmail.com) and Juliana Rangel, Texas A&M Univ., College Station, TX*

D43 **Interaction between defoliation and stink bug economic thresholds in soybean.** *Rafael Hayashida (hayashidarafael@gmail.com)[1], Adeney Bueno[2] and W. Wyatt Hoback[3], [1]Federal Univ. of Paraná, Curitiba, Brazil, [2]Embrapa Pesquisa e Desenvolvimento, Londrina, Brazil, [3]Oklahoma State Univ., Stillwater, OK*

D44 **Reciprocal benefits to cotton and bee pollinators in a cotton agroecosystem.** *Isaac Esquivel (iesqu002@tamu.edu)[1], Michael Brewer[2] and Robert Coulson[1], [1]Texas A&M Univ., College Station, TX, [2]Texas A&M AgriLife Research, Corpus Christi, TX*

D45 **The first record of *Halictophagus acutus* Bohart (Strepsiptera: Halictophagidae) from Wisconsin with COI barcode.** *Bonnie Ohler (bjohler@wisc.edu)[1], Samuel DeGrey[1], Matthew Kamiyama[2] and Dan Young[1], [1]Univ. of Wisconsin, Madison, WI, [2]Kyoto Univ., Kyoto, Japan*

Regular Poster Session / 8:00 AM-6:00 PM

Grand Ballroom Prefunction (Skirvin Hilton)

D46 **Don't let the bed bugs bite! *¡No deje que los chinches de cama le piquen!*.** *Amanda Skidmore (amanda.skidmore@gmail.com)[1], Alvaro Romero[2] and Carol Sutherland[3], [1]New Mexico State Univ., Los Lunas, NM, [2]New Mexico State Univ., Las Cruces, NM, [3]New Mexico Dept. of Agriculture, Las Cruces, NM*

D47 **Interactions between the microbial and insect community affect grain quality in the post-harvest environment / Las interacciones entre las comunidad de insectos y microbios afectan la cualidad del grano en el ambiente de poscosecha.** *Marco Ponce (marco26@k-state.edu)[1], Tania N. Kim[1] and William Morrison III[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS*

D48 **Sugarcane aphid *Melanaphis sacchari*, (Hemiptera: Aphididae) development over temperature ranges with thresholds for fecundity.** *J. Scott Armstrong (scott.armstrong@ars.usda.gov)[1], Misael de Souza[2], W. Wyatt Hoback[3], Sulochana Paudyal[3] and Phil Mulder[3], [1]USDA - ARS, Stillwater, OK, [2]Oklahoma State Univ., STILLWATER, OK, [3]Oklahoma State Univ., Stillwater, OK*

D49 **Evaluating sivanto in-furrow at planting for season long control of the sugar cane aphid, *Melanaphis sacchari*, in grain sorghum and impacts for silage and hay sorghums.** *Blayne Reed (blayne.reed@ag.tamu.edu)[1], Suhas Vyavhare[2], Patrick Porter[3] and Russ Perkins[4], [1]Texas A&M Univ., Plainview, TX, [2]Texas A&M AgriLife Research and Extension Center, Lubbock, TX, [3]Texas A&M AgriLife Extension, Lubbock, TX, [4]Bayer, Idalou, TX*

D50 **Identifying efficient attractants for overwintering *Drosophila suzukii*.** *Ariana Hernandez (herna403@msu.edu), Juan Huang, Larry Gut and Matthew Grieshop, Michigan State Univ., East Lansing, MI*

D51 **Diversity of floral visitors in *Bursera linanoe* and *B. copallifera* in a protected natural area, Mexico.** *Rubén Hernández Tapia (ruben.hernandezt@uaem.edu.mx)[1], Ma. Rosas Echeverría[2] and Concepción Martínez Peralta[2], [1]Universidad Autónoma del Estado de Morelos, Cuernavaca, MR, Mexico, [2]Universidad Autónoma del Estado de Morelos, Jojutla, MR, Mexico*

D52 **Insecticide efficacy for controlling pecan aphids, 2018.** *Phil Mulder (phil.mulder@okstate.edu) and S. Seuhs, Oklahoma State Univ., Stillwater, OK*

D53 **Stored product insects.** *Erin Scully (erin.scully@ars.usda.gov), USDA - ARS, Manhattan, KS*

D54 **The aggregation pheromone of *Tribolium castaneum* (Coleoptera: Tenebrionidae), but not food kairomones, modulates its foraging behavior.** *Alexander Bruce (alexander.bruce@ars.usda.gov)[1], James Campbell[1], Rachel Wilkins[2] and Rob Morrison[1], [1]USDA - ARS, Manhattan, KS, [2]Kansas State Univ., Manhattan, KS*

D55 **Efficacy of insecticides for control of pecan weevil in Oklahoma, 2019.** *S. Seuhs (k.seuhs@okstate.edu) and Phil Mulder, Oklahoma State Univ., Stillwater, OK*

D56 **Addressing knowledge gaps in sensory biology of stored product insects to improve behaviorally-based management practices.** *Jacqueline Maille (jmaille@ksu.edu)[1], Rob Morrison[2] and Erin Scully[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS*

D57 **New geographic distribution records of the gall midge, *Cystiphora sonchi*, in the United States.** *Louis Hesler (louis.hesler@usda.gov), USDA-ARS, North Central Agricultural Research Laboratory, Brookings, SD*

D58 **Impact of variable water levels on *Lygus* infestation in Texas High Plains cotton.** *Dol P. Dhakal (dol.dhakal@ag.tamu.edu), Abdul Hakeem, Megha N. Parajulee and Ziyan NanGong, Texas A&M AgriLife Research and Extension Center, Lubbock, TX*

D59 **Impact of early and late season pests on fiber yield and quality on Texas cotton.** *Abdul Hakeem (abdul.hakeem@ag.tamu.edu), Megha N. Parajulee, Dol P. Dhakal and Ziyan NanGong, Texas A&M AgriLife Research and Extension Center, Lubbock, TX*

D60 **Assessment of distribution of Turbocide® inside a building by measuring aerosol concentration in conjunction with bioassay data on *Tribolium confusum*.** *Srinivas Lanka (slanka@ksu.edu)[1], Fei Asuncion[1], Aminu Owonikoko[1], Daniel Brabec[2], James Campbell[3], Frank Arthur[3] and Kun Yan Zhu[1], [1]Kansas State Univ., Manhattan, KS, [2]USDA-ARS Center for Grain and Animal Health Research Center, Manhattan, KS, [3]USDA - ARS, Manhattan, KS*

D62 **Maintaining biodiversity of ant communities in the Crocker Range, Malaysian Borneo.** *Lilly Germeroth (lgm9d@mst.edu), Missouri Univ. of Science and Technology, Rolla, MO*

D63 **The ecology of ants (Hymenoptera: Formicidae): urban versus rural assemblages of eastern New Mexico.** *Dennis Tinucci (dennis.tinucci@gmail.com), Eastern New Mexico Univ., Portales, NM*

D64 **Bexar County bees: An assessment of family richness of bees using citizen science and bee bowls.** *Sally Lent (sallylent@yahoo.es)[1], Jessica Beckham[2] and Jeff Jackson[1], [1]Univ. of Texas at San Antonio, San Antonio, TX, [2]Univ. of North Texas, Denton, TX*

D65 **Meet them where they think: Engaging business majors in an undergraduate entomology course.** *Bruce Noden (bruce.noden@okstate.edu), Oklahoma State Univ., Stillwater, OK*

MONDAY, MARCH 16, 2020, MORNING

Regular Ten Minute Papers Session I - PBT & SysEB

Centennial 3 (Skirvin Hilton)

Moderator: Carol Sutherland, New Mexico Dept. of Agriculture, Las Cruces, NM

8:30 AM **38** **Insecticidal and antifeedant properties of extracts from Madagascan medicinal plants (*Cinnamosma* spp.) for mosquito vector control.** *Edna Alfaro (alfaroinocente.1@buckeyemail.osu.edu), Harinantenaina Rakotondraibe and Peter Piermarini, The Ohio State Univ., Wooster, OH*

8:40 AM **39** **Seasonal differences in the expression of seminal proteins in males of the Northern house mosquito.** *Megan Meuti (meuti.1@osu.edu), The Ohio State Univ., Columbus, OH*

8:50 AM **40** **Susceptibility and attraction of stored product pests to fungal mycotoxins.** *Valerie Nguyen (ngueyval@ksu.edu)[1], Matt Bakker[2], Susan McCormick[2], Tom Phillips[1], Frank Arthur[3] and Erin Scully[3], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Peoria, IL, [3]USDA - ARS, Manhattan, KS*

9:00 AM **41** **The fire-colored beetles of the North Central and Southwestern Branch regions (Coleoptera: Pyrochroidae).** *Daniel Young (dkyoung@wisc.edu), Univ. of Wisconsin, Madison, WI*

9:20 AM **43** **What's that bug? Annual report from your SWB Branch Insect Detection Committee** *Carol Sutherland (csutherl@nmsu.edu)[1], Xanthe Shirley[2] and Charles Konemann[3], [1]New Mexico Dept. of Agriculture, Las Cruces, NM, [2]USDA - APHIS, College Station, TX, [3]Oklahoma State Univ., Stillwater, OK*

Regular Ten Minute Paper Session II - MUVE

Centennial 2 (Skirvin Hilton)

Moderator: Adrienne Brundage, Texas A&M Univ., College Station, TX

8:30 AM **44** **Thermal tolerance of the larval stadia of two forensically important blow fly species, *Chrysomya rufifacies* (Macquart) and *Cochliomyia macellaria* (Fabricius) (Diptera: Calliphoridae).** *Lauren Beebe (lbeebe@tamu.edu), Travis Rusch and Aaron Tarone, Texas A&M Univ., College Station, TX*

8:40 AM **45** **Investigating aggregation cues of *Reticulitermes flavipes* in relation to food discovery.** *Tae Lee (lee.8230@buckeyemail.osu.edu) and Paul Phelan, The Ohio State Univ., Columbus, OH*

8:50 AM **46** **Effect of gut symbionts on presoldier differentiation in the eastern subterranean termite (*Reticulitermes flavipes*).** *Rajani Sapkota (rsapkota@purdue.edu) and Michael Scharf, Purdue Univ., West Lafayette, IN*

9:00 AM **47** **Therapeutic efficacy of a botanical acaricide against the southern cattle tick, *Rhipicephalus microplus* (Acari: Ixodidae).** *Guilherme M. Klafke (gmklafke@gmail.com)[1], Donald B. Thomas[1], Robert J. Miller[1] and Adalberto A. Pérez de León[2], [1]USDA - ARS, Edinburg, TX, [2]USDA - ARS, Kerrville, TX*

9:10 AM **48** **The impact of avian malaria (*Plasmodium relictum*) on the flight activity of *Culex quinquefasciatus* (Culicidae).** *Dayvion Adams (ajadams968@tamu.edu), Andrew Golnar and Gabriel Hamer, Texas A&M Univ., College Station, TX*

9:20 AM **49** **The residual effect of some selected acaricides against *Tyrophagus putrscentiae* (Shrank) on three different surfaces.** *Naomi Manu (nmanu30@ksu.edu)[1], M. Wes Schilling[2] and Thomas Phillips[1], [1]Kansas State Univ., Manhattan, KS, [2]Mississippi State Univ., Mississippi State, MS*

9:30 AM **50** **Feast or famine: Food availability affects the growth, development, and survival of *Cochliomyia macellaria* (Fabricius), secondary screwworm.** *Eric Bright (brighte@ou.edu) and Heather R. Ketchum, Univ. of Oklahoma, Norman, OK*

9:40 AM **51** **Incidence of the brown dog tick, *Rhipicephalus sanguineus* and its parasitoid, *Ixodiphagus hookeri* on dogs in South Texas.** *Alejandro Vasquez (alejandro.vasquez.pi@iblamar.org), Univ. of Texas Rio Grande Valley, Edinburg, TX*

9:50 AM **52** **The Journal of Entomological Education: An open access journal for educators in entomology.** *Adrienne Brundage (adrienne.brundage@tamu.edu), Texas A&M Univ., College Station, TX*

Regular Ten Minute Paper Session III - P-IE

Venetian Room (14th Floor) (Skirvin Hilton)

Moderator: Astri Wayadande, Oklahoma State Univ., Stillwater, OK

8:30 AM **53** **Do pollinators prefer pesticide-free plants? Experimental test with monarchs and milkweeds** *Paola Olaya Arenas (polayaar@purdue.edu), Michael Scharf and Ian Kaplan, Purdue Univ., West Lafayette, IN*

8:40 AM **54** **Creating education programs to address agribusiness professional's perception of pesticide effects on non-target species and the environment.** *Matt Hamblin (mkhamblin@ksu.edu)[1], Sarah Zukoff[2], Kun Yan Zhu[1] and Brian Spiesman[1], [1]Kansas State Univ., Manhattan, KS, [2]Kansas State Univ., Garden City, KS*

8:50 AM **55** **Impact of arthropod predators on cotton aphid abundance in Texas High Plains cotton.** *Dol P. Dhakal (dol.dhakal@ag.tamu.edu), Megha N. Parajulee, Abdul Hakeem and Ziyan NanGong, Texas A&M AgriLife Research and Extension Center, Lubbock, TX*

9:00 AM **56** **Diversity and dynamics of honey bee pollen forage across an urbanization gradient.** *Rodney Richardson (rtr87@yorku.ca)[1], Tyler D. Eaton[2], Chia-Hua Lin[2], Garrett Cherry[2], Reed Johnson[3] and Douglas Sponsler[4], [1]York Univ., Toronto, ON, Canada, [2]The Ohio State Univ., Columbus, OH, [3]The Ohio State Univ., Wooster, OH, [4]Pennsylvania State Univ., Univ. Park, PA*

9:10 AM **57** **A comprehensive review of maternal age effects on offspring fitness in insects.** *Shannon Murphy (Shannon.M.Murphy@du.edu), Claudia Hallagan and Robin Tinghitella, Univ. of Denver, Denver, CO*

9:20 AM **58** **Community-based collaboration - implementing IRM and IPM one conversation at a time.** *Clinton Pilcher (clint.pilcher@corteva.com), Corteva Agriscience, Johnston, IA*

9:30 AM **59** **Buzz pollination - An alternative method of artificial pollen extraction along with studying pollination biomechanics using different buzz pollinator species.** *Mandeep Tayal (mandeep.tayal01@utrgv.edu)[1], Jesus Chavana[2] and Rupesh Kariyat[3], [1]Graduate Assistant, Edinburg, TX, [2]Graduate Assistant, EDINBURG, TX, [3]Assistant Professor, Edinburg, TX*

9:40 AM **60** **Development of a laboratory assay to determine susceptibility of Western corn rootworm larvae to soil-applied insecticides.** *Ram B. Shrestha (shrestrb@iastate.edu) and Aaron J. Gassmann, Iowa State Univ., Ames, IA*

9:50 AM **61** **Electropenetrography of the CRISPR Cas9 mutant planthopper, *Peregrinus maidis* (Hemiptera: Delphacidae).** *Astri Wayadande (a.wayadande@okstate.edu)[1], Marcé Lorenzen[2], William Klobasa[2], Ordom Huot[3] and Anna Whitfield[2], [1]Oklahoma State Univ., Stillwater, OK, [2]North Carolina State Univ., Raleigh, NC, [3]Texas A&M Univ., College Station, TX*

Enhancing Ecosystem Services with Sustainable Pest Management

Crystal Room (Skirvin Hilton)

Moderators and Organizers: Paola Olaya-Arenas, Purdue Univ., West Lafayette, IN; Elias Bloom, Michigan State Univ., East Lansing, MI; Amanda Skidmore, New Mexico State Univ., Los Lunas, NM and Ashley Leach, Cornell Univ., Geneva, NY

9:00 AM **Welcoming remarks**

9:10 AM **62** **Effects of exposure to pesticides during development on adult honey bee (*Apis mellifera*) queens and drones.** *Juliana Rangel (jrangel@tamu.edu) and Elizabeth Walsh, Texas A&M Univ., College Station, TX*

9:30 AM **63** **Challenges for conducting pollinator health research in agroecosystems.** *Judy Wu-Smart (jwu-smart@unl.edu), Surabhi Vakil and Jennifer Albrecht, Univ. of Nebraska, Lincoln, NE*

9:45 AM **64** **Maximizing agricultural productivity through the conservation of pollinators.** *Jacob Pecenka (jacob.pecenka@gmail.com), Laura Ingwell, Rick Foster, Christian Krupke and Ian Kaplan, Purdue Univ., West Lafayette, IN*

10:00 AM **65** **Does integrated pest management enhance natural enemy biocontrol of cucumber beetles in commercial watermelon production?** *Paola Olaya-Arenas (polayaar@purdue.edu)[1], Amanda Skidmore[2], Iván Grijalva[1], Rick Foster[1] and Steve Yaninek[1], [1]Purdue Univ., West Lafayette, IN, [2]New Mexico State Univ., Los Lunas, NM*

10:15 AM **Break**

10:30 AM **66** **Using native plant mixes to promote beneficial insects.** *Miranda Kersten (mkersten@nmsu.edu) and Amanda Skidmore, New Mexico State Univ., Los Lunas, NM*

10:45 AM **67** **Farm management decisions with repercussions for natural pest biocontrol, pollination, and human welfare.** *Scott Swinton (swintons@msu.edu), Michigan State Univ., East Lansing, MI*

11:00 AM **68** **The bioeconomics of integrated pest and pollinator management: The case of neonicotinoid insecticides.** *Linghui Wu (lw1063@wildcats.unh.edu) and Shadi Atallah, Univ. of New Hampshire, Durham, NH*

11:15 AM **69** **Landscape configuration and agricultural pest suppression.** *Nathan Haan (haannath@msu.edu), Yajun Zhang and Douglas Landis, Michigan State Univ., East Lansing, MI*

11:30 AM **70** **The benefits and perceived risks of wooded hedgerows.** *Hannah Penn (hannahjpenn@gmail.com), Univ. of Texas, Edinburg, TX*

11:45 AM **71** **Re-designing agricultural landscapes: The effect of habitat on arthropod communities.** *Aleksandra Dolezal (adolezal@uoguelph.ca), Andrew MacDougall and Ellen Esch, Univ. of Guelph, Guelph, ON, Canada*

12:00 PM **Panel discussion**

12:30 PM **Concluding remarks**

Regular Ten Minute Paper Session IV - P-IE

Centennial 3 (Skirvin Hilton)

Moderator: Jeffrey Bradshaw, Univ. of Nebraska, Scottsbluff, NE

9:30 AM **72** **Landscape-scale effects of insecticide drift on monarch butterfly (*Danaus plexippus*) populations in an Iowa agroecosystem.** *Tyler Grant (tgrant@iastate.edu), Niranjana Krishnan and Steven Bradbury, Iowa State Univ., Ames, IA*

9:40 AM **73** **Four years of West Texas efficacy trials on the BASF experimental insecticide, Sefina, for sugarcane aphid, *Melanaphis sacchari*, control in High Plains grain sorghum.** *Blayne Reed (blayne.reed@ag.tamu.edu)[1], Suhas Vyavhare[2], Patrick Porter[3], Adam Hixson[4] and Jacob Reed[5], [1]Texas A&M Univ., Plainview, TX, [2]Texas A&M AgriLife Research and Extension Center, Lubbock, TX, [3]Texas A&M AgriLife Extension, Lubbock, TX, [4]BASF, Lubbock, TX, [5]BASF, Wolfforth, TX*

9:50 AM **74** **Parasitism of a novel host, *Diatraea indigenella* (Lepidoptera: Crambidae), by the gregarious parasitoid *Cotesia flavipes* (Hymenoptera: Braconidae).** *Carolina Londono-Sanchez[1], James Montoya-Lerma[2], J. P. Michaud (jpmi@ksu.edu)[3] and German Vargas[4], [1]Universidad de Valle, Cali, Colombia, [2]Universidad del Valle, Cali, Colombia, [3]Kansas State Univ., Hays, KS, [4]Colombian Sugarcane Research Center, Cali, Colombia*

10:00 AM **Break**

10:40 AM **76** **Landscape context influences use of residential habitats by native and exotic lady beetles.** *Mary Gardiner (gardiner.29@osu.edu)[1], Yvan Delgado de la Flor[1], Kayla I. Perry[1], Christopher Riley[1], Frances S. Sivakoff[1,2] and Katherine Turo[1], [1]The Ohio State Univ., Columbus, OH, [2]The Ohio State Univ., Marion, OH*

10:50 AM **77** **Soybean gall midge: Impact of infestation at different plant developmental stages.** *Débora Montezano (deiagm@gmail.com)[1], Anthony McMechan[2], Robert Wright[1] and Thomas Hunt[3], [1]Univ. of Nebraska, Lincoln, NE, [2]Univ. of Nebraska-Lincoln, Ithaca, NE, [3]Univ. of Nebraska, Concord, NE*

11:00 AM **78** **The very hungry caterpillars: Influences of tillage and rotation on plant-insect interactions.** *Emily Althoff (era2n4@missouri.edu) and Kevin Rice, Univ. of Missouri, Columbia, MO*

11:10 AM **79** **Synergism between local and landscape-level pesticides reduce wild but not honey bee floral visitation in pollinator-dependent crops.** *Elias Bloom (bloomel1@msu.edu)[1], Thomas Wood[1], Keng-Lou Hung[2], John Ternest[3], Laura Ingwell[3], Ashley Leach[4], Karen Goodell[5], Ian Kaplan[3] and Zsofia Szendrei[1], [1]Michigan State Univ., East Lansing, MI, [2]The Ohio State Univ., Columbus, OH, [3]Purdue Univ., West Lafayette, IN, [4]Cornell Univ., Geneva, NY, [5]The Ohio State Univ., Newark, OH*

11:20 AM **80** **Influence of aerosol application methods on spatial variability in the efficacy of methoprene against late larvae of *Tribolium confusum* and *Trogoderma inclusum*.** *Srinivas Lanka (slanka@ksu.edu)[1], James Campbell[2], Frank Arthur[2] and Kun Yan Zhu[1], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS*

11:30 AM **81** **Evaluating the effects of insecticide use on predation in watermelon systems / Evaluando los efectos del uso de insecticidas sobre predación en producción de sandía.** *Iván Grijalva (grijalva@ksu.edu)[1], Amanda Skidmore[2], Steve Yaninek[3] and Ricky E. Foster[3], [1]Kansas State Univ., Manhattan, KS, [2]New Mexico State Univ., Los Lunas, NM, [3]Purdue Univ., West Lafayette, IN*

11:40 AM **82** **Characterization of Bt resistance in *Helicoverpa zea* to Bt transgenic cotton.** *Ziyan NanGong (ngzyheb@163.com), Abdul Hakeem, Dol P. Dhakal and Megha N. Parajulee, Texas A&M AgriLife Research and Extension Center, Lubbock, TX*

Regular Ten Minute Paper Session V - P-IE

Venetian Room (14th Floor) (Skirvin Hilton)

Moderators: Charles Konemann, Oklahoma State Univ., Stillwater, OK and Scott Ludwig, AMVAC, Arp, TX

10:30 AM 83 **Root symbionts boost grass defense against fall armyworm (Spodoptera frugiperda; Lepidoptera: Noctuidae).** *Chase Stratton (stratton@landinstitute.org)[1], Swayamjit Ray[2], Jason Kaye[2], Jared Ali[3] and Ebony Murrell[4], [1]The Land Institute, Salina, KS, [2]Pennsylvania State Univ., Univ. Park, PA, [3]Univ. of Florida, Lake Alfred, FL, [4]Univ. of Wisconsin, Madison, WI*

10:50 AM 85 **Living on the edge: Determining the potential of multipurpose perennial crops as habitat for native pollinators and natural enemies.** *Tania Kim (tkim@ksu.edu)[1], Jessica Butters[1], Brian Spiesman[1], Ebony Murrell[2], David Van Tassel[3] and Brandon Schlautman[3], [1]Kansas State Univ., Manhattan, KS, [2]Univ. of Wisconsin, Madison, WI, [3]The Land Institute, Salina, KS*

11:00 AM 86 **Evaluation of the *Glance n' Go* binomial sequential sampling system for sugarcane aphid *Melanaphis sacchari* Zehntner (Hemiptera: Aphididae) in grain sorghum.** *Thomas Hess (tmhess@ostatemail.okstate.edu), Jessica Lindenmayer and Tom Royer, Oklahoma State Univ., Stillwater, OK*

11:10 AM 87 **Chromosome-scale genome assembly of potato psyllid *Bactericera cockerelli* (Sulc), a plant pathogen vector.** *Zhen Fu (zhen.fu@tamu.edu)[1], Surya Saha[2], Carmen Carrillo[3], Yang Ge[4] and William Snyder[5], [1]Texas A&M Univ., College Station, TX, [2]Boyce Thompson Institute, Ithaca, NY, [3]Instituto Nacional de Investigaciones Agropecuarias (INIAP), Quito, Ecuador, [4]Chinese Academy of Chinese Medical Sciences, Beijing, China, [5]Univ. of Georgia, Athens, GA*

11:20 AM 88 **Screening *Helicoverpa zea* populations in the U.S. for the presence of invasive *H. armigera* using next-generation DNA sequencing.** *Zhen Fu (zhen.fu@tamu.edu)[1], Todd Gilligan[2] and Gregory Sword[1], [1]Texas A&M Univ., College Station, TX, [2]USDA - APHIS, Fort Collins, CO*

11:40 AM 90 **SIMPAS™: The next generation of precision, prescriptive, in-furrow application equipment.** *Scott Ludwig (scottl@amvac.com)[1], Wen Carter[2], Mason Newark[3] and Rick Rice[4], [1]AMVAC, Arp, TX, [2]AMVAC, Tifton, GA, [3]AMVAC, Gainesville, FL, [4]AMVAC, Collierville, TN*

11:50 AM 91 **Transform® WG with IsoclastTM active: A selective insecticide for management of soybean aphid in the Midwest.** *Laura Campbell (laura.campbell@corteva.com)[1] and Patti Prasifka[2], [1]Corteva Agriscience, Carbondale, IL, [2]Corteva Agriscience, West Fargo, ND*

MONDAY, MARCH 16, 2020, AFTERNOON

Student Ten Minute Paper Competition: Ph.D - MUVE

Centennial 3 (Skirvin Hilton)

Moderators: Michael Merchant, Texas A&M AgriLife Extension Service, Dallas, TX and Janet Hurley, Texas A&M Univ., Dallas, TX

2:30 PM 92 **Determining the critical threshold of blood meal reduction to reduce general fecundity in the horn fly (Diptera: Muscidae).** *Jesus Zamudio (jjfigz@nmsu.edu) and Brandon Smythe, New Mexico State Univ., Las Cruces, NM*

2:40 PM 93 **Plant essential oil constituents synergize deltamethrin toxicity in resistant bed bugs (*Cimex lectularius* L.) by inhibiting cytochrome P450 enzymes.** *Sudip Gaire (sgaire@purdue.edu), Wei Zheng, Michael Scharf and Ameya Gondhalekar, Purdue Univ., West Lafayette, IN*

2:50 PM 94 **Sub-lethal reproductive effects on *Alphitobius diaperinus* from insecticide and litter amendment treatments.** *Brandon Lyons (brandon.lyons@okstate.edu), Justin Talley, Tom Royer, Astri Wayadande and Blake Wilson, Oklahoma State Univ., Stillwater, OK*

3:00 PM 95 **The relationship between insecticide resistance and the gut microbiome of *Blattella germanica*.** *Zachery Wolfe (wolfez@purdue.edu) and Michael Scharf, Purdue Univ., West Lafayette, IN*

3:10 PM **Break**

3:40 PM 96 **Thermal stress of eggs differentially impacts larval emergence and survival among multiple hard tick species.** *Oluwaseun Ajayi (ajayiom@mail.uc.edu), Kennan Oyen and Joshua Benoit, Univ. of Cincinnati, Cincinnati, OH*

3:50 PM 97 **Temporal changes in knockdown resistance-associated mutations in bed bug populations across the United States.** *Cari Lewis (cdl5261@utulsa.edu)[1], Coby Schal[2], Edward Vargo[3] and Warren Booth[1], [1]Univ. of Tulsa, Tulsa, OK, [2]North Carolina State Univ., Raleigh, NC, [3]Texas A&M Univ., College Station, TX*

4:00 PM 98 **Exposure to a reduced-risk insecticide on maize reduces movement by the stored product pests, *Prostephanus truncatus* and *Sitophilus zeamais*.** *Hannah Quellhorst (hquellho@ksu.edu)[1], Frank Arthur[2] and Rob Morrison[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS*

4:10 PM 99 **Raising the "anty" in decomposition ecology: Effect of vertebrate carrion on fire ant colony performance.** *Constance Lin (clin75@tamu.edu), Aaron Tarone and Micky Eubanks, Texas A&M Univ., College Station, TX*

Student Ten Minute Paper Competition: Ph.D - PBT & SysEB

Centennial 2 (Skirvin Hilton)

Moderator: Kristopher Giles, Oklahoma State Univ., Stillwater, OK

2:30 PM 100 **Biorational tick repellents: Differences in response by species.** *Colin Wong (cwong1@iastate.edu), Kylie Crystal and Joel Coats, Iowa State Univ., Ames, IA*

2:40 PM 101 **Determining how honey bee (*Apis mellifera*) nurse visitation rates and brood type might facilitate larval cell invasion by the mite *Varroa destructor*.** *Taylor Reams (tdreams@tamu.edu) and Juliana Rangel, Texas A&M Univ., College Station, TX*

2:50 PM 102 **Osmoregulation and thermoregulation in *Amblyomma americanum:* The lone star tick sucks and sweats!.** *L. Paulina Maldonado-Ruiz (lpmaldonado@ksu.edu)[1] and Yoonseong Park[2], [1]Kansas State Univ., Manhattan, KS, [2]Dept. of Entomology/Kansas State Univ., Manhattan, KS*

3:00 PM 103 **Surveying termite communities in primary and secondary neotropical rainforest.** *Mark Janowiecki (janowiecki@tamu.edu) and Edward Vargo, Texas A&M Univ., College Station, TX*

3:10 PM **Break**

3:40 PM 104 **Identification and expression profile of putative double-stranded RNA-degrading enzymes in the biting midge, *Culicoides sonorensis* (Diptera: Ceratopogonidae).** *Cameron Osborne (cjosborne@ksu.edu)[1], Lee Cohnstaedt[1,2] and Kristopher Silver[1], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS*

3:50 PM 105 **Estimating risks of insecticide exposure on different life stages of monarch butterfly (*Danaus plexippus*).** *Niranjana Krishnan (nkrish@iastate.edu), Melanie Aust, Joel Coats and Steven Bradbury, Iowa State Univ., Ames, IA*

4:00 PM 106 **Avoiding delay tactics: Improved student insect collections by assembling the parts.** *Melissa Reed (mleath@okstate.edu) and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK*

4:10 PM 107 **Larvicide activity and oviposition deterrence of *Aedes aegypti* mosquitoes to cajeput oil chemistries.** *Ellis Johnson (ellisjamesj@gmail.com) and Troy Anderson, Univ. of Nebraska, Lincoln, NE*

Student Ten Minute Paper Competition: Ph.D - P-IE - Session I

Centennial 1 (Skirvin Hilton)

Moderator: Frank Arthur, USDA - ARS, Manhattan, KS

2:30 PM **108** **Robustness of biological control using multiple natural enemies against whitefly influx or delayed natural enemy releases.** *Erfan Vafaie (erfanv@tamu.edu)[1], Brent Pemberton[2], Mengmeng Gu[3], Micky Eubanks[3], David Kerns[3] and Kevin Heinz[3], [1]Texas A&M Univ., Overton, TX, [2]Texas A&M AgriLife Research, Overton, TX, [3]Texas A&M Univ., College Station, TX*

2:40 PM **109** **Using geospatial tools to quantify continuous corn in landscapes surrounding fields with a history of injury to Cry3 corn by Western corn rootworm.** *Coy St. Clair (cstclair@iastate.edu) and Aaron J. Gassmann, Iowa State Univ., Ames, IA*

2:50 PM **110** **Monarch butterfly (*Danaus plexippus*) host plant selection and the effects of aphid competitors.** *Katie LaPlante (kmlaplante@mail.missouri.edu), Terryl L. Woods and Debbie Finke, Univ. of Missouri, Columbia, MO*

3:00 PM **111** **Seasonal relationships between naturally occurring entomopathogenic nematodes and Asiatic garden beetle, *Maladera castanea*, in Ohio agroecosystems.** *Adrian Pekarcik (pekarcik.4@osu.edu) and Kelley Tilmon, The Ohio State Univ., Wooster, OH*

3:10 PM **Break**

3:40 PM **112** **Bee community form and function in urban vacant land: Implications for managing pollinator friendly cities.** *Katherine Turo (kjtodd91@gmail.com), MaLisa Spring, Frances S. Sivakoff, Yvan Delgado de la Flor and Mary Gardiner, The Ohio State Univ., Columbus, OH*

3:50 PM **113** **Honeydew microbiota of the invasive sugarcane aphid.** *Jocelyn Holt (holtjocelyn@tamu.edu)[1], Antonino Malacrinò[2], Crys Wright[1] and Raul F. Medina[1], [1]Texas A&M Univ., College Station, TX, [2]Linköping Univ., Linköping, Sweden*

4:00 PM **114** **Effects of lifetime dietary exposure to SmartStax PRO® in the F0 generation on life history traits of western corn rootworm (Coleoptera: Chrysomelidae) F1 progeny.** *Jordan Reinders (jordan.reinders3@gmail.com)[1], William Moar[2], Paula A. Price[2], Sean Evans[2], Graham P. Head[2] and Lance J. Meinke[1], [1]Univ. of Nebraska, Lincoln, NE, [2]Bayer Crop Science, Chesterfield, MO*

4:10 PM **115** **Making scents of host preference in *Lygus lineolaris*.** *Matthew Hetherington (mhetheringto@wisc.edu) and Christelle Guédot, Univ. of Wisconsin, Madison, WI*

4:20 PM **116** **The behavioral response of two cosmopolitan stored product beetles to microbial-produced volatiles.** *Marco Ponce (marco26@k-state.edu)[1], Tania N. Kim[1] and William Morrison III[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS*

4:30 PM **117** **How do plant-associated microbes modify host-plant selection for insect herbivores?** *Morgan Thompson (mthompson@tamu.edu), John Grunseich, Natalie Aguirre and Anjel Helms, Texas A&M Univ., College Station, TX*

Student Ten Minute Paper Competition: Ph.D - P-IE - Session II

Crystal Room (Skirvin Hilton)

Moderator: Abdul Hakeem, Texas A&M AgriLife Research and Extension Center, Lubbock, TX

2:30 PM **118** **The use of a relay cropping system to improve biological control.** *Jeffrey Cluever (cluever.jeffrey@huskers.unl.edu)[1], Nevin Lawrence[2], Robert Wright[3], Julie Peterson[4] and Jeffrey Bradshaw[1], [1]Univ. of Nebraska, Scottsbluff, NE, [2]Univ. of Nebraska-Lincoln, Scottsbluff, NE, [3]Univ. of Nebraska, Lincoln, NE, [4]Univ. of Nebraska, North Platte, NE*

2:40 PM **119** **Fungal volatiles as semiochemicals for ambrosia beetles in mixed hardwood forests.** *Matthew W. Ethington (methingt@purdue.edu) and Matthew Ginzel, Purdue Univ., West Lafayette, IN*

2:50 PM **120** **Investigating the effects of *Rice hoja blanca virus* on the insect vector *Tagosodes orizicolus*.** *Jaclyn Martin (jaclyn.martin@tamu.edu) and Ismael E. Badillo-Vargas, Texas A&M Univ., College Station, TX*

3:00 PM **121** **Application of protein immunomarking in understanding dispersal of woodboring beetles.** *Scott Gula (sgula@purdue.edu)[1], Vanessa Lopez[2], Ann Ray[3], Scott Machtley[4], James Hagler[4] and Matthew Ginzel[1], [1]Purdue Univ., West Lafayette, IN, [2]USDA - Forest Service, Washington, DC, [3]Xavier Univ., Cincinnati, OH, [4]USDA - ARS, Maricopa, AZ*

3:10 PM **Break**

3:40 PM **122** **Sorghum tolerance to sugarcane aphids.** *Sajjan Grover (sajjan.grover@huskers.unl.edu)[1], Earl Agpawa[1], Scott E. Sattler[2] and Joe Louis[1], [1]Univ. of Nebraska, Lincoln, NE, [2]USDA - ARS, Lincoln, NE*

3:50 PM **123** **Density-dependent mortality of larval Western corn rootworm in Bt and non-Bt corn.** *John McCulloch (johnmcc@iastate.edu) and Aaron J. Gassmann, Iowa State Univ., Ames, IA*

4:00 PM **124** **Everything's sweeter in Texas? A chemical and palynological analysis of honey in Texas** *Pierre Lau (plau0168@tamu.edu), Vaughn Bryant and Juliana Rangel, Texas A&M Univ., College Station, TX*

4:10 PM **125** **Locally adapted predator defense and eclosing behavior of the fall webworm (*Hyphantria cunea*).** *Amy Adams (amy.e.adams@ou.edu), Univ. of Oklahoma, Norman, OK*

4:20 PM **126** **Parasitism of stink bugs by native parasitoids in Nebraska.** *Blessing Ademokoya (bademokoya@huskers.unl.edu)[1], Thomas Hunt[2] and Robert Wright[1], [1]Univ. of Nebraska, Lincoln, NE, [2]Univ. of Nebraska, Concord, NE*

TUESDAY, MARCH 17, 2020, MORNING

Ecology and Management of Sucking Bugs in Cotton Agroecosystems

Crystal Room (Skirvin Hilton)

Moderators and Organizers: Abdul Hakeem, Texas A&M Univ., Lubbock, TX; Michael Brewer, Texas A&M AgriLife Research, Corpus Christi, TX and Megha N. Parajulee, Texas A&M AgriLife Research and Extension Center, Lubbock, TX

9:45 AM **Introduction to the symposium**

9:50 AM **127** **Hemipteran mouthpart morphology and its role in pathogen transmission.** *Jesus Esquivel (jesus.esquivel.phd@gmail.com), USDA - ARS, College Station, TX*

10:20 AM **128** **Plant bugs, stink bugs and leaffooted bugs: A pictorial and experimental comparison of cotton boll injury type and severity.** *Michael Brewer (mjbrewer@ag.tamu.edu)[1] and James Glover[2], [1]Texas A&M AgriLife Research, Corpus Christi, TX, [2]Univ. of Florida, Davie, FL*

10:40 AM **129** **Temporal instability of local population structure in cotton fleahopper and implications for management.** *Tyler Raszick (tjraszick@gmail.com)[1], Charles Suh[2], C. Micheal Dickens[1] and Gregory Sword[1], [1]Texas A&M Univ., College Station, TX, [2]USDA - ARS, College Station, TX*

11:00 AM **130** **Management of cotton fleahoppers in the Texas High Plains.** *Abdul Hakeem (abdul.hakeem@agnet.tamu.edu) and Megha N. Parajulee, Texas A&M AgriLife Research and Extension Center, Lubbock, TX*

11:15 AM **Break**

11:25 AM **131** ***Lygus* management in Texas High Plains cotton.** *Megha N. Parajulee (m-parajulee@tamu.edu), Abdul Hakeem and Dol Dhakal, Texas A&M AgriLife Research and Extension Center, Lubbock, TX*

11:55 AM **132** **Evaluating efficacy and economic profitability of preventive insecticide seed treatments in cotton.** *Suhas Vyavhare (suhas.vyavhare@ag.tamu.edu)[1], Blayne Reed[2], David Kerns[3], Megha N. Parajulee[1], Daniella Sekula-Ortiz[4], Stephen Biles[5] and Michael Brewer[6], [1]Texas A&M AgriLife Research and Extension Center, Lubbock, TX, [2]Texas A&M Univ., Plainview, TX, [3]Texas A&M Univ., College Station, TX, [4]Texas A&M Univ., Weslaco, TX, [5]Texas A&M Univ., Port Lavaca, TX, [6]Texas A&M AgriLife Research, Corpus Christi, TX*

12:15 PM **133** **Field scouting for pest management in West Texas production fields with Strider.** *Blayne Reed (blayne.reed@ag.tamu.edu), Texas A&M Univ., Plainview, TX*

On the Road Again: Management and Conservation of Migratory Insects

Centennial 2 (Skirvin Hilton)

Moderators and Organizers: Robert Wright, Univ. of Nebraska, Lincoln, NE; Erin Hodgson, Iowa State Univ., Ames, IA and Anthony McMechan, Univ. of Nebraska-Lincoln, Ithaca, NE

9:45 AM **Introductory remarks**

9:50 AM **134** **Seasonal movement of potato leafhoppers.** *Elson J. Shields (es28@cornell.edu), Cornell Univ., Ithaca, NY*

10:20 AM **135** **Seasonal movement of fall armyworm.** *Rob Meagher (rob.meagher@ars.usda.gov), USDA - ARS, Gainesville, FL*

10:40 AM **136** **Tracking migration of red admiral and painted lady butterflies: Weekly surveys, flight direction monitoring, citizen science observations, mark-recapture studies, and stable isotope analysis.** *Royce Bitzer (mariposa@iastate.edu), Iowa State Univ., Ames, IA*

11:00 AM **137** **Using the Ag Pest Monitoring Network to share data and improve understanding of seasonal insect movement.** *Joseph LaForest (laforest@uga.edu), Univ. of Georgia, Tifton, GA*

11:20 AM **Break**

11:30 AM **138** **Status of corn earwom resistance to Bt toxins in the southern U.S..** *David Kerns (dlkerns@tamu.edu)[1], Jose Santiago González[1], Fei Yang[1], Dominic Reisig[2], Nathan Little[3] and Gregory Payne[4], [1]Texas A&M Univ., College Station, TX, [2]North Carolina State Univ., Plymouth, NC, [3]USDA - ARS, Stoneville, MS, [4]Univ. of West Georgia, Carrollton, GA*

11:50 AM **139** **Status of corn earworm resistance to Bt hybrids in the North Central region and improving maize protection from the pest.** *Craig Abel (craig.abel@ars.usda.gov)[1], Brad Coates[1], Nick Lauter[1], Erin Hodgson[2], Meaghan Anderson[3] and Royce Bitzer[2], [1]USDA-ARS, Ames, IA, [2]Iowa State Univ., Ames, IA, [3]Iowa State Univ. Extension and Outreach, Nevada, IA*

12:10 PM **140** **Monarch butterfly conservation in the North Central region.** *Kelsey E. Fisher (kefisher@iastate.edu), Iowa State Univ., Ames, IA*

Things They Don't Teach You in Grad School

Centennial 1 (Skirvin Hilton)

Moderator and Organizers: Benjamin Jaffe, ExxonMobil Biomedical Sciences, Clinton, NJ; Amy Morey, Univ. of Minnesota, St. Paul, MN; Rob Morrison, USDA - ARS, Manhattan, KS; Ana Vélez Arango, Univ. of Nebraska, Lincoln, NE; Scott O'Neal, Univ. of Nebraska, Lincoln, NE and Hannah Penn, Univ. of Texas, Edinburg, TX

9:45 AM **Welcoming remarks**

9:50 AM 141 **PhD to post hole digging: A switch from academia to ag production startup.** *Cheri Abraham (cherimabraham@gmail.com), US Citrus, LLC, Hargill, TX*

10:10 AM 142 **The secret to work-life balance is to stop searching for it.** *Jody Green (jgreen17@unl.edu), Univ. of Nebraska, Lincoln, NE*

10:30 AM 143 **Better than survival: How to thrive in graduate school (and beyond) using strategies that promote mental health.** *Leo Taylor (taylor.3408@osu.edu), The Ohio State Univ., Columbus, OH*

10:50 AM 144 **Conflict is inevitable, but combat is optional.** *John Ruberson (jruberson2@unl.edu)[1] and Ana Vélez Arango[2], [1]Univ. of Nebraska-Lincoln, Lincoln, NE, [2]Univ. of Nebraska, Lincoln, NE*

11:10 AM **Break**

11:20 AM 145 **Optimizing small business innovation, technical transfer, and growth through collaboration with government, university, and community.** *Bill Lingren (blingren@trece.com), Trece, Inc., Adair, OK*

11:40 AM 146 **Building your brand to land an academic job - separating what matters from the noise.** *Mary Gardiner (gardiner.29@osu.edu), The Ohio State Univ., Columbus, OH*

12:00 PM **Discussion**

From Molecules to Ecosystems: A Survey of Data Management and Analytical Strategies in Entomological Research

Centennial 3 (Skirvin Hilton)

Moderator and Organizers: Christopher Riley, The Ohio State Univ., Columbus, OH; Aleksandra Dolezal, Univ. of Guelph, Guelph, ON, Canada and Jocelyn Holt, Texas A&M Univ., College Station, TX

9:45 AM 147 **Incorporating multivariate models into ecological research.** *John Couture (couture@purdue.edu), Purdue Univ., West Lafayette, IN*

10:05 AM 148 **Using a functional trait approach to study insect community ecology.** *Kayla I. Perry (perry.1864@osu.edu), The Ohio State Univ., Columbus, OH*

10:25 AM 149 **Using game theory to understand plant-pest-pollinator relationships.** *Abdel Halloway (ahallo2@uic.edu), Kliffi Blackstone and Gordon McNickle, Purdue Univ., West Lafayette, IN*

10:45 AM 150 **Using functional programming to model population interactions between herbivorous biocontrol agents and their target plant with the Python package, *Generations*.** *Mary Marek-Spartz (patt0335@umn.edu), George Heimpel and Roger Becker, Univ. of Minnesota, St. Paul, MN*

11:05 AM **Break**

11:15 AM 151 **Meta-analysis toolbox: Novel approaches for working in the 21st Century's overwhelming amount of scientific literature.** *Fabian List (fabian.list@tamu.edu), Texas A&M Univ., College Station, TX*

11:35 AM 152 **Metagenetic applications in entomological research: From biosurveillance to trophic ecology.** *Rodney Richardson (rtr87@yorku.ca), York Univ., Toronto, ON, Canada*

11:55 AM 153 **The bioinformatic analysis of the insect microbiome.** *Antonino Malacrinò (antonino.malacrino@gmail.com), Linköping Univ., Linköping, Sweden*

12:15 PM 154 **Asking and answering behavioral questions about insects with commercial and low-cost computerized, automated video tracking systems.** *William Morrison III (william.morrison@usda.gov)[1], Rachel Wilkins[2], Chloe Albin[2] and Hannah Quellhorst[2], [1]USDA-ARS, Manhattan, KS, [2]Kansas State Univ., Manhattan, KS*

TUESDAY, MARCH 17, 2020, AFTERNOON

Extension Delivers: Showcasing Successful Program Delivery Methods for Insects

Centennial 2 (Skirvin Hilton)

Organizers: Molly Keck, Texas A&M AgriLife Extension Service, San Antonio, TX; Erin Hodgson, Iowa State Univ., Ames, IA and Kelley Tilmon, The Ohio State Univ., Wooster, OH

1:30 PM 155 **Broadening our audience by diversifying the messenger - how training agents and volunteers can expand IPM.** *Janet Hurley (jahurley@tamu.edu)[1], Faith Oi[2], Arthur Appel[3] and Fudd Graham[3], [1]Texas A&M Univ., Dallas, TX, [2]Univ. of Florida, Gainesville, FL, [3]Auburn Univ., Auburn, AL*

1:50 PM 156 **Special delivery: Timely and tailored extension programs in urban entomology.** *Jody Green (jgreen17@unl.edu), Univ. of Nebraska, Lincoln, NE*

2:10 PM 157 **Pesticide applicator training: Have we got it all wrong?** *Michael Merchant (m-merchant@tamu.edu), Texas A&M AgriLife Extension Service, Dallas, TX*

2:30 PM 158 **Customizing your extension experience with myFields.info.** *Brian McCornack (bmccornack@gmail.com) and Wendy Johnson, Kansas State Univ., Manhattan, KS*

2:50 PM 159 **The master volunteer entomology advanced training program in Texas: A history.** *Wizzie Brown (ebrown@ag.tamu.edu)[1], Michael Merchant[2] and Molly Keck[3], [1]Texas A&M AgriLife Extension Service, Austin, TX, [2]Texas A&M AgriLife Extension Service, Dallas, TX, [3]Texas A&M AgriLife Extension Service, San Antonio, TX*

3:10 PM **Break**

3:30 PM 160 **The handy Bt trait table: A simple deliverable with unexpected consequences.** *Chris DiFonzo (difonzo@msu.edu)[1] and Patrick Porter[2], [1]Michigan State Univ., East Lansing, MI, [2]Texas A&M AgriLife Extension, Lubbock, TX*

3:50 PM 161 **Using citizen science to identify pollinator-attractive plants.** *Erfan Vafaie (erfanv@tamu.edu)[1], Eric Rebek[2], Scott Longing[3], Adam Mitchell[4], Michael Merchant[5] and Danielle Dunn[5], [1]Texas A&M Univ., Overton, TX, [2]Oklahoma State Univ., Stillwater, OK, [3]Texas Tech Univ., Lubbock, TX, [4]Tarleton State Univ., Stephenville, TX, [5]Texas A&M AgriLife Extension Service, Dallas, TX*

4:10 PM 162 **Extension: An ECP perspective.** *Amanda Skidmore (amanda.skidmore@gmail.com), New Mexico State Univ., Los Lunas, NM*

4:30 PM 163 **The wheat farmer's challenge: An educational game teaching the wheat-mite-virus complex and associated pest management practices.** *Douglas Golick (dgolick2@unl.edu)[1], Anthony McMechan[2] and Gary Hein[1], [1]Univ. of Nebraska, Lincoln, NE, [2]Univ. of Nebraska-Lincoln, Ithaca, NE*

4:50 PM 164 **Southwestern Branch educational outreach activities, expanding over the last 20 years.** *Andrine A. Shufran (andrine@okstate.edu), Oklahoma State Univ., Stillwater, OK*

Frontiers in Risk Assessment and Management of Flies

Centennial 3 (Skirvin Hilton)

Moderators and Organizers: Brandon Smythe, New Mexico State Univ., Las Cruces, NM; Dana Nayduch, USDA-ARS, Manhattan, KS and Gary Brewer, Univ. of Nebraska, Lincoln, NE

1:30 PM **Introductory remarks**

1:35 PM 165 **Frontiers in fly risk assessment: What role are house flies playing as reservoirs and disseminators of bacteria in urban and agricultural environments?** *Dana Nayduch (dana.nayduch@usda.gov)[1] and Saraswoti Neupane[2], [1]USDA-ARS, Manhattan, KS, [2]Kansas State Univ., Manhattan, KS*

1:57 PM 166 **Frontiers of novel long-lasting repellent and attractant discovery and technology development for integrated fly management.** *Jerry Zhu (Jerry.Zhu@ARS.USDA.GOV)[1] and Gary Brewer[2], [1]USDA - ARS, Lincoln, NE, [2]Univ. of Nebraska, Lincoln, NE*

2:19 PM 167 **Frontiers in horn fly management: Manipulating not-so-universal concepts to better serve the complexities of this parasitic interaction.** *Brandon Smythe (bsmythe@nmsu.edu), New Mexico State Univ., Las Cruces, NM*

2:41 PM 168 **Efficacy of products against house fly eggs, larvae and pupae in poultry manure.** *Sonja Swiger (slswiger@ag.tamu.edu)[1] and Hannah Walker[2], [1]Texas A&M Univ., Stephenville, TX, [2]Tarleton State Univ., Stephenville, TX*

3:03 PM 169 **Bacterial carriage by male and female house flies (*Musca domestica* L.) collected from confined cattle operations in northeast Kansas.** *Victoria Pickens (vlpicken@ksu.edu)[1], Brandon Hall[1], Brianna Davis[2], Edward Bird[1], Grant Brooke[1] and Dana Nayduch[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA-ARS, Manhattan, KS*

3:15 PM **Break**

3:30 PM **170** **What can traps tell us.** *David Taylor (dave.taylor@ars.usda.gov), USDA - ARS, Lincoln, NE*

3:52 PM **171** **A biopesticide strategy for managing stable flies.** *Alexander Lehmann (alexander.lehmann@huskers.unl.edu)[1], Gary Brewer[1] and David Boxler[2], [1]Univ. of Nebraska, Lincoln, NE, [2]Univ. of Nebraska, North Platte, NE*

4:04 PM **172** **The effect of horn fly infestations on ruminal fermentation and digesta kinetics in beef cows.** *Ulises Sanchez (ulises91@nmsu.edu) and Brandon Smythe, New Mexico State Univ., Las Cruces, NM*

4:16 PM **173** **The influence of eastern red cedar (ERC), *Juniperus virginiana* on Tabanidae populations in Oklahoma.** *Justin Talley (justin.talley@okstate.edu), Kylie Sherrill and Bruce Noden, Oklahoma State Univ., Stillwater, OK*

4:38 PM **174** **Filth fly diversity and abundance associated with shallow, trench, composting process for swine mortalities from a simulated African swine fever disease outbreak.** *Justin Turner (justin.turner11@okstate.edu)[1], Justin Talley[2], Fernando Bauermann[3] and W. Wyatt Hoback[2], [1]Oklahoma State Unversity, Stillwater, OK, [2]Oklahoma State Univ., Stillwater, OK, [3]Oklahoma State Univeristy, Stillwater, OK*

4:50 PM **175** **Field surveillance and trap comparison of tabanid species found in varying locations around Texas.** *Hannah Walker (hannahag16@gmail.com)[1] and Sonja Swiger[2], [1]Tarleton State Univ., Stephenville, TX, [2]Texas A&M Univ., Stephenville, TX*

5:02 PM **Concluding Remarks**

Biological Control in Agroecosystems and Natural Areas: Highlighting the Work of a New Generation of Biocontrol Scientists

Crystal Room (Skirvin Hilton)

Organizers: Jason Harmon, North Dakota State Univ., Fargo, ND; Marianna Szücs, Michigan State Univ., East Lansing, MI and Jen White, Univ. of Kentucky, Lexington, KY

1:30 PM **Welcoming remarks**

1:35 PM **176** **Perspectives in biological control approaches and application.** *Allison Bistline-East (abistlin@purdue.edu), Purdue Univ., West Lafayette, IN*

1:47 PM **177** **The stresses and successes of leading an international biological control effort.** *Kenneth Masloski (kemasloski@tamu.edu), Mengmeng Gu and Kevin Heinz, Texas A&M Univ., College Station, TX*

1:59 PM **178** **Petition process and risk assessment for a weed biocontrol agent of *Alliaria petiolata* in the United States.** *Mary Marek-Spartz (patt0335@umn.edu), George Heimpel and Roger Becker, Univ. of Minnesota, St. Paul, MN*

2:11 PM **179** **Improving assessments of biological control by arthropod predators with low and high-tech tools.** *Hannah Gray (grayx379@umn.edu) and David Andow, Univ. of Minnesota, St. Paul, MN*

2:23 PM **180** **The use of *Trichogramma ostriniae* as a biological control agent of lepidopterous pests.** *Jeffrey Cluever (cluever.jeffrey@huskers.unl.edu)[1], Robert Wright[2], Julie Peterson[3], Nevin Lawrence[1] and Jeffrey Bradshaw[1], [1]Univ. of Nebraska, Scottsbluff, NE, [2]Univ. of Nebraska, Lincoln, NE, [3]Univ. of Nebraska, North Platte, NE*

2:35 PM **181** **Augmentative releases of *Trissolcus japonicus* for the biological control of *Halyomorpha halys* in Michigan apple orchards.** *Olivia Simaz (simazoli@msu.edu), John Pote, Larry Gut, Julianna Wilson and Marianna Szücs, Michigan State Univ., East Lansing, MI*

2:47 PM **182** **Optimizing sterile insect release for farm-level application as part of an overall IPM program.** *Megan Andrews (andre278@msu.edu), Christopher Adams and Larry Gut, Michigan State Univ., East Lansing, MI*

2:59 PM **Break**

3:19 PM **183** **The ecological consequences of hyperparasitoid attacks on two biological control agents of the imported cabbageworm.** *Dhaval Vyas (dhaval.vyas@du.edu)[1], Paul Ode[2] and Ryan Paul[2], [1]Univ. of Denver, Denver, CO, [2]Colorado State Univ., Fort Collins, CO*

3:31 PM **184** **Intraspecific biocontrol insects compete even when disparately located on shared Russian knapweed host.** *Theresa Barosh (theresa.barosh@colostate.edu) and Paul Ode, Colorado State Univ., Fort Collins, CO*

3:43 PM **185** **Differential survivability between the wheat stem sawfly and its parasitoids in grass hosts.** *Bethany Thomas (bethany.thomas@huskers.unl.edu)[1], Jeffrey Bradshaw[2] and Gary Hein[1], [1]Univ. of Nebraska, Lincoln, NE, [2]Univ. of Nebraska, Scottsbluff, NE*

3:55 PM **186** **Characterization of sugarcane aphid honeydew on different host plants.** *Crys Wright (cwright02@tamu.edu), Keyan Zhu-Salzman, Anjel Helms and Raul F. Medina, Texas A&M Univ., College Station, TX*

4:07 PM **187** **Insights into the population dynamics of *Aphelinus certus*, a naturalized parasitoid of soybean aphid in North America.** *James Miksanek (miks0007@umn.edu) and George Heimpel, Univ. of Minnesota, St. Paul, MN*

4:19 PM **188** **Going beyond the growing season to understand biological control: Studies of the overwintering biology of *Aphelinus* spp., parasitoids of soybean aphid.** *Carl Stenoien (sten0364@umn.edu) and George Heimpel, Univ. of Minnesota, St. Paul, MN*

4:31 PM **189** **Spider assemblages in western Nebraska agroecosystems and their potential as agents of conservation biocontrol.** *Samantha Daniel (sdaniel403@gmail.com)[1], Julie Peterson[1] and Robert Wright[2], [1]Univ. of Nebraska, North Platte, NE, [2]Univ. of Nebraska, Lincoln, NE*

4:43 PM **190** **Can temporally continuous resource landscapes promote natural enemy conservation? Lessons from lady beetles in Wisconsin** *Benjamin Iuliano (biuliano@wisc.edu)[1], Tania N. Kim[2], Brian Spiesman[2], David Hoekman[3], Gabriella Stadler[1] and Claudio Gratton[1], [1]Univ. of Wisconsin, Madison, WI, [2]Kansas State Univ., Manhattan, KS, [3]Southern Nazarene Univ., Bethany, OK*

4:55 PM **191** **Seeking common ground between insecticides and predatory natural enemies.** *Carlos Esquivel (esquivelpalma.1@osu.edu)[1], Andy Michel[1], Erick Martinez[1], Rogelio Trabanino[2], Raven Baxter[1], Rachel Bienemann[1] and Luis Canas[1], [1]The Ohio State Univ., Wooster, OH, [2]Escuela Agricola Panamericana, Tegucigalpa, Honduras*

5:07 PM **Discussion**

Urban Entomology Challenges in Midwestern and Southwestern United States

Centennial 1 (Skirvin Hilton)

Moderators and Organizers: Shripat Kamble, Univ. of Nebraska, Lincoln, NE; Jason Meyers, BASF Corporation, Kansas City, MO; Bob Davis, BASF Corporation, Pflugerville, TX and Robert Puckett, Texas A&M Univ., College Station, TX

1:30 PM **Introductory remarks**

1:35 PM **192** **Hot topics in urban entomology: Opening the world of science to the public and industry.** *Molly Keck (mekeck@ag.tamu.edu), Texas A&M AgriLife Extension Service, San Antonio, TX*

1:55 PM **193** **Determining termiticide residues in building foundation fills, and wood protection field tests in Oklahoma.** *Brad Kard (b.kard@okstate.edu) and Charles Konemann, Oklahoma State Univ., Stillwater, OK*

2:15 PM **194** **Understanding subterranean termite tunneling and foraging behavior.** *Mark Janowiecki (janowiecki@tamu.edu) and Edward Vargo, Texas A&M Univ., College Station, TX*

2:35 PM **195** **Insecticide resistance in bed bugs and its management.** *Alvaro Romero (aromero2@nmsu.edu), New Mexico State Univ., Las Cruces, NM*

2:55 PM **196** **Identification: the foundation of sound IPM for ants in urban settings.** *Eric Paysen (Eric.Paysen@syngenta.com), Syngenta Crop Protection, Cave Park, AZ*

3:15 PM **Break**

3:30 PM **197** **Novel formulations to provide better efficiency in controlling pest problems in the urban environment.** *Raj Saran (raj.saran@bayer.com)[1], Alexander Ko[2], Kurt Vandock[3], John Paige[4], James Hempfling[5] and Byron Reid[6], [1]Bayer Crop Science, Austin, TX, [2]Bayer Crop Science, Cary, NC, [3]Bayer Environmental Crop Science, Austin, TX, [4]Bayer Crop Sciences, Vero Beach, FL, [5]Bayer Environmental Science, Austin, TX, [6]Bayer Crop Science, Research Triangle Park, NC*

3:50 PM **198** **Pest management challenges in food plant - PMP Prospective.** *Pari Pachamuthu (pari.pachamuthu@rentokil.com), Rentokil, Houston, TX*

4:10 PM **199** **Field control of flies in a swine facility using Alpine water-soluble granule (WSG) insecticide.** *Jason Mayer (Jason.meyers@basf.com)[1] and Grzegorz Buczkowski[2], [1]BASF Corp., Kansas City, MO, [2]Purdue Univ., West Lafayette, IN*

4:30 PM **200** **The growing need for advanced-degree entomologists in structural pest control.** *J Portugal (sportugal@goanteater.com), ABC Home and Commercial Pest Management Services, Austin, TX*

4:50 PM **201** **Past, present and future of urban entomology.** *Shripat Kamble (skamble1@unl.edu), Univ. of Nebraska, Lincoln, NE*

5:10 PM **Discussion**

The Latest Advances in Pollinator Health Research

Venetian Room (14th Floor) (Skirvin Hilton)

Moderators and Organizers: Pierre Lau, Texas A&M Univ., College Station, TX; Alexandria Payne, Texas A&M Univ., College Station, TX and Juliana Rangel, Texas A&M Univ., College Station, TX

1:30 PM **202** **Optimizing macronutrient ratios in honey bee pollen substitutes and how we can apply this information to honey bee pathogen defense.** *Alexandria Payne (alexnpayne@gmail.com), Pierre Lau, Cora Garcia, Jordan Gomez, Pierre Lesne, Spence Behmer and Juliana Rangel, Texas A&M Univ., College Station, TX*

1:45 PM **203** **Bee genotype and viral infection impact macronutrient preferences.** *Hannah Penn (hannahjpenn@gmail.com)[1], Michael Simone-Finstrom[2], Rachel Dickens[3] and Lilia de Guzman[2], [1]Univ. of Texas, Edinburg, TX, [2]USDA - ARS, Baton Rouge, LA, [3]USDA ARS Honey Bee Lab, Baton Rouge, LA, Baton Rouge, LA*

2:00 PM **204** **How do bees assess food quality? Taste and nutrition play different roles in learning and memory formation in the honey bee** *Julie Mustard (julie.mustard@utrgv.edu)[1], Valerie Alvarez[2], Sofy Barocio[3] and Karin Robles[3], [1]Univ. of Texas Rio Grande Valley, Brownsville, TX, [2]The Univ. of Texas, Brownsville, TX, [3]Univ. of Texas Rio Grand Valley, Brownsville, TX*

2:15 PM **205** **Current approaches for pollen nutrient analysis and implications in pollinator research.** *Pierre Lau (plau0168@tamu.edu), Pierre Lesne, Spence Behmer and Juliana Rangel, Texas A&M Univ., College Station, TX*

2:45 PM **207** **Bees differentiate in nutritional space through pollen host-plant preferences: Implications for community conservation.** *Anthony Vaudo (advaudo@gmail.com) and Anne Leonard, Univ. of Nevada, Reno, NV*

3:00 PM **208** **Resource availability at the local and landscape scales underlie conservation of diverse insect pollinators.** *Elinor Lichtenberg (elichten@unt.edu)[1], Jaclyn Heiser[2], Kristen Baum[3] and Shalene Jha[2], [1]Univ. of North Texas, Denton, TX, [2]Univ. of Texas, Austin, TX, [3]Oklahoma State Univ., Stillwater, OK*

3:15 PM **209** **Landscape diversity but not honey bee presence shapes wild bee communities in an agricultural landscape.** *Ashley St. Clair (astclair@iastate.edu)[1], Ge Zhang[1], Adam Dolezal[2], Matthew O'Neal[1] and Amy Toth[1], [1]Iowa State Univ., Ames, IA, [2]Univ. of Illinois, Champaign, IL*

3:30 PM **Break**

3:45 PM **210** **The state of native bee pollinators in the cotton agroecosystem: Contribution to cotton yield?** *Isaac Esquivel (iesqu002@tamu.edu)[1], Robert Coulson[1] and Michael Brewer[2], [1]Texas A&M Univ., College Station, TX, [2]Texas A&M AgriLife Research, Corpus Christi, TX*

4:00 PM **211** **Pollinator-attracting companion plantings increase crop yield of cucumbers and habanero peppers.** *John Montoya (jmontoya@tarleton.edu)[1], Michael Arnold[2], Juliana Rangel[2], Marco Palma[2] and Larry Stein[3], [1]Tarleton State Univ., Stephenville, TX, [2]Texas A&M Univ., College Station, TX, [3]Texas A&M Univ., Uvalde, TX*

4:15 PM **212** **Exposure of foraging wild bees to neonicotinoids in the U.S. Southern High Plains.** *Scott Longing (scott.longing@ttu.edu), Eric Peterson, Christopher Jewett, Bianca Rendon and Samuel Discua, Texas Tech Univ., Lubbock, TX*

4:30 PM **213** **Monitoring for pesticide incidents and other hive issues using dead bee traps.** *Judy Wu-Smart (jwu-smart@unl.edu) and Jennifer Albrecht, Univ. of Nebraska, Lincoln, NE*

4:45 PM **214** **Mitigating pesticide exposure on pollinators through landscape enhancements.** *Surabhi Vakil (guptasurbhi8a@gmail.com) and Judy Wu-Smart, Univ. of Nebraska, Lincoln, NE*

5:00 PM **215** **Balancing risk with reward: The challenges and opportunities concerning IPM in confection sunflower insect management.** *Jeffrey Bradshaw (jbradshaw2@unl.edu)[1], G. Brewer[2] and Jarrad Prasifka[3], [1]Univ. of Nebraska, Scottsbluff, NE, [2]Univ. of Nebraska-Lincoln, Lincoln, NE, [3]USDA - ARS, Fargo, ND*

5:15 PM **216** **Quantifying neonicotinoid residues in pollen and nectar by LC-MS/MS.** *Maura Hall (mjhall@iastate.edu), Ge Zhang, Matthew O'Neal, Steven Bradbury and Joel Coats, Iowa State Univ., Ames, IA*

5:30 PM **217** **How the science informs the safe use of a pesticide for pollinators: A case study.** *Daniel Schmehl (daniel.schmehl@bayer.com)[1], Ana R. Cabrera[2] and Ralf Nauen[3], [1]Bayer CropScience, Research Triangle Park, NC, [2]Bayer Crop Science, Research Triangle Park, NC, [3]Bayer Crop Science, Monheim am Rhein, Germany*

WEDNESDAY, MARCH 18, 2020, MORNING

Plant Responses to Insect Herbivory: Molecular Mechanisms and Ecological Interactions

Centennial 1 (Skirvin Hilton)

Organizers: Sajjan Grover, Univ. of Nebraska, Lincoln, NE and Mandeep Tayal, Graduate Assistant, Edinburg, TX

9:00 AM **218** **Plant defense against green peach aphid (*Myzus persicae*): Involvement of *Resistance* gene signaling?** *Moon Twayana and Jyoti Shah (shah@unt.edu), Univ. of North Texas, Denton, TX*

9:20 AM **219** **A dual threat of water-stress and herbivory, what's a plant to do?** *Ricardo Ramirez (ricardo.ramirez@usu.edu), Utah State Univ., Logan, UT*

9:40 AM **220** **Plant defense signaling to insect herbivory.** *Joe Louis (joelouis@unl.edu), Univ. of Nebraska, Lincoln, NE*

10:00 AM **221** **Examining the role of polyphenol rich purple corn pericarp extract on herbivore growth, development, and fitness.** *Rupesh Kariyat (rupesh.kariyat@utrgv.edu)[1], Mandeep Tayal[2], Pavel Somavat[1], Isabella Rodriguez[3], Tina Thomas[4] and Bradley Christoffersen[1], [1]Assistant Professor, Edinburg, TX, [2]Graduate Assistant, Edinburg, TX, [3]High Scholar, Edinburg, TX, [4]Lecturer, Edinburg, TX*

10:20 AM **Break**

10:35 AM **222** **CCA1 controls resistance to aphids by altering indole glucosinolate contents.** *Jiaxin Lei[1], G. Jayaprakasha[2], Eli Borrego[3] and Keyan Salzman (ksalzman@tamu.edu)[4], [1]Texas A&M Univ., College Station, TX, [2]Research Professor, College Station, TX, [3]Texas A&M Univ., New York, NY, [4]Professor, College Station, TX*

10:55 AM **223** **Enhanced photosynthesis in an aphid resistant tomato genotype.** *Janithri Wickramanayake (jswickra@uark.edu)[1], Carlos Avila[2] and Fiona Goggin[3], [1]Post-doctoral Associate, Fayetteville, AR, [2]Texas A&M AgriLife Research, Weslaco, TX, [3]Univ. of Arkansas, Fayetteville, AR*

11:15 AM **224** **Bee foraging preference for wild and domesticated plants.** *Margarita López-Uribe (mml64@psu.edu), Pennsylvania State Univ., Univ. Park, PA*

New Technologies and Applications for Stored Product Insect Management

Centennial 2 (Skirvin Hilton)

Organizers: Deanna Scheff, USDA - ARS, Manhattan, KS and Edmond Bonjour, Oklahoma State Univ., Stillwater, OK

9:00 AM **Welcoming remarks**

9:05 AM **225** **Stored product entomology past, present, and future: thoughts from a 34-year retrospective.** *Frank Arthur (frank.arthur@usda.gov), USDA - ARS, Manhattan, KS*

9:30 AM **226** **Where did these insects come from? Challenges and advances in understanding stored product insect movement** *James Campbell (james.campbell@ars.usda.gov) and Alison Gerken, USDA - ARS, Manhattan, KS*

9:50 AM **227** **Saving fumigant and increasing effectiveness of stored product fumigation using a closed loop system.** *Carol Jones (jcarol@okstate.edu) and Edmond L. Bonjour, Oklahoma State Univ., Stillwater, OK*

10:10 AM **228** **Using professional weather forecasts to control insects better at lower costs.** *Brian Adam (brian.adam@okstate.edu), Oklahoma State Univ., Stillwater, OK*

10:30 AM **Break**

10:40 AM **229** **Functional genomics for improved management of stored product insects.** *Erin Scully (erin.scully@ars.usda.gov), USDA - ARS, Manhattan, KS*

11:00 AM **230** **Response of six stored product pests to MaxForce FC Magnum gel bait.** *Sharon Dobesh (sdobesh@ksu.edu)[1] and Frank Arthur[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS*

11:20 AM **231** **Behavioral genetics in *Tribolium castaneum* to understand variation in attraction to pheromone and kairomone lures.** *Alison Gerken (alison.gerken@ars.usda.gov), Erin Scully and James Campbell, USDA - ARS, Manhattan, KS*

11:40 AM **232** **Phosphine resistance in stored product insects of Oklahoma.** *Charles Konemann (charles.e.konemann@okstate.edu), George Opit and James Danso, Oklahoma State Univ., Stillwater, OK*

Plant-Insect Ecosystems Symposium: Integrated Pest Management of Arthropod Pests in Large Scale Agroecosystems

Crystal Room (Skirvin Hilton)

Moderators and Organizers: Ashleigh Faris, Texas A&M Univ., College Station, TX; Gary Hein, and Michael Brewer, Texas A&M AgriLife Research, Corpus Christi, TX

9:00 AM **Welcoming remarks**

9:05 AM **233** **Ecology of aphid parasitoids in winter wheat habitats of the Southern Plains: How latitude and crop diversity influence pest management.** *Kristopher Giles (kris.giles@okstate.edu)[1], Norman Elliott[2] and Haley Butler[1], [1]Oklahoma State Univ., Stillwater, OK, [2]USDA - ARS, Stillwater, OK*

9:35 AM **234** **Spatial interactions of the mite-virus complex in winter wheat.** *Gary Hein (ghein1@unl.edu)[1], Elliot Knoell[1], Anthony McMechan[1], Lindsay Overmyer[1] and Abby R. Stilwell[2], [1]Univ. of Nebraska, Lincoln, NE, [2]USDA - APHIS - PPQ, Raleigh, NC*

9:55 AM **235** **Soybean gall midge: Understanding a new and emerging pest of soybean.** *Anthony McMechan (justin.mcmechan@unl.edu)[1], Erin Hodgson[2], Bruce Potter[3], Adam Varenhorst[4], Thomas Hunt[5] and Robert Wright[6], [1]Univ. of Nebraska-Lincoln, Ithaca, NE, [2]Iowa State Univ., Ames, IA, [3]Univ. of Minnesota, Lamberton, MN, [4]South Dakota State Univ., Brookings, SD, [5]Univ. of Nebraska, Concord, NE, [6]Univ. of Nebraska, Lincoln, NE*

10:15 AM **Break**

10:25 AM **236** **Caterpillars on corn in northern Mexico: Species, natural enemies and biocontrol tests with entomopathogens.** *Sergio Sánchez-Peña (sanchezcheco@gmail.com)[1], Renato Villegas-Luján[1], Oscar E. Rosales-Escobar[2], Fernando Sanchez-Pedraza[1], Paulina Vega-Aquino[3], Patricia Espericueta-Medina[4], Gabriel Gallegos-Morales[1], Jose Rodriguez-Contreras[5] and Celso Morales-Reyes[2], [1]Universidad Autónoma Agraria Antonio Narro, Saltillo, CU, Mexico, [2]Universidad Autónoma Agraria Antonio Narro, Saltillo, Mexico, [3]Dupont Pioneer, Los Mochis, Mexico, [4]Universidad Autonoma Agraria Antonio Narro, Saltillo, Coahuila, Mexico, [5]Koppert, Saltillo, Mexico*

10:55 AM **237** **Cereal aphids and yellow dwarf viruses with movement among small grains and corn.** *Louis Hesler (louis.hesler@usda.gov)[1], Marie A. C. Langham[2], Walter Riedell[1] and Shannon Osborne[1], [1]USDA-ARS, North Central Agricultural Research Laboratory, Brookings, SD, [2]South Dakota State Univ., Brookings, SD*

11:15 AM **Break**

11:20 AM **238** **Geographic patterns of sugarcane aphid infestation risk in Oklahoma and varietal selection guidelines for grain sorghum producers.** *Norman Elliott (norman.elliott@ars.usda.gov)[1], Kristopher Giles[2], Tom Royer[2] and J. Scott Armstrong[1], [1]USDA - ARS, Stillwater, OK, [2]Oklahoma State Univ., Stillwater, OK*

11:40 AM **239** **Natural enemy regulation of the sugarcane aphid in the southern U.S. Great Plains: Who are the key regulatory agents and where are they?** *Ashleigh Faris (ashleigh.faris@ag.tamu.edu)[1], Blake Elkins[2], James Woolley[1] and Michael Brewer[3], [1]Texas A&M Univ., College Station, TX, [2]USDA - ARS, Stoneville, MS, [3]Texas A&M AgriLife Research, Corpus Christi, TX*

12:00 PM **Concluding remarks**

This symposium is supported by a grant from the Plant-Insect Ecosystems Section of the ESA. P-IE encompasses crop protection, host-plant responses, plant pathology/vectors, pollination, biological and microbial control, microbial control, and many other areas of study. To learn more about the interesting activities of P-IE, visit https://www.entsoc.org/pie.

Highlights of Successful Entomology Research and Education at Small Colleges and Universities

Centennial 3 (Skirvin Hilton)

Organizers: Ryan Caesar, Schreiner Univ., Kerrville, TX and Loriann Garcia, Austin College, Sherman, TX

9:00 AM **240** **Infusing entomology across the undergraduate biology curriculum.** *Loriann Garcia (lgarcia@austincollege.edu), Austin College, Sherman, TX*

9:20 AM **241** **A growing interest: Cultivating experiences in entomology using urban agriculture.** *Warren Sconiers (wsconiers@ozarks.edu), Univ. of the Ozarks, Clarksville, AR*

9:40 AM **242** **Establishing a research program at a small teaching university through opportunistic external collaborations.** *Ryan Caesar (rmcaesar@schreiner.edu), Schreiner Univ., Kerrville, TX*

10:00 AM **243** **Approachable entomology at an HBCU: Incorporating arthropod lessons in undergraduate urban agriculture courses.** *Tracey L. Payton (tlpayton@langston.edu), Langston Univ., Stillwater, OK*

10:20 AM **Break**

10:35 AM **244** **Research and education at a rural four-year comprehensive university: Mistakes, successes, and lessons learned.** *Kenwyn Cradock (Kenwyn.Cradock@enmu.edu), Eastern New Mexico Univ., Portales, NM*

10:55 AM **245** **Damselfly population genetics as a cure for general biology students at a small university.** *Ryan Caesar (rmcaesar@schreiner.edu), Schreiner Univ., Kerrville, TX*

11:15 AM **246** **Course-based research in insect behavior: Pedagogical best-practices, case studies, and publishing with undergraduate collaborators.** *Carrie Hall (carrie.hall@unh.edu) and Daniel Howard, Univ. of New Hampshire, Durham, NH*

11:35 AM **247** **Introducing JEEO: Journal of Entomology Education.** *Loriann Garcia (lgarcia@austincollege.edu), Austin College, Sherman, TX*

11:55 AM **Panel Discussion**

Notes

Abstracts

Student Ten-Minute Paper Competition

Student Ten Minute Paper Competition: Undergrad - MUVE, P-IE, & SysEB

1. **Toxicity effects of formic acid on the lone star tick**

Bailee Dorsey (BNDors5434@schreiner.edu)[1], Allan T. Showler[2] and Ryan Caesar[1], [1]Schreiner Univ., Kerrville, TX, [2]USDA - ARS, Kerrville, TX

Bovine babesiosis (cattle fever) is spread by the ixodid tick *Rhipicephalus microplus*. Despite being locally eradicated for decades from Texas, *R. microplus* remains entrenched along a corridor of south Texas bordering Mexico and has recently been found beyond the quarantine zone. As such, babesiosis remains a potential threat to the Texas cattle industry. In addition to conventional pesticides and biotechnology-based solutions, chemically-inert and environmentally-safe methods to control tick populations are under investigation. We examined the potential repellency and lethality of formic acid on juvenile *Amblyomma americanum* (lone star tick), a three-host ixodid. While formic acid failed to repel ticks, it is strongly lethal when applied as a fumigant or by direct contact. Overall, larvae killed at a quicker and higher mortality rate than the nymphs. We demonstrate the potential for formic acid as an acaricide or acaricide component ingredient.

2. **The effect of nicotine and cotinine on survival and duration of development of *Cochliomyia macellaria* (Fabricius) (Diptera:Calliphoridae)**

Zoe Narvaez (znarvaez@ou.edu), Gautham Gautham, Heather Ketchum and Eric Bright, Univ. of Oklahoma, Norman, OK

Nicotine poses a lethal threat as it is easily accessible and highly toxic in its liquid form. Nicotine is metabolized into cotinine in as little as 20 minutes in the plasma and has 10-times longer terminal half-life than nicotine. With the growing prevalence of nicotine-related deaths comes the increased possibility of finding nicotine or cotinine in the tissues of a corpse, which can distort postmortem interval (PMI) estimates. Through entomotoxicology, the study of how drugs and toxins influence the development of insects present on a decomposing body, this study aimed to determine if varying concentrations of nicotine and cotinine affected the growth rate and survival of the forensically important *Cochliomyia macellaria* (Fabricius) [Diptera: Calliphoridae], secondary screwworm. In this study, *C. macellaria* maggots were reared on three different concentrations - 25% (QD), 50% (HD), and 100% (LD) of the lethal dose of nicotine. Knowing 75% of metabolized nicotine is cotinine, we used 75% of the lethal nicotine to calculate the QD, HD, and LD concentrations of cotinine. The results demonstrate significant differences in survival between the untreated and treated liver in the nicotine trial but not in the cotinine trial. Except for duration of the third instar in the cotinine reared maggots, there were no differences among the duration of each instar for nicotine or cotinine reared maggots. There were no differences in adult eclosion (male, female, nor total) between the maggots reared on the untreated and treated liver in both the cotinine and nicotine trials.

3. **Evaluating and comparing techniques used to assess horn fly susceptibility to permethrin and abamectin**

Halee Fincher (fincherh@nmsu.edu) and Brandon Smythe, New Mexico State Univ., Las Cruces, NM

Horn flies (*Haemtobia irritans*) pose a constant risk to profitable cattle production. The horn fly is an obligate blood feeder, that lives most of it its life on range land cattle. Annual production losses associated with horn flies is estimated to be in excess of $1 billion. In order to mitigate production losses due to horn fly infestation, identification of insecticidal resistance can lead to more informed managerial interventions. Field based biological assays have been utilized to rapidly identify insecticidal resistance in field populations. However, inconsistencies in procedures employed for these assays may compromise inferences across assessments. Therefore, the objective of this study was to compare common insecticidal assessment assays using different delivery methods across and within multiple horn fly strains exposed to permethrin and abamectin insecticides. Preliminary results indicate that permethrin tolerant horn fly strains are 70 and 4 times less tolerant to permethrin and abamectin, respectively, when the compounds are delivered on a glass substrate in comparison to filter paper. Further research is required to standardize procedures when assessing horn fly susceptibility profiles to various insecticidal compounds.

4. The lethal effects of CimeXa and Drione on *Amblyomma americanum* (lone star tick) populations

Allan Showler[1], Ryan Caesar[2] and **Abigail Garcia** (argarcia098@gmail.com)[3], [1]USDA - ARS, Kerrville, TX, [2]Schreiner Univ., Kerrville, TX, [3]Student, Kerrville, TX

Amblyomma americanum (lone star tick) is the most commonly reported tick to bite humans in the southern United States, and transmits diseases such as ehrlichiosis, tularemia, and protozoan infections. Control methods include the use of conventional pesticides directly applied to pets, livestock and wild game. While effective, these methods can contribute to pesticide resistance and may harm non-targeted arthropod species. The use of inert non-toxic methods can avoid causing pesticide resistance and harm towards non-targeted species. CimeXa is a non-toxic insecticidal dust used to control tick populations and has previously been used to control bed bugs; it is composed of silica gel particles. Drione is a mixture of CimeXa and synthesized natural pyrethrum, an organic toxin that negatively affects the nervous system of arthropods. In this study CimeXa was compared to Drione when applied in multiple forms to juvenile lone star ticks in the laboratory. The aim of this research is to observe and compare the effects of these two substances on controlling tick populations and their effects on non-targeted insects.

5. Assessing horn fly (Diptera: Muscidae) susceptibility to permethrin under different levels of induced starvation

Jovy Ramirez (zerimarj@nmsu.edu) and Brandon Smythe, New Mexico State Univ., Las Cruces, NM

The use of push-pull strategies for horn fly control may provide alternative approaches to combat on-going issues with insecticidal control methods. Although the current push-pull model assumes that pest species can be deterred (pushed) into a state of attraction (pull), the consequences related on the transition period between the two stimuli have yet been thoroughly examined. Horn flies require multiple blood meals throughout the day as they are obligate hematophagous pests of rangeland cattle. Extended transition times in which horn flies must relocate to find a suitable host may induce moderate states of starvation and corresponding energy depletion of the fly. Therefore, the objective of the current study is to evaluate the effects of starvation on the horn fly susceptibility to permethrin using filter paper bioassays. Lethal dose estimates were established for colonized horn flies fed throughout the assay or starved for 4, 8, and 12 hours prior to initiation of the assays. Mortality responses and lethal dose estimates were compared at each level of starvation. Blood fed flies were 1.18, 1.89, and 3.12 times more tolerant to permethrin than horn flies starved for 4, 8, and 12 hours, respectively. Incorporating transition state factors into current push-pull models may lead to reduced insecticide use and more comprehensive integrated pest management programs aimed at controlling the horn fly.

6. Honey bee (*Apis mellifera*) macronutrient regulation: Nurse bee nutritional preferences for proteins and lipids

Cora Garcia (coragarcia1999@gmail.com), Pierre Lau, Alexandria Payne, Jordan Gomez, Pierre Lesne, Spence Behmer and Juliana Rangel, Texas A&M Univ., College Station, TX

Poor nutrition has been linked to declining honey bee populations, as it makes bees more susceptible to pathogens and lowers their survival and productivity. Given the growing prevalence of changing landscapes, resource availability has presented challenges to honey bees trying to acquire the resources necessary for adequate nutrition. Thus, commercial pollen substitutes are available for beekeepers to support colony health. Although the importance of nutrition in colony health is emphasized, research regarding specific macronutrient requirements of honey bees is limited. The necessity of protein to honey bee diets is well known, as it is required for rearing brood. Nurse bees consume protein-rich bee bread, a combination of pollen and nectar or honey to develop their glands for brood rearing. However, lipids are often overlooked in the bee diet. By creating a range of artificial diets that differed in macronutrient ratios of protein (P) and lipid (L), our research objective sought to determine a target macronutrient intake for nurse bees. Through a series of choice and no-choice assays, daily consumption was measured. In the no-choice test honey bees consumed the most of the 30:20 (%P:%L) diet. For the choice test, honey bees regulated their diet intake to an average of 1.4 P:L. Thus, the significant differences in this observed ratio to the macronutrient composition of pollen substitutes suggests the value of lipids may be underestimated in honey bee nutrition.

7. Improving inclinations around insects through imagination and ingenuity

Morgan Partin-Topper (morpart@ostatemail.okstate.edu), Andrine A. Shufran and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK

The Insect Adventure is a petting zoo utilizing live arthropods that is open two Saturdays of each month to the general public. At public open hours, patrons come into the zoo and interact with live arthropods as well as participate in activities using live insects and art projects. The desired outcome at the Insect Adventure is when guests visit, their negative preconceived notions about arthropods shifts from being fear-based to positive and interested. To achieve these goals, methods were implemented including changing the room's layout and supervising volunteers to create a welcoming and inviting atmosphere, using insect costumes to excite guests, and providing art activities to keep guests engaged for longer periods of time. Guests are staying much longer compared to previous years, often thanking us for educating them and changing their opinion on entomology as they leave. The guests leaving with more long-term positive feelings surrounding insects will share these experiences, allowing positive conversation about entomology, science, and nature to spread through the general public. The more the general public understands and appreciates entomology, the better for entomology and the environment as the new awareness and consciousness the public has will lead to more conservation efforts and stigma collapse.

8. Comparison of male and female probing activities of the planthopper, *Peregrinus maidis*

Alexis Coles (alexis.coles@okstate.edu) and Astri Wayadande, Oklahoma State Univ., Stillwater, OK

Female planthoppers have been electronically recorded for the study of feeding behaviors and transmission of plant pathogens. There have been no studies conducted to look at the male planthopper probing behavior and their ability to transmit plant pathogens. In this study, we looked at the probing behavior of male *Peregrines maidis* planthoppers to see if it was the same as that of female planthoppers. We used an electrical penetration graph (EPG) system to record and measure several probing behavior parameters, including probe number, probe duration, time to first probe, time to first ingestion, and total probing duration. Overall, the appearance of the waveforms was identical between the two genders. Analysis suggested that males probed in a manner similar to females. The conclusion for this study was the male planthoppers had a similar feeding strategy as that of the female planthoppers, suggesting that males may exhibit similar ability to transmit plant viruses.

9. Using social media to promote entomology

Bailee Posey (baposey@ostatemail.okstate.edu), W. Wyatt Hoback and Andrine A. Shufran, Oklahoma State Univ., Stillwater, OK

Entomology as a discipline has suffered as the general public has lost understanding of the impacts insects have on human health, food security, and ecosystem services. Oklahoma State University's Insect Adventure (OSUIA) is an entomology educational program utilizing live arthropods to increase insect literacy. The OSUIA interacts with hundreds of thousands of people, annually via school visits, fairs, expos, and many other events. Prior to September 2019, the OSUIA had little active online footprint. The goal of this research is to promote the awareness of entomology to non-entomologists through social media and discover if this method of insect education can generate a greater public understanding of arthropods. As entomologists, we are aware of how insects have a diverse impact on the environment from crops to clothing and beyond. Despite our knowledge, the bigger picture is how well the public understands this importance which may then lead to an increased interest in entomology. The OSUIA's online appearance and communication with the public has been expanded by sharing local events as well as posting insect facts, information about zoo tours, and articles on multiple media platforms (Facebook, Twitter) for followers. In addition, the OSUIA is also in the process of updating record keeping from paper records to online drives to increase organization. Following these expansions at the OSUIA, the hopeful outcome will be an increase in monetary support for the OSUIA and insect collections.

Student Ten Minute Paper Competition: Master's - PBT, SysEB, & MUVE

10. Identifying small RNAs of exosomes isolated from a *Diabrotica* cell line

Kyah Featherston (kyahf@ksu.edu)[1], Yoonseong Park[2], Kun Yan Zhu[1] and Kristopher Silver[1], [1]Kansas State Univ., Manhattan, KS, [2]Dept. of Entomology/Kansas State Univ., Manhattan, KS

Exosomes are nanoscale extracellular vesicles produced from cellular multi-vesicular bodies. Recently, they have shown promise as an important area of biomedical research. Exosomes play roles in intracellular communication and may contribute significantly to development and immunity. Depending on the tissue of origin, they can carry specific protein and nucleic acid cargoes that can have profound effects on gene expression patterns and physiology of target cells. Most research to date has focused on the roles of exosomes in mammalian systems and their potential as diagnostic markers or even delivery vehicles for therapeutic purposes. In contrast, very little is known about insect exosomes. In an effort to enhance our understanding of insect exosomes, we have isolated and sequenced small RNAs from a cultured cell line from *Diabrotica undecimpunctata* (SCR) as well as exosomes isolated from this cell line. RNAseq analysis revealed that the SCR cell line expresses a variety of small RNAs with similarity to those previously identified in *Tribolium castaneum*. Only a subset of these small RNAs, however, were detected in exosome preparations, and these ranged in size from 17 to 50 nucleotides in length. By identifying and characterizing small RNAs produced by the SCR cell line and the exosomes they produce, we are learning not only about the specific messages that exosome carry between cells, but also their overall role in intercellular communication.

11. Spotted-wing drosophila (*Drosophila suzukii* Matsumura) cold tolerance physiology and population genetics

Samuel DeGrey (degrey@wisc.edu), Christelle Guédot and Sean Schoville, Univ. of Wisconsin, Madison, WI

Drosophila suzukii has become one of the most well-known pests of soft fruit crops in temperate areas around the world. In order to understand the potential of this pest to expand to new regions, it is important to learn more about the basic aspects of its biology. In particular, the ability of an insect to deal with cold temperatures is often a highly important limiting factor in their distribution. To better understand the invasion biology of *D. suzukii*, we drew comparisons in cold tolerance physiology between populations living in recently invaded cold and warm regions (Wisconsin and California) of North America. A variety of commonly used cold tolerance parameters including critical thermal minimum and chill coma recover time were assessed. These tests revealed little difference in cold tolerance ability between populations. In addition, pooled sequencing was done on populations of flies from Wisconsin, California, British Columbia, Japan, and Europe in order to detect genomic signals of cold adaptation. Our work provides a basic framework for assessing adaptive trends of cold tolerance in the worldwide invasive fly *D. suzukii*.

13. A field deployable Rapid *Anaplasma* Detection (RAD) kit for screening three *Anaplasma* species infecting livestock

Andrea Salazar (andrsa@okstate.edu), Francisco Ochoa-Corona, Justin Talley and Bruce Noden, Oklahoma State Univ., Stillwater, OK

Cattle production is worth $50 billion in the United States. An important tick-borne disease affecting U.S. cattle is bovine anaplasmosis, costing around $300 million per year. Caused by the bacteria, *Anaplasma marginale,* Anaplasmosis spreads via ticks, flies or contaminated veterinary equipment. Worldwide, three *Anaplasma* species affect cattle (*A. marginale*), sheep and goats (*A. ovis*), and a broad host range including humans (*A. phagocytophilum*). Currently, *Anaplasma* detection in cattle uses a USDA-approved cELISA, a serologic test that targets the highly conserved *Anaplasma msp5* gene but does not distinguish among species. PCR or ELISA analyses are not suitable for field screening due to expensive laboratory equipment and trained personnel. A specific, sensitive, easy-to-use, and rapid detection method is needed to improve the accuracy of *Anaplasma* diagnosis. To address this need, three recombinase polymerase amplification (RPA) primers were designed using consensus sequences of *A. marginale, A. ovis,* and *A. phagocytophilum*. To develop the RAD kit, an elution independent collection device (EICD) was used to collect nucleic acids and pathogens from animal blood. A 20-minute RPA detection assay was developed at 37°C and a detection limit was 0.1pg/µl for *A. marginale*, 1pg/µl for *A. ovis* and 1fg/µl for *A. phagocytophilum*. Finally, RPA results were observed using either electrophoresis or lateral flow strips. Resulting assays, which included *Anaplasma*-free tick DNA and non-template controls, demonstrated no cross-reactions between the *Anaplasma* species. The RAD kit prototype will be practical for low-cost field use as well as a point-of-care diagnostic to discriminate among the three main *Anaplasma* species.

14. The timing of winter survival in *Culex pipiens* mosquitoes

Caitlin Peffers (peffers.2@buckeyemail.osu.edu) and Megan Meuti, The Ohio State Univ., Columbus, OH

The Northern house mosquito, *Culex pipiens*, is the major vector of West Nile Virus. In order to survive harsh conditions in winter, adult females of *Cx. pipiens* enter a state of arrested reproductive development called diapause. Diapause is a photoperiodic response triggered by the short daylengths of late summer and early fall. Females in diapause will seek out protected refuges, stop blood feeding, and will have smaller egg follicles leading to a halt in reproduction. Understanding the ecology of mosquito diapause is highly important for mosquito control because diapausing females don't bite and therefore do not transmit diseases. The photoperiod where 50% of a population enters diapause is known as the critical photoperiod (CPP). The CPP can vary based on location, and usually increases with latitude. In this study, we determined the CPP of females of *Cx. pipiens* from 3 populations: Lansing, MI (42.7°N); Columbus, OH (40°N); and Lexington, KY (38°N). Mosquitoes from each population were exposed to one of 7 photoperiods ranging from 8 to 16 hours of light per day throughout their development, and one week after adult emergence we assessed the diapause status of 20 females per population by measuring the size of their egg follicles. Preliminary data indicate that the CPP of the Lexington population is 13.25 hours of light, which corresponds to August 21st. The results of this research may improve existing control efforts by allowing us to better target insecticide sprays, and thereby reduce mosquito populations and disease transmission in future seasons.

15. Artificial Light at Night (ALAN) induces abnormal seasonal responses in *Culex pipiens* mosquitoes

Lydia Fyie (fyie.1@osu.edu), Mary Gardiner and Megan Meuti, The Ohio State Univ., Columbus, OH

Cities experience a wide range of environmental impacts, one of which is light pollution caused by artificial light at night (ALAN). ALAN has been shown to impact insect physiology, behavior, and ecology, but the effects on seasonal responses have not been extensively investigated. The West Nile virus vector, *Culex pipiens*, is abundant in cities. Female mosquitoes enter a state of developmental arrest, or reproductive diapause, when exposed to short days in order to survive the winter. While in diapause females halt reproductive development and do not engage in host seeking behaviors, and instead increase fat reserves. In contrast, long days inhibit females from entering diapause and stimulate reproductive development and bloodfeeding. The goal of this study is to determine if ALAN interferes with mosquito perception of day length, thus altering the timing of diapause initiation; we hypothesize that mosquitoes exposed to environmentally-relevant levels of ALAN will be less likely to enter diapause and more likely to bite than those that are not exposed to ALAN. We tested this hypothesis by rearing mosquitoes in diapause-inducing short day conditions with either dim ALAN or no added ALAN. Under both conditions, we measured three markers of diapause: egg follicle size, fat content, and propensity to bloodfeed. ALAN-exposed females exhibited increased egg follicle size, decreased fat content, and were more likely to bloodfeed, suggesting that some females averted diapause. These results indicate that city residents may be at risk of mosquito bites and disease transmission for longer than their rural counterparts.

Student Ten Minute Paper Competition: Master's - P-IE Session I

16. Assessing asparagus beetle overwintering habitats and survival in an agroecosystem

Jennifer Zavalnitskaya (zavalnit@msu.edu) and Zsofia Szendrei, Michigan State Univ., East Lansing, MI

Asparagus beetles *(Crioceris asparagi,* Coleoptera: Chrysomelidae*)* are one of the key pests of asparagus in Michigan. Although this specialist insect can cause significant economic losses for the asparagus industry, few studies have been conducted to understand their overwintering biology. Growers have observed beetle populations overwintering within and surrounding asparagus fields in decaying asparagus stalks and under tree bark. In this study, our goal was to characterize five different types of substrates used for overwintering and compare the level of thermodynamic insulation provided to beetles. Overwintering cages were constructed with five substrates commonly found within and surrounding asparagus fields. Ten adult asparagus beetles were placed into each cage and allowed to overwinter under natural conditions. Half of the cages were deconstructed in the middle of the winter, while the other half remained intact until beetle emergence. We measured the temperature inside cages throughout the winter with data loggers. We hypothesize that beetle mortality will decrease with more thermodynamically insulating substrates. Results of this study will help us better understand where beetles are overwintering and what habitat types throughout the agroecosystem contribute to pest pressure in asparagus fields. Implications of this research will allow us to develop sustainable pest management strategies for the asparagus industry.

17. Does the creation of pocket prairies improve the conservation value of urban vacant land for ant communities?

Alex Tyrpak (tyrpak.3@buckeyemail.osu.edu), Kayla I. Perry, Joe Raczkowski, Christopher Riley and Mary Gardiner, The Ohio State Univ., Columbus, OH

Shrinking cities such as Cleveland, OH, have experienced population loss, resulting in an overabundance of infrastructure that is demolished, creating vacant land. Vacant land is viewed as a blight but these greenspaces may have the potential to promote biodiversity and ecosystem services. Nevertheless, urban soil quality has been shaped by decades of heavy metal pollution, which could limit the conservation value of vacant land. Our aim was to determine if creating "pocket prairies" consisting of native wildflowers on vacant lots promoted ant species richness. We chose ants because of their ecological value as biological indicators. We compared pocket prairie ant communities with those in vacant lots and Metroparks. Vacant lots consisted of early successional weedy vegetation representing current inner-city land management practices. Metroparks are suburban preserves of second-growth forest and viewed as the principal urban conservation habitat for the greater Cleveland area. We hypothesized that establishing pocket prairies would promote species richness, but that Metroparks would be a superior habitat for ants. Further we predicted that soil contamination would be negatively associated with ant richness across habitats. We collected ants monthly (June – August 2018) using pitfall traps. Our data did not support our initial hypothesis, as species richness was equivalent within vacant lots and pocket prairies and reduced within Metroparks. Surprisingly, we did not observe a significant relationship between soil lead (Pb) contamination and ant species richness. Our results indicate that urban vacant land is highly suitable for several ant species, which can persist in soils with high Pb contamination.

18. On the move: Attract-and-kill tactic for Japanese beetles (Coleoptera: Scarabaeidae)

Kelsey Benthall (kjbhnd@mail.missouri.edu) and Kevin Rice, Univ. of Missouri, Columbia, MO

Japanese beetles *(Popillia japonica* Newman) were unintentionally introduced to the United States and are currently established in 28 states. Adult beetles feed on over 300 host plant species including wild shrubs, hardwoods, and several agricultural commodities including fruits, vegetables, and field crops, often resulting in severe economic damage. To manage this pest species, growers have increased foliar insecticidal applications that have non-target effects on pollinators and natural enemies. We designed an attract-and-kill strategy for Japanese beetles using insecticidal nets in field crops. Attract-and-kill treatments consisted of soybean fields with 76 m of insecticidal net placed along a single field border and baited with Japanese beetle lures (consisting of pheromone and floral

attractants). Control treatments consisted of insecticidal sprays based on current grower standards. We quantified defoliation, pollinator, natural enemy, and Japanese beetle abundance between treatments. Compared with grower standards, attract-and-kill treatments provided equal protection against defoliation and reduced seed damage due to preserving populations of natural enemies.

19. Effects of fungus volatiles on the consumption and growth of tobacco hornworms (*Manduca sexta*)

Alyssa Lucas (alyssa.l.lucas@gmail.com) and Kevin Rice, Univ. of Missouri, Columbia, MO

Plant defense theory predicts that tradeoffs occur among resource allocations for growth, reproduction and defense. Fast growing plants typically invest less in defensive compounds compared with slow growing plants. However, plants can adjust resource allocations based on environmental cues, including volatile organic compounds. Numerous studies have observed increased secondary metabolite production and/or defensive priming when plants detect volatile cues from herbivores. We discovered volatiles from the fungus *Cladosporium sphaerospermum* (strain TC09) stimulate tobacco plant growth, increasing plant bioamass by 124 fold. We predicted 1) faster growing tobacco plants would have reduced defensive alkaloids, and 2) herbivores feeding on fast growing plants would experience higher growth rates. We compare the growth of tobacco hornworm larvae consuming tobacco plants in the presence of fungus volatiles (fast growing plants) with larvae feeding on control plants (no fungus volatiles), and quantify foliar alkaloid concentrations. Plants exposed to fungus volatiles had reduced foliar alkaloid concentrations. Larvae grew faster on plants exposed to fungus volatiles and experienced increased digestion efficiency compared with larvae feeding on control plants.

20. Are females better listeners? Interactions between herbivore bioacoustics and chemical defenses in dioecious plants

Layne Leake (lblc8c@mail.missouri.edu)[1], Reginald Cocroft[1], Eric Yip[2], John Tooker[2], Sabrina Michael[1] and Kevin Rice[1], [1]Univ. of Missouri, Columbia, MO, [2]Pennsylvania State Univ., Univ. Park, PA

Chemical defense theory predicts tradeoffs occur between plant growth, defense, and reproduction. Female plants typically invest more resources towards defense than males. Many plants species increase allocations towards defensive chemicals after detecting the presence of herbivores. Plants can detect herbivore saliva, frass, footsteps and herbivore induced plant volatiles. Additionally, plants can detect and respond to acoustic vibrations produced by feeding insects. We recorded the vibrational signals of red admiral butterfly larvae consuming stinging nettle. Then used linear resonant actuators to playback the recorded vibrations to male and female plants, and analyzed their subsequent chemical defense responses.

21. Temporal changes in olfactory cues from plant roots influence foraging by entomopathogenic nematodes

John Grunseich (johngrunseich@tamu.edu) and Anjel Helms, Texas A&M Univ., College Station, TX

It has been well documented that herbivory triggers the production of herbivore-induced plant volatiles (HIPVs), which can protect plants directly by repelling herbivores, as well as indirectly by recruiting natural enemies that kill herbivores. However, our understanding of root-produced HIPVs and their ecological functions in soil environments remains more limited. In this study, we characterized the HIPVs produced by roots of cucumber plants (*Cucumis sativus*) in response to different durations of herbivory by striped cucumber beetle larvae (*Acalymma vittatum*). Furthermore, we investigated the role of *C. sativus* root HIPVs in mediating foraging decisions by entomopathogenic nematodes (EPNs, *Heterohabditis bacteriophora*). Our findings revealed that feeding damage by *A. vittatum* larvae on *C. sativus* for 24 hours induced a characteristic blend of root HIPVs that was different from undamaged control roots and was more attractive to EPNs. However, after 8 days of continuous herbivory by *A. vittatum* larvae, *C. sativus* root HIPVs were not different from the volatiles emitted by undamaged control roots. EPNs did not discriminate between olfactory cues from roots of undamaged control plants and roots damaged by *A. vittatum* larvae for 8 days. Our results indicate that HIPVs from *C. sativus* roots initially serve as indirect defenses against *A. vittatum* larvae by recruiting EPNs. However, production of root HIPVs changes over the course of herbivory and is eventually suppressed by *A. vittatum* larvae.

22. New host plant identified for wheat stem maggot

Julia Campos (julia.nog.campos@gmail.com)[1], Anthony McMechan[2] and Robert Wright[1], [1]Univ. of Nebraska, Lincoln, NE, [2]Univ. of Nebraska-Lincoln, Ithaca, NE

Wheat stem maggot *Meromyza americana* Fitch (Diptera: Chloropidae) (WSM) is a pest of wheat and other grasses. In 2017, WSM was found causing injury to corn fields in Nebraska that had wheat or rye as a cover crop that were established in the fall the previous year. One alternative method of control for this pest is crop rotation. However, since many grasses can be a host for WSM, it is important to identify which species are a suitable host. Field surveys in 2017 showed no evidence of injury to corn fields when triticale (*x Triticosecale* Wittmack) was used as a cover crop. The

object of this study was to determine if triticale is a suitable host for WSM. A no-choice experiment was conducted in the greenhouse using adult WSM from a colony maintained with wheat since 2017. A total of 10 pots with 15 plants each of triticale or wheat were each infested with six adults at Zadoks 1.2 or 1.3 stage of development. Adult emergence numbers and timings were collected. Results found that adult emergence occurred from triticale indicating that it is a suitable host for WSM. However, emergence from triticale was delayed an average of six days when compared to wheat. The identification of triticale as a suitable host raises concern about the risk of triticale as source for WSM in cover crop to corn systems. Further studies on the biology and ecology of WSM on triticale will be needed to better understand its risk and management.

23. Egg-laying monarchs do not discriminate oviposition based on the presence of a neonicotinoid insecticide

Alex Mullins (mullinsan8@gmail.com), Iowa State Univ., Ames, IA

Monarch butterfly (*Danaus plexippus*) populations have declined precipitously over the last two decades, attributable in part to declines in its larval host plant, milkweed (*Asclepias*), across the monarch's breeding range. Conservation efforts call for restoration of 1.3 billion milkweed stems into the Midwestern landscape. To reach this goal, habitat establishment in marginal croplands is required and the proximity of such habitat to crops presents potential exposure to agrochemicals. Corn and soybean seeds are frequently treated with neonicotinoid insecticides that provide systemic protection against insect pests. Foliar treatments with neonicotinoids are also used in some cropping systems. Here, we investigate whether ovipositing monarchs discriminate against milkweed plants exposed systemically or through topical leaf application, to the neonicitinoid insecticide Imidacloprid. In our first experiment, we placed gravid females in enclosures containing a choice of two cut stems for oviposition: one in 15mL, 0.5mg/mL aqueous solution of imidacloprid and one in 15mL water. In a second experiment, we placed gravid females in the same enclosures with a choice of milkweed plants treated with surface applications of 30µL of 0.825mg/mL imidacloprid-surfactant solution or control plants treated with surfactant only. To evaluate oviposition preference, eggs were counted and removed daily from each plant over three days. Results indicate that the presence of imidacloprid did not influence oviposition in female monarchs. This suggests that female oviposition preference is not affected by imidacloprid-exposed milkweed. The significance of these findings on monarch population response will be informed by the results of ongoing egg and larval toxicity studies.

24. Improving trap design and placement for overwintering *Drosophila suzukii*

Ariana Hernandez (herna403@msu.edu), Juan Huang, Larry Gut and Matthew Grieshop, Michigan State Univ., East Lansing, MI

Monitoring traps have become essential tools for growers and researchers to estimate population levels of *Drosophila suzukii.* Trap design and placement of these monitoring traps are of extreme concern to obtain maximum yields. The standard deli cup trap design has been used for both summer and winter morphotypes of *D. suzukii,* without literature supporting that the trap was optimized for both morphotypes. Although, with winter morphotype taking refuge under the leaf litter, a ground trap may be more suited for overwinter trapping. To compare two trap types, the standard cup trap and a dome trap were compared in laboratory and field settings. Our laboratory experiment showed that regardless of trap design, the placement of the trap was the determining factor for the number of winter morphotypes captured; furthermore, if a trap was placed on the ground it was six times more likely to capture winter morphotypes than an aerial trap. In the field, the aerial cup trap was the favored trap for wild *D. suzukii* summer morphotypes, similar to laboratory findings. Overall, the morphotype of *D. suzukii* that are being targeted should be the determining factor for where traps should be placed to have accurate estimates of population levels.

25. Using high throughput sequencing to link cotton fleahopper gut content to host plants

Kristin Hamons (kritlee@tamu.edu)[1], Lindsey Perkin[2], Charles Suh[2] and Gregory Sword[1], [1]Texas A&M Univ., College Station, TX, [2]USDA - ARS, College Station, TX

The cotton fleahopper, *Pseudatomoscelis seriatus* (Reuter), is an early season cotton pest whose feeding can result in square abortion, irregular plant growth, and delayed maturity. This Texas native generalist has been documented feeding on over 160 host plants across 35 families. For the most part, identification of these host plants was accomplished through field observation and/or controlled feeding studies under lab conditions. As an opportunistic or obligatory feeder, these results may not be an accurate representation of the cotton fleahopper diet. Previous studies have demonstrated that it is possible to identify plant families by analyzing plant DNA found in the insect gut. In these studies, DNA was extracted from the gut of large chewing insects or whole small-bodied, sponging-feeding insects. We present a proof-of-concept that this technique works in the cotton fleahopper, a small piercing-sucking insect. This new method may produce a more definitive list of host plants used by the cotton fleahopper and prove useful for identifying hosts plants used by other piercing-sucking pests.

Student Ten Minute Paper Competition: Master's - P-IE- Session II

26. Assessment of plastic mulches for managing spotted-wing drosophila, fruit quality and yield, and soil health in raspberry

Hanna McIntosh (hrmcintosh@wisc.edu), Amaya Atucha, Beth Ann Workmaster and Christelle Guédot, Univ. of Wisconsin, Madison, WI

Berry and soft-skinned fruit production worldwide are experiencing substantial damage from the invasive spotted-wing drosophila (*Drosophila suzukii,* SWD). Management relies primarily on chemical control, which is not adequate to control the pest and is not economically or environmentally sustainable. We tested metallic polyethylene, white biodegradable, and black biodegradable mulches to assess their impact on SWD, as well as on important horticultural factors. We found fewer adult flies in the canopy above mulched plots compared to controls, suggesting that mulches repel adult flies. Fruit infestation in the canopy was also lower in mulched plots compared to controls. Finally, all larvae placed directly on mulches died within 1 hour on black mulch and within 3 hours on white and metallic mulches. Data analysis is ongoing to characterize how mulches change abiotic factors in the canopy (temperature, relative humidity, and light intensity) and to determine the impacts of mulches on fruit quality, estimated yield, plant establishment, and soil health. Overall, plastic and biodegradable mulches seem to be a promising cultural control tool for managing SWD.

27. Evaluating volatile organic compounds emitted from male and female pecan weevils, *Curculio caryae* Horn (Coleoptera: Curculionidae)

Katherine Arnold (arnoldk@nmsu.edu)[1], David C. Thompson[1], Ikju Park[2] and Larry Blackwell[1], [1]New Mexico State Univ., Las Cruces, NM, [2]Univ. of California, Davis, Davis, CA

The pecan weevil, *Curculio caryae* Horn (Coleoptera: Curculionidae), is an obligatory nut feeder that is a major pest of commercial and residential pecan trees. Originating from the eastern United States, weevils feed and oviposit exclusively during the gel stage of pecan development. The infestation of this pest within Chaves, Curry, Eddy, and Lea counties in New Mexico resulted in a quarantine and can require insecticide application to reduce yield loss. Low capture numbers in pheromone traps from infested New Mexico counties have prompted a need to reassess the adult pheromone profile. To reevaluate the chemical composition of the pecan weevil pheromone, we collected volatile organic compounds (VOCs) emitted from conspecific pairs of pecan weevils in combination with pecan plant nutlets and leaflet at 500 ml/min for 6 hours. Field-collected pecan weevils were transported from Georgia to a biosafety level two quarantine facility at New Mexico State University. Each pecan weevil was placed in a preconditioned glass vial (1.9 liter with Teflon lined lid) with three pecan nuts and one leaflet or weevil only. The eluted analytes were injected into gas chromatography-mass spectrometer and gas chromatography-electroantennogram. The preliminary findings from these samples will be reported. The use of the VOCs in traps will hopefully improve the detection rate of pecan weevils within commercial orchards and in residential areas.

28. Deployment of long-lasting insecticide-incorporated netting in pilot-scale warehouses effectively prevents dispersal and reduces infestation by stored product insects in commodities

Rachel Wilkins (rachwilk15@gmail.com)[1], Kun Yan Zhu[1] and Rob Morrison[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS

Historically, long-lasting insecticide netting (LLIN) has been used as bed nets for vector control. Recently, in our lab, LLIN has shown to significantly reduce movement and dispersal in multiple stored product insects that come in contact with the netting in the laboratory, but these effects have not yet been tested in more realistic field situations. In this study, we evaluated the optimal method of LLIN deployment in pilot-scale warehouses. LLIN was either hung in front of a commodity (to mimic partition application), draped directly over the commodity (to mimic pallet applications), or intersected a PVC pipe (to mimic insect immigration through a vent from the landscape). A total of 100 insects each of *Tribolium castaneum, Rhyzopertha dominica,* and *Trogoderma variabile* (all major stored product pests) were released in the warehouses and given 72 h to disperse to a commodity containing a standardized mixture of wheat and flour. Afterwards, individuals were collected directly from the commodity, or in a 0.5, 1, or >1 m radius around the commodity, and their health condition was recorded. The commodity was sieved for adults, which were recorded, and the commodity was held for 6 wk to check for progeny. Regardless of deployment method, warehouses with LLIN experienced reduced insect infestation and progeny production by 9–200-fold compared to controls. This is expected to be even larger at commercial-scale facilities where insects must disperse farther to reach the commodity, suggesting that LLIN use may be a promising method for improving IPM.

30. Do small patches of prairie conserve pollinators, including native bees and pollinating flies, in an agricultural setting?

Caroline Murray (cjmurray@iastate.edu), Matthew O'Neal and John Tyndall, Iowa State Univ., Ames, IA

The STRIPS (Science-based Trials of Row-crops Integrated with Prairie Strips) project works with row-crop farmers to incorporate strips of prairie consisting of 10% or less of the field area, into

a crop field. These strips provide in-field benefits by reducing soil erosion and nutrient loss. We hypothesized that these patches would provide more flowering resources and harbor more pollinators than field edges or grass waterways. Farmers cooperating with the STRIPS project allowed us to survey the plant and pollinator community within the reconstructed prairie (referred to as strips sites). In addition, we found farms (control sites) with no prairie within a 1.6 km radius and growing the same crop as the nearest prairie sites. Once per month (June to August), we used timed observational surveys to assess Monarch butterfly populations, and twice per month, we used bee bowls to assess the pollinator community. Flowering plants and all milkweed were counted along a 100m transect to measure potential forage. In the 2018 and 2019 field seasons, control sites had on average fewer flowering plant species (1.17±0.35 vs 4.3±0.50 in 2018, 0.96±0.29 vs 4.84±0.57 in 2019). Bees collected by pan traps are being identified to species, and syrphid flies (Eristalinae and Toxomerus) have been quantified to better understand the pollinator community in agricultural landscapes. Despite the presence of significantly more flower species in 2018 at strips sites than control sites, we found no significant difference in the number of syrphid flies (10.69±4.19 vs 13.56±8.31). We plan to update these results following the identification of native bees and syrphids collected during the 2019 field season.

31. Combining COI and simple morphometric analysis to inform billbug (*Sphenophorus* spp.) management

Marian Rodriguez-Soto (rodri561@purdue.edu)[1], Laramy Enders[1], Ricardo Ramirez[2] and Douglas Richmond[1], [1]Purdue Univ., West Lafayette, IN, [2]Utah State Univ., Logan, UT

Billbugs (*Sphenophorus* spp.), are a complex of grass-feeding weevils damaging the aesthetic and functional qualities of turfgrass. Effective monitoring and management rely on a clear understanding of their seasonal biology. Our limited understanding of regional variation in the species compositions and seasonal biology of billbugs, driven largely by our inability to identify the damaging larval stage to species level, has hindered efforts to articulate efficient IPM strategies to growers. We use a combination of modern DNA barcoding methods and classical morphometric measures to fill critical gaps in our understanding of the seasonal biology of the billbug species complex across a broad geographic range. Adult billbugs from Indiana, Missouri and Utah were collected and identified morphologically to species level. Cytochrome oxidase subunit 1 (COI) was amplified and sequenced to create a reference library against which unknown larval specimens could be compared and identified. Larval specimens were then collected across the growing season in Utah and their head capsule diameters were measured as a proxy for development instar. COI was amplified, sequenced and compared against the adult reference library. Sequences varied among billbug species, but the variation was not influenced by geography, indicating that this locus alone is useful for resolving larval species identity. When overlaid with head capsule diameter data from specimens collected across the growing season, a better visualization of billbug seasonal biology emerged. This approach will provide researchers with the tools necessary to fill critical gaps in our understanding of billbug biology thereby improving turfgrass pest management.

32. Insecticide efficacy evaluation and emergence observations for soybean gall midge

Mitchell Helton (mhelton@iastate.edu)[1], Erin Hodgson[1], Anthony McMechan[2] and Nick Tinsley[3], [1]Iowa State Univ., Ames, IA, [2]Univ. of Nebraska-Lincoln, Ithaca, NE, [3]Bayer Crop Science, White Heath, IL

Soybean gall midge, *Resseliella maxima* Gagné (Diptera: Cecidomyiidae), is a new soybean pest in Nebraska, Iowa, South Dakota, Minnesota, and Missouri. In 2018, severe economic loss occurred in commercial fields and therefore our research focused on sampling and efficacy evaluation strategies. This project evaluated application methods to asses performance (e.g., seed treatments, in-furrow and foliar) at two locations in western Iowa in 2019. An injury rating system was developed to measure severity of plant injury from soybean gall midge infestations. Plots were evaluated for yield at the conclusion of the growing season. Additionally, cages were placed over the soil to monitor for adult emergence. Soil and air temperature data loggers were used to correlate accumulated temperatures with adult emergence. This presentation will discuss insecticide efficacy from western Iowa and cumulative emergence data from Iowa and Nebraska.

33. Hymenoptera feeders: Sugarcane aphid (*Melanaphis sacchari*) honeydew as a resource in sorghum (*Sorghum bicolor*) and Johnson grass (*Sorghum halepnese*) fields

Michael Caballero (michaelcaballero9@gmail.com)[1], W. Wyatt Hoback[1] and J. Scott Armstrong[2], [1]Oklahoma State Univ., Stillwater, OK, [2]USDA - ARS, Stillwater, OK

The sugarcane aphid (*Melanaphis sacchari*) (SCA), a recent perennial pest of sorghum, quickly forms dense colonies and produces large amounts of waste material commonly called honeydew. The aphids feed on the underside of the leaves resulting in waste accumulation on the leaf directly below them. While aphid colonization and sooty mold growth can cause economic loss, honeydew may create a resource that other insects could use, especially in areas that have few plants in the flowering stage. A pan trap and yellow sticky card survey was conducted in sorghum and Johnson grass sites where SCA was found. Blue, yellow, and white pan traps were used along with yellow sticky traps placed on a garden stake at plant height. Sixteen sorghum sites with aphids and four control sites were surveyed. Twelve sites were surveyed for Johnson grass, 11 with aphids and one control. The pan traps in sorghum with SCA caught

11 families comprised of 45 morphospecies while only 7 families and 21 morphopecies were collected at sorghum control sites. The sticky cards caught 10 families with 26 morphospecies, and the control locations had 7 families with 9 morphospecies. Johnson grass results were similar with 15 families and 43 morphospecies collected in the pan traps in areas with SCA. At the control site, 4 families and 5 morphospecies were caught. Sticky cards at these sites caught 9 families and 19 morphospecies when SCA were present and 3 families with 4 morphospecies at the control. Overall, higher abundances of Hymenoptera were collected in plants with SCA. The results of these experiments indicate that SCA may provide a sugar resource. Future research should examine the effects of strips at field edges with susceptible sorghum may benefit parasitoid and pollinator populations.

34. The effects of fire and grazing on pollinator abundance and diversity

Jessica Butters (jbutters@ksu.edu), Tania N. Kim and Brian Spiesman, Kansas State Univ., Manhattan, KS

Pollinator abundance and diversity are threatened by habitat loss and fragmentation, lowering the effectiveness of pollination services. Therefore, the remaining fragments of natural habitat must be managed in a way that is beneficial to pollinator biodiversity. Fire and grazing are two management practices commonly implemented in tallgrass prairies, but few studies have examined how the combination of these factors affects pollinator communities. In a one-year field study at the Konza Prairie Biological Station, we collected pollinators from 12 bison-grazed or ungrazed sites that were under a fire rotation of 1, 4, or 20 years. We found that bison grazing significantly increased the abundance of moths, butterflies, and most species of bees, while fire rotation had no significant effect on pollinator abundance. Bison grazing effects on pollinators could be mediated through the plant community, soil conditions, or through direct interactions. We will be investigating whether these trends persist across multiple seasons.

35. Optimizing RNA interference in fall armyworm *Spodoptera frugiperda* using improved nanoparticles

Ana Trabanino (trabaninopino.1@buckeyemail.osu.edu), Yosra Helmy, Gireesh Rajashekara and Andy Michel, The Ohio State Univ., Wooster, OH

Fall armyworm (FAW), *Spodoptera frugiperda*, is one of the most important pests in agriculture due to its ability to feed and damage several important agronomic crops. Nonetheless, FAW has developed resistance to several insecticides including transgenic traits, leading to significant yield loss. Therefore, there is an urgent need to develop and implement novel strategies to control FAW populations. RNA interference (RNAi) is rapidly becoming a promising tool for insect pest control by silencing biologically important genes that result in death of the insect. Several studies have shown successful RNAi approaches with mosquitos, aphids and beetles. However, current RNAi approaches in lepidopteran pests (e.g. fall armyworm) are still ineffective. This study focuses on evaluating siRNA coupled with different types of nanoparticles to achieve gene silencing in FAW. To determine the efficacy of this technique, FAW neonates will be nebulized with three different types of nanoparticles separately (chitosan, PFC (perfluorocarbon) and Poly (lactic-co-glycolic acid)) mixed with siRNA. By using nanoparticles, we aim to protect siRNA from degradation during delivery, help accumulate around target tissue and therefore achieve a robust RNAi response in fall armyworm. Gene expression will be measured 24 and 120 hours after nebulization through qRT-PCR. Through this study we intent to exploit full RNAi potential and therefore provide a baseline for a consistent and reliable RNAi assay that can be used as a pest control strategy.

Student Three-Minute Presentations

All Sections: All Degree Levels

36. Best way to spray: Spray volume and application frequency determine insecticide efficacy against western flower thrips

Devin Radosevich (devinrados@earthlink.net) and Ray Cloyd, Kansas State Univ., Manhattan, KS

Western flower thrips (*Frankliniella occidentalis*) is a major insect pest of greenhouse-grown horticultural crops that causes direct and indirect damage by feeding on leaves, stems, flowers, and fruits. Feeding damage and the vectoring of diseases results in significant economic losses for greenhouse producers. Insecticides are the primary management strategy used against this pest. The effect of spray volume and application frequency on insecticide efficacy against *F. occidentalis* on yellow transvaal daisy (*Gerbera jamesonii*) cut flowers was investigated. Three spray volumes and two application frequencies were evaluated. Spinosad, chlorfenapyr, and flonicamid were used as the insecticide treatments. Application frequency had a significant effect on *F. occidentalis* percent mortality with spinosad and chlorfenapyr causing 100% (n=118) mortality at two applications. Spray volume and the type of insecticide also significantly impacted *F. occidentalis* percent mortality. Flonicamid caused lower *F. occidentalis* percent mortality and had more variable results than spinosad and chlorfenapyr. A better understanding of how to properly and effectively use contact insecticides against this pest can reduce insecticide inputs and costs associated with labor and insecticides, which will alleviate issues related to environmental contamination, worker safety, and insecticide resistance. Western flower thrips (*Frankliniella occidentalis*) is a major insect pest of greenhouse-grown horticultural crops that causes direct and indirect damage by feeding on leaves, stems, flowers, and fruits. Feeding damage and the vectoring of diseases results in significant economic losses for greenhouse producers. Insecticides are the primary management strategy used against this pest. The effect of spray volume and application frequency on insecticide efficacy against *F. occidentalis* on yellow transvaal daisy (*Gerbera jamesonii*) cut flowers was investigated. Three spray volumes and two application frequencies were evaluated. Spinosad, chlorfenapyr, and flonicamid were used as the insecticide treatments. Application frequency had a significant effect on *F. occidentalis* percent mortality with spinosad and chlorfenapyr causing 100% (n=118) mortality at two applications. Spray volume and the type of insecticide also significantly impacted *F. occidentalis* percent mortality. Flonicamid caused lower *F. occidentalis* percent mortality and had more variable results than spinosad and chlorfenapyr. A better understanding of how to properly and effectively use contact insecticides against this pest can reduce insecticide inputs and costs associated with labor and insecticides, which will alleviate issues related to environmental contamination, worker safety, and insecticide resistance.

Student Poster Competition

Student Poster Competition: Undergrad Session I - MUVE & PBT

D1. Let the worms eat *Tenebrio/T. molitor*

Kalli Baumgardner (kallibeth2020@gmail.com), Northwest Technology Center, Fairview, OK

Polystyrene take up to 30% of landfill space by volume, and take over 500 years to decompose. This makes finding a solution to disposing of plastics and Styrofoam imperative. Mealworms, *Tenebrio molitor* L. may be part of that solution in that they have the ability to consume some polystyrene products because of specialized bacteria in their gut. This experiment was designed to determine the feeding preference of *T. molitor* on open and closed cell polystyrene. Our research has shown using Student's t-test and having a 95% confidence that the difference is not due to chance, the worms preferred the open cell to closed cell, consuming 4.6:1. This demonstrated to us that T. molitor are a viable solution to aiding in the decomposition of polystyrene products.

D2. Prevalence of *Plasmodium* sp. in mosquitoes collected in urban areas of southern Oklahoma

Brandon Henriquez (brandon.henriquez@okstate.edu), Jordan Sanders and Bruce Noden, Oklahoma State Univ., Stillwater, OK

The Asian Tiger mosquito, *Aedes albopictus¸* is native to Asia but over the last century has become established in almost 30 countries all over the globe. *Ae. albopictus* is a known competent vector of at least 22 arboviruses, including dengue, chikungunya and Zika; it has also been identified as a major vector for *Dirofilaria immitis* (canine heartworm) in North America. The vector competence of *Ae. albopictus* for *Plasmodium* sp. in the United States is understudied. Mosquitoes were collected and identified to species from six urban clusters in southern Oklahoma (Altus, Ardmore, Davis, Elk City, Mangum and Marietta). The objective of the study was to determine the prevalence of avian malaria in urban Southern Oklahoma. The DNA was extracted from collected mosquitoes and tested using a nested primer set (Haem NF/NR and Haem IF/IR) in a polymerase chain reaction. Out of 669 pools tested, 90 pools (13.45%) are potentially positive for avian malaria. Further testing will be done on *Culex pipiens* samples and confirmation by sequence analysis will be carried out. Results from this study will provide information regarding the transmission of *Plasmodium* sp. in the southern great plains and the potential involvement of different host species.

D3. Mutations in the voltage-gated sodium channel gene of pyrethroid-resistant *Amblyomma mixtum* (Acari: Ixodidae) from Mexico

Odessa A. Mata (odessa.mata01@utrgv.edu)[1], Guilherme M. Klafke[2], Jason P. Tidwell[2], Francisco T. Barradas-Piña[3], Teresa Feria[1] and Adalberto A. Pérez de León[4], [1]The Univ. of Texas Rio Grande Valley, Edinburg, TX, [2]USDA - ARS, Edinburg, TX, [3]INIFAP, Medellin de Bravo, VL, Mexico, [4]USDA - ARS, Kerrville, TX

Amblyomma mixtum is a vector of rickettsiosis to humans and also affects domestic animals. Tick infestations are controlled by using acaricides. The most used are the pyrethroids, however, studies have shown increasing reports of resistance to this pesticide class. The most common mechanism of resistance to pyrethroids is the presence of mutations in the voltage-gated sodium channel gene (Na-channel). This research tested the hypothesis that mutations in the Na-channel gene are associated with resistance to pyrethroids in *A. mixtum*. Adult female ticks were collected in 5 different ranches in northeastern Mexico, and incubated to obtain larvae used in resistance detection bioassays with permethrin. One population was obtained from a Nilgai antelope captured in Texas. DNA from the ticks was used in real-time PCR followed by high resolution melting (PCR-HRM) analysis to identify different haplotypes at the second domain of the Na-channel gene. The studied populations presented varying levels of resistance to permethrin. Population 1 had a low level of resistance. Populations 6 and 16 were moderately resistant. Population 20 was susceptible. For populations 2 and 3 (Nilgai collection) there was no bioassay information. After running PCR-HRM on all these samples, 6 different haplotypes (*H*) were found. *H*1 was found in all the resistant populations, in frequencies between 60 to 81.3%. *H*2 was highly frequent in the susceptible population (62.5%). The other haplotypes appeared in lower frequencies among the populations. The sequences of the haplotypes will be further investigated to search for nucleotide polymorphisms possibly associated with pyrethroid resistance.

D4. Effect of bluetongue virus infection on blood meal feeding behavior in female *Culicoides sonorensis*

Brandon Hall (Brandon.Hall@usda.gov)[1,2], Paula Rozo-Lopez[1,2], Barbara Drolet[1] and Dana Nayduch[1], [1]USDA-ARS, Manhattan, KS, [2]Kansas State Univ., Manhattan, KS

Female *Culicoides sonorensis* midges (Diptera: Ceratopogonidae) are well-known vectors of bluetongue virus (BTV; *Orbivirus*), which causes bluetongue (BT) disease. BT can cause severe morbidity and mortality in wild and domestic ruminants leading to significant economic losses for U.S. agriculture. Previous studies have shown that orbiviruses infect sensory organs of infected *Culicoides,* which may affect sensory perception including host detection and other behaviors. We hypothesized that this change in sensory perception may be reflected by a change in the feeding behavior of BTV-infected midges. Given that febrile responses frequently accompany the viremic period of BTV infections in animals, we evaluated blood meal temperature preferences of BTV-infected and uninfected *C. sonorensis* females. Preliminary results showed a trend that midges, irrespective of treatment, preferred to feed on warmer blood for their first blood meal. The effect of BTV infection status on other aspects of *C. sonorensis* blood-feeding behavior, and the possible impact to orbivirus transmission, will be discussed.

D5. Gas chromatography – mass spectrometry analyses of pesticide treated honey bee (*Apis mellifera*) brood pheromones

Omar Khan (omarikhan@tamu.edu), Juliana Rangel and Elizabeth Walsh, Texas A&M Univ., College Station, TX

Brood pheromones are a vital component in the development of honey bee (*Apis mellifera*) larvae, stimulate feeding, capping of cells prior to pupation, and stimulate foraging in bees. Developing larvae produce these numerous brood pheromones in order to sustain their own development. In many commercial agricultural operations organophosphates and miticides are used excessively by famers and beekeepers in order to maintain the health of their crops and colonies respectively. As a result, these colonies are saturated with chemicals which may inhibit the production of brood pheromones in honey bee larvae which subsequently can hinder their development. Various hives were treated with these agrichemicals and the larvae were extracted before maturation in order to analyze the various brood pheromones present in each treatment group. The brood pheromones were extracted through a series of washes involving dichloromethane and ethyl acetate. These extracted brood pheromones were analyzed by a process known as gas chromatography–mass spectrometry (GC–MS) to evaluate fatty acid esters—the pheromonal compounds—in different parts of the larvae. Several trials were then run in order to fully document which brood pheromones were present but most importantly absent in these larvae.

D6. Evaluation of the temperature tolerance of the predatory mite *Stratiolaelaps scimitus* for biological control of the honey bee ectoparasitic mite *Varroa destructor*

Travis Trimm (travistrimm501@gmail.com) and Juliana Rangel, Texas A&M Univ., College Station, TX

We propose using Stratiolaelaps scimitus as biological control agents in managed honey bee (Apis mellifera) colonies against Varroa destructor. In order to test this, we must first consider several factors that may affect the mites while inside of a beehive. One factor that must be explored is the suitable temperature conditions for Stratiolaelaps scimitus. This is important for determining the habitability of the beehive for the mites, and how it may impede their ability to control Varroa destructor. In order to test this, several containers with a set number of mites were placed into incubators at temperatures of room temperature, 26°C, 29°C, 32°C, and 35°C. The containers were then checked every 24 hours and placed back into the incubators after the number of mites alive and dead were recorded. After comparing data from all three trials, it was found that the mites survived best at temperatures of 29°C. This evidence may suggest that Stratiolaelaps scimitus are not suitable to live in the temperature conditions inside of a beehive

D7. Evidence of pheromone production in an orb weaver (Genus *Metepeira)*

Bryan Lara (larabryan20@gmail.com)[1] and David Thompson[2], [1]Student, El Paso, TX, [2]New Mexico State Univ., Las Cruces, NM

Pheromone activity in spiders is rarely studied despite or because of the complex interactions of many ecological topics, including sexual selection, mating competition, and intraspecific behavior. In previous studies, the main model organisms used to explore the chemical properties of spider sexual behavior were wolf spiders; however, in this experiment we focus on two species of orb weavers native to the southwestern U.S., *Metepeira comanche* Levi and *Metepeira arizonica* Chamberlin and Ivie. These spiders can be common in mesquite dominated semiarid rangelands of southern NM. Techniques to collect volatile organic compounds (VOCs) from spiders and their webs were initiated using adult and sub-adult spiders, because mating status has an effect on their production of pheromones. Two separate groups were tested for differences in either the amount or type of VOCs produced, with one group having their mating status unknown and the other being virgins. Using a dynamic headspace volatile collection system and gas chromatography-mass spectrometry, we identified VOCs created by either the spider itself or the silk it produced, with the majority of the recurring compounds having low molecular weight. This study is very preliminary, we plan to increase sample size, separate the silk and spider to determine the source of the chemicals, improve the process of headspace sampling, maintain specimens in a more 'natural' environment, and include bioassay simulations to strengthen the evidence of a possible sex pheromone. Further analysis of chemical signals from spiders will help provide an understanding of the role of pheromones in arachnids.

D8. Determining the effects of nutrition on honey bee (*Apis mellifera*) pathogen defense against deformed wing virus

Jordan Gomez (jordangomez363@gmail.com), Pierre Lau, Alexandria Payne, Cora Garcia, Pierre Lesne, Spence Behmer and Juliana Rangel, Texas A&M Univ., College Station, TX

Deformed Wing Virus (DWV) is one of the leading causes of overwinter collapse in managed honey bee (*Apis mellifera)* colonies due to its effects on an individual's physiology, including decreased

longevity due to crumpled wings from adult emergence and poor hive task performance. DWV titers are highest in colonies that are heavily parasitized by the mite *Varroa destructor*, which is a vector of the virus. DWV effects all developmental stages of honey bees and has been shown to impact the learning and memory abilities in infected individuals. Organisms have been proven to alter their diets to meet nutritional needs in response to infection of pathogens, through increasing protein ratios to improve immunity or through the reduction of protein ratios to limit nutritional sources available to the pathogen. This project is focused on the use of various diets with varying nutritional specifications to manage DWV levels in honey bee colonies. Caged cohorts of either test bees or control bees (30 bees per cage) were given a 50% sugar solution containing a DWV inoculum. To assess the effects of diets differing in the ratios of proteins to lipids on DWV infection, no-choice assays were performed with newly emerged bees that were fed diets containing various protein to lipid ratios. We based these diets on a baseline choice-assay that determined the bee's intake target ratio. To measure nutritional status, the hypopharyngeal glands of infected bees were dissected and measured to analyze acini size as a method of determining nutritional status. We also quantified the total lipid content in each group of bees. This work will elucidate the benefits of a honey bee diet with specific macronutrient ratios to combat viral infections in a realistic method that is both effective, and practical to beekeepers.

D9. Improvements to RNAi in mosquitoes through nanoparticle mediated delivery

Rachel Brown (r.brown@uky.edu), Dhandapani Ramesh, Laura Ruberg and Reddy Palli, Univ. of Kentucky, Lexington, KY

Known vectors of Yellow Fever, Dengue, Chikungunya, Zika and more, *Aedes aegypti* are among the most prominent disease vectors in the world. This makes it crucial to identify and develop new potential methods to control the mosquito population. One method is RNA Interference (RNAi) which uses double-stranded RNA (dsRNA) to knockout target genes. This provides a highly targeted approach to kill pest insects while minimizing off-target effects. RNAi has had some success in *Aedes aegypti* through the injection delivery method. However, this method is not feasible on a large scale. In order to deliver dsRNA to wild populations, the dsRNA should be fed to the mosquitoes; however, there has been little success with this method previously. One way to improve this method is through nanoparticle-mediated delivery in which the dsRNA is conjugated with nanoparticles to increase the efficiency of RNAi feeding. Nanoparticles have been used successfully on *Aedes aegypti* larvae. However there have been few attempts to use it in adults. Results from our experiments using dsRNA formulated with nanoparticles to improve RNAi in the yellow fever mosquito, *Aedes aegypti* will be presented.

Student Poster Competition: Undergrad Session II - SysEB & P-IE

D10. Does predation prevent or promote the evolution of virulence in soybean aphids?

Kelsey Shepherd (kelshep@iastate.edu), Jessica Hohenstein, Matthew O'Neal and Matthew Kaiser, Iowa State Univ., Ames, IA

The soybean aphid (*Aphis glycines)* is the most economically damaging pest of soybean in the Northcentral US and can potentially cause yield losses worth over $1 billion annually. Soybean aphids can be managed successfully with aphid-resistant soybean varieties. However, soybean aphids that can overcome plant resistance have been identified and these can threaten sustainable crop production. These aphids are *virulent* whereas aphids that cannot overcome plant resistance are *avirulent*. The refuge strategy (i.e. susceptible plants planted among resistant plants) can delay evolution of virulence by preserving a population of *avirulent* insects which dilute *virulent* aphid genetics. However, this refuge strategy alone is not capable of completely preventing evolution of virulence. We investigated the compatibility of combining the refuge strategy with aphid natural enemies. We hypothesized that natural enemies may further delay the evolution of virulence in soybean aphids. To test this, we infested susceptible and resistant plants with pure or mixed populations of *virulent* and *avirulent* soybean aphids for 10 days. Ladybeetle predators (*Hippodamia convergens*) were added to half of the plants and half were left without predators. After two days, aphid populations were counted on each plant and a random subset of aphids were removed from each plant for genetic analyses to distinguish *virulent* and *avirulent* aphids and calculate their relative frequencies. Preliminary results show that ladybeetles feed non-preferentially on *virulent* and *avirulent* aphids. These results suggest that natural enemies can be safely used with the refuge strategy to manage soybean aphids, as they do not contribute the spread of virulent soybean aphids.

D11. Chemical and foraging ecology of *Theocolax elegans (Westwood) (Hymenoptera: Pteromalidae)* on two alternate hosts

Chloe Albin (albinc@ksu.edu)[1] and Rob Morrison[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS

There is an active push to diversify integrated pest management (IPM) programs for post-harvest products, and one alternate strategy is biological control. A potential post-harvest biocontrol agent is *Theocolax elegans* (Hymenoptera: Pteromalidae) whose host range includes the rice weevil, *Sitophilus oryzae* (Coleoptera: Curculionidae), and lesser grain borer, *Rhyzopertha dominica* (Coleoptera: Bostrichidae). In designing resilient biocontrol strategies, food facilities may be able to deploy important semiochemicals to manipulate the abundance of natural enemies, including *T. elegans*. The Hodgkins-Host Selection principle suggests that these important semiochemicals may depend on the natal host environment. In order to investigate the behavioral response of *T. elegans* to potential hosts, and impacts by its natal host environment, we reared *T. elegans* on either *S. oryzae* or *R. dominica* for multiple generations. In a four-arm, still-air behavioral olfactometer, we then evaluated the orientation and taxis of *T. elegans* to six treatments: damaged grain+*S. oryzae*, damaged grain+*R. dominica*, *S. oryzae* alone, *R. dominica* alone, damaged grain+insects from the natal environment, or a control. Further, we characterized the volatiles from these treatments using dynamic headspace collection and gas chromatography coupled with mass spectrometry (GC-MS). Additionally, we evaluated the attractive ability of these volatiles in a pilot-scale mill setting to determine the ability of *T. elegans* to parasitize at increasing distances. We found that the natal host and odor source significantly affected chemotaxis of *T. elegans*, and our treatments emitted unique blends of semiochemicals, some of which may be useful in future behaviorally based management approaches for improving biological control.

D12. Feeding performance and preference of the Asiatic garden beetle, *Maladera castanea,* in field crops

Matthew Lorentz (mlorentz1@luc.edu), Adrian Pekarcik, Amy Raudenbush and Kelley Tilmon, The Ohio State Univ., Wooster, OH

The Asiatic garden beetle, *Maladera castanea* Arrow, was introduced to the United States in 1921 in New Jersey and has spread to 24 states and 2 provinces of Canada. It is a generalist species that can feed on over 100 species of plants, and has historically caused sporadic problems in turf grasses, ornamentals, and vegetables. Recently, populations have emerged as early-season pests of corn in sandy soils of Indiana, Michigan and Ohio; grub root-feeding can severely damage seedling corn. There is anecdotal evidence that Asiatic garden beetle also shows preference for common agricultural weeds, like marestail, which are often present in corn fields. However, it is unknown how the presence of alternative hosts influences grub feeding behavior. Do grubs perform better on, and show preference for non-crop hosts relative to the main crop? The objectives of this research were to 1) assess how Asiatic garden beetle grubs feed and development on different diets present in agricultural systems, and 2) evaluate grub feeding preference for these diets in a choice test. Understanding grub feeding behavior may ultimately contribute to management decision making of Asiatic garden beetle.

D13. Effect of Asiatic garden beetle, *Maladera castanea,* grub density on corn and soybean seedlings

Madeleine Ferguson (mferguson20@wooster.edu), Adrian Pekarcik, Amy Raudenbush and Kelley Tilmon, The Ohio State Univ., Wooster, OH

The Asiatic garden beetle, *Maladera castanea* Arrow, is a generalist species that was introduced to the United States in 1921 in New Jersey and has since spread to 24 states causing erratic problems in turf grasses, ornamentals, and vegetables. Several grub populations have recently begun to feed on roots of early-season corn (and rarely soybean) in sandy soils of Indiana, Michigan, and Ohio, causing corn plants to stunt, wilt, discolor, and ultimately die, reducing yields by up to 40%. Scouting for Asiatic garden beetle is problematic as the grubs are subterranean, and the adults are nocturnal. Sampling methods have been studied, but, it is still poorly understood how Asiatic garden beetle densities correspond to plant injury and stand losses in the field. The objective of this study was to understand how Asiatic garden beetle densities impact corn and soybean growth. Six grub densities were evaluated on both corn and soybean seedlings grown in sand for 7 weeks in the greenhouse. The results from this experiment will help to inform management decision making for Asiatic garden beetle in field crops.

D14. Geographical distribution of Western bean cutworm, *Striacosta albicosta*, in Ohio

Kimberley Gault (kagault06@gmail.com), Adrian Pekarcik, Amy Raudenbush and Kelley Tilmon, The Ohio State Univ., Wooster, OH

Over the last 20 years Western bean cutworm (WBC), *Striacosta albicosta,* has been a pest of corn and dry beans in the Great Lakes region. Previously, management of WBC relied heavily on the use of Cry1F Bt hybrids to mitigate WBC damage; however, there has been recent documentation of resistant WBC to Cry1F. These findings emphasize the importance of trapping and monitoring WBC adult populations to make the best management decisions for growers. Therefore, the objective of this study was to identify peak adult WBC flight patterns over time within Ohio. Bucket traps and lures were distributed to various counties across Ohio and monitored weekly for WBC adults from the end of June through August (2016 to 2019). Results indicated the average peak adult flight varied from the 2nd week of July to the 4th week of July. Furthermore, population size within Ohio has also varied with the highest average WBC adult trap count observed in 2017. Overall, by monitoring WBC adults we will gain knowledge to help determine patterns in WBC adult populations. In addition, this knowledge will allow growers to make the best management decisions against WBC.

D15. The effect of *Apis mellifera* on the nesting habits of solitary cavity nesting insects

Sierra Rach (sierrarach@yahoo.com)[1], Jessica Beckham[2] and Jeffrey Jackson[1], [1]Univ. of Texas at San Antonio, San Antonio, TX, [2]Univ. of North Texas, Denton, TX

Domesticated honeybee hives are commonly kept for hobby and agricultural pollination purposes. Native bees have also been declining in recent years, leading to concern about competition between honeybees and native bees. A rise in awareness of the plight of bees has led to an interest in the use of native bee hotels to support solitary bee pollinators. The present research aims to investigate both the issue of competition between honeybees and native bees, as well as the efficacy of bee hotels by asking the following questions: (1) Does the presence of an established honey bee hive influence the nesting habits of solitary pollinators? (2) Do pollinators use bee hotels? Methods for conducting the research included placing two types of bee hotels (polypropylene tubes and wooden blocks) at varying distances from an established honeybee hive located on the UTSA campus. Results indicate that the number of inhabited cavities is unaffected by increasing distance from the honey bee hive. The greatest habitation of bee hotels occurred at sites nearest to, and farthest from, the honeybee hive. However, this study looks at only a single possible relationship between native bees and honey bees, native bee nesting habits as a function of proximity to a honeybee hive. The observed results were likely influenced by factors other than distance from honeybee hive.

D16. Secondary plant metabolites in a novel oilseed crop, *Silphium integrifolium* and chemotaxis by its main insect pest, *Eucosma giganteana* (Lepidoptera: Pyralidae)

Kaitlyn Ruiz (kpruiz@ksu.edu)[1], Damián Ravetta[2], Chase Stratton[3], Ebony Murrell[3] and Rob Morrison[4], [1]Kansas State Univ., Manhattan, KS, [2]Museo Paleontológico Egidio Feruglio, Buenos Aries, Argentina, [3]The Land Institute, Salina, KS, [4]USDA - ARS, Manhattan, KS

Silphium is a novel crop that is being developed for oilseed and biofuel needs in the midwestern US. The plant produces a thick resin when the integument is pierced by insects or by mechanical damage, and there is an ongoing breeding program to enhance host plant resistance. One of the primary pests in this system is *Eucosma giganteana* (Lepidoptera: Pyralidae), which is univoltine, with larvae boring into the roots and stems. Prior research has shown that populations generally peak around May and June. There is currently a push to develop novel monitoring and behaviorally-based management approaches for this pest. While little is known about the chemical ecology of *E. giganteana*, many semiochemicals have been identified from other closely related Eucosma species. The goal of this study was to evaluate whether any of these previously identified compounds could improve capture of *E. giganteana* when combined with clear sticky cards in the field, as well as identify new potential pheromone targets and secondary metabolites produced by conspecific *E. giganteana* and *Silphium*, respectively. We found that there was significant attraction to (*E*)-8-dodecenyl acetate, while there was significant repellency to (*Z*)-9-dodecenyl acetate. These compounds may be useful in behaviorally-based monitoring and management strategies. In addition, we characterized pheromone emissions by moths, secondary metabolites found in *Silphium* resins, and headspace from *Silphium* plants, and found some new potential target pheromones and kairomones in this novel ecosystem. Overall, our research greatly expands the knowledge on the chemical ecology of *E. giganteana* and its interactions with *Silphium*.

Student Poster Competition: Undergrad Session III - P-IE

D17. Do food and egg density levels have an effect on intraspecific interactions that could lead to cannibalism among monarch (*Danaus plexippus*) larvae?

Kayla Shepherd (kaylas2@iastate.edu) and Nancy Shryock, Iowa State Univ., Ames, IA

The North American monarch (*Danaus plexippus*) butterfly is an iconic species. The eastern and western populations have declined dramatically over the last two decades. Scientists have proposed that billions of additional milkweed stems are needed to maintain viable populations. Larval development begins with an egg and progresses through 5 stages (instars). Cannibalism has been observed between monarch larvae; first instars cannibalizing monarch eggs has also been observed. We wanted to know if cannibalism would occur while rearing larvae of the same cohort on different quantities of food. We also wanted to know which instar would be most likely to cannibalize monarch eggs. We hypothesized that larval interactions and cannibalism would increase as the food quantity decreased; and that first instars would cannibalize more eggs. For the food quantity study, we reared five larvae starting at instar one, in five different treatments with decreasing food quantities, with approximately four replicates each. We made a total of 20 observations of their interactions, rating the intensities. Our results showed the intensity of observed interactions increased as the food quantities decreased. For the egg cannibalism study, we had five treatments, each instar, with thirty replicates each. We provided a leaf with ten eggs to a single larva for twenty-four hours. Second instars were observed cannibalizing the most eggs. This study helps to understand monarch behavior when more than one larva is present on the same milkweed stem. These results suggest a need to reduce intraspecific interactions by adding more milkweed stems to the landscape.

D18. Evaluation of different bowl trap colors for sampling bees

Haider Ibrahim (haider.ibrahim@okstate.edu) and Eric Rebek, Oklahoma State Univ., Stillwater, OK

A bowl trap is one of several techniques for collecting bees and other hymenopterans. Bowl traps of various color are placed on the ground and filled with soapy water, which serves to drown visiting insects. During the summer of 2019, we used different colors of bowl traps to compare their attractiveness to bees at the Oklahoma State University Botanic Garden in Stillwater, Oklahoma. It is important to determine which colors are most attractive to specific taxa of bees so that future studies are based on effective sampling techniques. We used five different colors (i.e., red, white, yellow, green, and blue) of bowls set in five different locations within open grassland areas at the Botanic Garden. Sampling was conducted from May through September of 2019 for a total of eleven weeks. We will present data showing which colors were most attractive to bees and other insect taxa of interest.

D19. Indirect interaction between mammalian and insect herbivores mediated by a nurse plant

Shadley Grove, **Chaneka Lightbourne** (chatlig@email.ecok.edu) and George Wang, East Central Univ., Ada, OK

Nurse plant facilitation is a positive plant–plant interaction that can also affect the insect communities on the plants. It has been demonstrated to enhance plant recovery after insect herbivory damage. It may also mediate indirect interactions between different herbivores sharing the same food plant. We conducted an experiment to examine the nurse effect of *Acacia etbaica* on the herbivory of *Solanum campylacanthum* in a savanna in Kenya. We hypothesized that the thorny branches of *A. etbaica* will protect *S. campylacanthhum* seedlings from herbivory by mammalian herbivores, resulting in larger plants. We also predicted that the protected plants will suffer more insect herbivory due to their higher available nutrients. Ninety *S. campylacanthum* seedlings (< 30 cm height) were selected and assigned to one of three treatments: covered in *A. ethbaica* branches (thorn), covered in *Croton dichogamous* branches (non-thorn), and uncovered (control). The plants were allowed to grow for nine months, and we collected five leaves from each *S. campylacanthum* plant at the end of the experiment. We quantified the proportion of area lost to insect herbivory on each leaf using ImageJ, and compared leaf damage between the three treatments using mixed-effects modeling. *S. campylacanthum* leaves from plants covered with *A. etbaica* branches (thorn) had significantly higher missing area than leaves in the control treatment, suggesting more insect herbivory on the covered plants.

D20. Feeding on glandular and non-glandular leaf trichomes negatively affect growth and development in tobacco hornworm (*Manduca sexta*) caterpillars

Cristina Raya Vaca (cristina.raya01@utrgv.edu)[1] and Rupesh Kariyat[2], [1]Student, Edinburg, TX, [2]Univ. of Texas Rio Grande Valley, Edinburg, TX

Trichomes are hair-like projections developed from epidermis and functions as a form of protection from biotic and abiotic stressors that negatively affect plant fitness. Although well documented as a herbivore defense, whether variation in trichome type can have negative effects through the different stages of herbivore life cycle is poorly understood. Using *Solanum elaeagnifolium* that produce non-glandular stellate trichomes, and *Solanum lycopersicum* that predominantly produce glandular, non-branched trichomes, we examined how trichomes affect choice and growth of *Manduca sexta*, a specialist herbivore of plant species belonging to the family Solanaceae. To accomplish this, we removed leaf trichomes and added them into artificial diet for caterpillars, and allowed the caterpillars to grow and develop. Our results show that trichomes negatively affected caterpillar body mass and mass gain, although there was no preference or aversion for them in choice assays. Non-glandular trichomes were particularly damaging, as their consumption resulted in suppressed mass gain and increased time to pupation. While the consumption of glandular trichomes also affected growth, the effects were significantly lower compared to the consumption of non-glandular ones. Taken together, our results show that feeding on trichomes can have negative effects on herbivore larval growth and development, and should be examined further.

D21. Diversity of insects in the Central Plains

Taylor Coles (taylor.ann.coles@okstate.edu) and Astri Wayadande, Oklahoma State Univ., Stillwater, OK

Insect diversity has been a hot topic of discussion as some recent studies suggest that insect populations and diversity are shrinking world wide. The purpose of this research was to look at populations of insects over time within the Central US and obtain estimates of diversity. Since many insects are most abundant during the late summer and early fall, September to the end of October was the main time focus for collecting samples in order to identify population diversity of insects. To collect the data, an aerial net was used to sweep in three separate locations near Stillwater, OK. One location was mixed grasses next to a major highway, a second location was a plot of land containing mixed grasses in a rural area, and the last one was the Botanic Garden at Oklahoma State University. Thirty sweep samples were collected weekly and frozen until the insects could be identified. The results showed majority of the insects caught were grasshoppers, leafhoppers, and flies.

Minor orders included parasitoids and small beetles. A comparison of diversity indices will be presented.

D22. Physiological responses of sorghum to sugarcane aphid feeding

Juan Raya Vaca (juan.raya01@utrgv.edu)[1], Adryenna Perez[1], Rupesh Kariyat[1], Sajjan Grover[2] and Joe Louis[2], [1]Univ. of Texas Rio Grande Valley, Edinburg, TX, [2]Univ. of Nebraska, Lincoln, NE

Sorghum (*Sorghum bicolor*) is one of the seven main cereal crops grown globally. Despite its social and agricultural importance, it is constantly under attack by above-ground herbivores. One of these devastating, above-ground herbivores is the sugarcane aphid (*Melanaphis saccari*). Since their first reported incidence in Texas on 2013, these phloem-feeding insects have continued to spread across the United States, causing a great amount of yield loss in sorghum. This rapid spread and farmer's pesticide use as a mean to control their spread have resulted in pesticide resistance in this species. However, such consequences have also been used towards developing advances and novel approaches in finding economical and environmentally friendly methods to manage this pest. In this study, three representative genotypes of sorghum (RTx430, SC1345, and SC265) that vary in their succeptibility to *M. saccari* (SCA) were used to conduct bioassays and electrical penetration graph studies to quantify each genotype's antibiosis and antixenosis on SCA. Following these studies, one of sorghum's natural phloem-blocking defense mechanisms, callose, was quantified at various time points over a 48-hour time period in order to evaluate how each sorghum genotype uses callose production as a defense against sugarcane aphid herbivory. The results from this study demonstrated that SC265 sorghum genotype had a higher resistance to SCA feeding, as well as increased callose production throughout all three timepoints tested, when compared to the other genotypes. Furthermore, this study can be used as a baseline to expand to other studies including gene expression, herbivory induced plant volatiles and phytohormones. Additionally, results of this study have applications in reducing chemical usage in agriculture and help promote sustainable agriculture.

D23. Evaluation of row covers for exclusion of squash bug, *Anasa tristis* (DeGeer) (Hemiptera:Coreidae), from squash

Hollie Thorne (hollie.thorne@okstate.edu)[1], Eric Rebek[1], James Shrefler[1], Tracey Peyton-Miller[2] and Lynda Carrier[1], [1]Oklahoma State Univ., Stillwater, OK, [2]Langston Univ., Langston, OK

Evaluation of Row Covers for Exclusion of Squash Bug, *Anasa tristis* (DeGeer) (Hemiptera: Coreidae), from Squash

Squash bug, *Anasa tristis*, is a key insect pest of cucurbit crops such as pumpkin, cucumber, and squash. This pest feeds on plant sap, which causes wilt and results in yield loss and eventual plant mortality. Squash bugs can also harbor plant pathogens that cause maladies like cucurbit yellow vine disease. We assessed the effectiveness of row covers in excluding squash bugs from plots of yellow summer squash at three sites in Oklahoma. In two separate trials, our objectives were to evaluate: 1) timing of row cover removal for excluding squash bugs while allowing pollinators access to squash flowers and 2) various row cover fabrics for their effectiveness as exclusion devices. Results of our first trial show that timing of row cover removal had little effect on reducing the overall number of squash bug eggs, nymphs, and adults compared to control plots. However, results from our second trial provide evidence that overall squash bug abundance was much lower in plots under row covers, regardless of the material used, compared to control plots. Importantly, the number and weight of marketable fruit was not affected by row covers in either trial. Therefore, row covers may be used effectively to reduce squash bug access to susceptible host plants while allowing pollinator access to flowers and maintaining crop productivity.

Student Poster Competition: Master's Session I - PBT & SysEB

D24. Characterization of microbial communities in American burying beetle (*Nicrophorus americanus*) secretions through gram staining and MALDI-TOF analysis

Carrie J. Pratt (carrie.pratt@okstate.edu), John E. Gustafson and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK

The American burying beetle (*Nicrophorus americanus*) is a necrophagous insect that provides biparental care to its offspring through the use of carrion. Beetles prepare a brood ball by first burying a carcass, then removing the fur, feathers, and digestive tract, and finish by covering the carcass in oral and anal secretions. Characterizing the microbes present in these secretions may aid in identifying how the beetles are able to preserve and utilize carrion throughout larval development. Using both Gram staining and MALDI-TOF analysis we have identified thirteen aerobic microbes present in both oral and anal burying beetle secretions. Of these unknown microbes, two were identified as *Myroides odoritimimus* and two were identified as *Proteus hauseri*. Myroides *odoritimimus* has been reported to reduce the growth of other microbes. Another three unknowns were identified as *Acinetobacter* sp., and three single isolates were identified as possible *Pseudochrobacterium* sp., *Corynebacterium* sp., and *Glutamibactor* sp. Three unknown organisms went unidentified by MALDI-TOF analysis. Additional 16S rDNA sequencing is underway to determine all unknown species, and select organisms are being prepared for full genome sequencing.

D25. Risk assessment of genetically modified cotton against *Thrips tabaci* (thrips) and indirect resistance assessment in *Pectinophora gossypiella* (pink bollworm) against different insecticides

Majid Muhammad (majidento07@snnu.edu.cn), Shaanxi Normal Univ., Xian, China

Cotton (*Gossypium hirsutum* L.) is an important cash crop in the world. The yield of cotton is reduced due to many factors but the major problem is insect pest damage. There are different species of insect pests that attack on cotton crop but thrips (*thrips tabaci*) damages young cotton seedlings, flowers, leaves and stems. The other pest pink bollworm *Pectinophora gossypiella* (Saunders) (Gelichiidae: Lepidoptera) is major yield destructive pest. Different types of pesticides are used to control the pest. The insects develop resistance against extensive used insecticides. Besides, the extensive use of insecticides leads to adverse effects. The present study was focused on whole cotton plant life cycle in relation to its stage specific insect pests viz thrips at seedling and vegetative stage while pink boll worms at reproductive stage till maturation. This experiment was conducted to assess the different transgenic varieties viz, FH-Lalazar, FH-142, FH-118 and one non-transgenic against *Thrips tabaci*. Results of that experiment show that almost similar population of thrips observed on transgenic and non-transgenic cotton varieties. Mean population of thrips observed on different varieties during all samplings as on FH-Lalazar, 4.56±0.31, FH-142, 4.84±0.30, FH-118, 4.660.43±, and on NIAB-2008 was 4.91±0.55. So, transgenic varieties having insecticidal Bt protein causing no effect on the population of sucking insect pest especially thrips. Another experiment was conducted to determine the resistance in pink bollworm against commonly used insecticides. In Laboratory, as recommended in field three insecticides Trizone 40% EC(triazophos) @ 1ml/100ml, Talstar 10% EC(bifenthrin) @ 0.25/100mland Arrivo 10% EC (cypermethrin) @ 0.25ml/100ml was tested against pink under laboratory condition. Mortality tests, Results shows triazophos shows maximum efficacy as mortality of pink bollworm was maximum where the bolls treated with triazophos. But bifenthrin and cypermethrin was not shows nominal efficacy that is the indirect indication of the resistance against pyrethroids group of insecticides in pink bollworm. In field studies, recommended doses of Trizone 40% EC, Talstar 10% EC and Arrivo 10% EC were used. Results show that minimum population of pink bollworm were observed where triazophos was applied in comparison to bifenthrin and cypermethrin. Maximum population of pink bollworm recorded where Bifenthrin and cypermethrin was applied in field, but in comparison to control treatment these shows a nominal efficacy against pink bollworm.

D26. Transcriptomic analysis of the honey bee (*Apis mellifera*) queen brain in response to pesticide exposure during development

Myra Dickey (mdickey2@tamu.edu)[1], Tonya Shepherd[2], Raul F. Medina[3], Aaron Tarone[3] and Juliana Rangel[3], [1]Texas A&M, College Station, TX, [2]Texas A&M, College station, TX, [3]Texas A&M Univ., College Station, TX

Honey bees (*Apis mellifera*) are the most economically and agriculturally important insect, supplying an estimated $15 billion annually to our agricultural economy, primarily through crop pollination. Despite their importance, honey bee health has been declining for many reasons, including poor queen quality, parasites and pathogens, and exposure to pesticides. As the sole egg-layer in a colony, the queen's health is directly linked to colony-wide fitness and productivity. Our ongoing research projects are focused on understanding how queen health is affected by exposure to agricultural pesticides during development. Wax in a honey bee colony is often contaminated with various pesticides, including miticides used to treat the ectoparasitic mite, *Varroa destructor*. Because behavior is dictated by neural responses, we want to understand effects that pesticide exposure during development might have on the honey bee queen brain. For this project, we sequenced the queen's brain transcriptome after they are reared in wax that is contaminated with the miticides fluvalinate, coumaphos and amitraz. To do this, we used plastic queen cups that were coated with beeswax that was miticide-free, or contaminated with field-relevant concentrations. We then grafted one-day-old worker larvae and allowed them to develop to maturity. Once the queens mated naturally (n = 3 per treatment), we dissected their brains into Direct-zol™. We then extracted RNA and sent for sequencing on Illumina NextSeq. Our next step is to analyze the RNA-Seq data to elucidate important pathways that will be the focus of future studies examining the effects of pesticides on honey bee health.

***D27*. Comparing grasshopper species richness in Oklahoma's cross timbers and mixed-grass prairie regions**

Alexander Harman (aleharm@okstate.edu) and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK

While some species of grasshoppers (Orthoptera: Acrididae) can be serious pests, the majority are of little economic importance. As a result, many of these species are understudied. The objective of this study was to survey the two largest ecological regions in Oklahoma, the cross timbers and the mixed-grass prairie, and compare the species richness of grasshoppers between these two regions. Surveys took place from June through October, each site was visited for approximately 30 minutes, and as many species of adult grasshoppers were collected as possible. We collected a total of 49 species in the two ecoregions. Of these, 16 were only collected in the mixed-grass prairie, 15 in the cross timbers, and 21 occurred in both. Because grasshoppers rely directly on plants for food, they can likely be used as indicator species to assess insect herbivore diversity. This represents the first comprehensive grasshopper survey in Oklahoma since 1958-61 and resulted in one new state record.

***D28*. Determining *Nicrophorus americanus* months of reproduction in Oklahoma**

Leonardo Vieira Santos (leonardo.santos@okstate.edu) and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK

The endangered American burying beetle (ABB), *Nicrophorus americanus* Olivier (Coleoptera: Silphidae), depends on small vertebrate carcasses that it buries and uses as a food source for their offspring. For reproduction, the beetles usually use 80-250 g vertebrate carcasses. The species occurs in two separate populations in the Midwest, a southern population centered in Oklahoma and a northern population centered in Nebraska. Seasonal activity is from April to October in the southern population and June to August in the northern population leading to the possibility of double brooding in the south. The objective of this study was to determine which months ABB reproduces in Oklahoma. A laboratory study was conducted by collecting two male/female pairs twice per month from April to October in Muskogee County Oklahoma. In the laboratory ABB pairs were placed into containers, filled with moist peat moss and provided a large rat (175 grams) as a food/reproduction source. Each pair was left at room temperature and checked for reproduction. The first successful brood happened with ABB collected in July and the last one in August, with the average of brood size of 15. ABB collected in other months did not reproduce and died in the laboratory. Based on these results, it appears that ABB is an annual species in both regions and reproduces later than was previously believed in the southern population.

***D29*. A survey of the polypore fungus beetles of Wisconsin (Coleoptera: Tetratomidae)**

Jacquelyn Whisenant (jacki.whisenant@gmail.com)[1] and Dan Young[2], [1]Wisconsin Insect Research Collection, Madison, WI, [2]Univ. of Wisconsin, Madison, WI

Although a few published Wisconsin species records for Tetratomidae exist from a revision of North American Eustrophinae, this was the first survey of the entire family for the state. Material was collected from malaise and Lindgren trapping as well as hand collecting from fungi in underrepresented counties during the 2019 field season. Additionally, historic collection records were incorporated from specimens in the Wisconsin Insect Research Collection, the Milwaukee Public Museum, and the Field Museum of Natural History. Results confirm 13 Wisconsin tetratomids along with one new species, bringing the current total to 14 species representing seven genera and five subfamilies. The most speciose subfamily in Wisconsin is Eustrophinae with five species confirmed. Specimens were identified to species or had previous determinations confirmed. Collection event data, including host fungi where possible, were digitized and entered into a relational database. From georeferenced data, distribution maps were generated for each species. Although it is unrealistic to consider this a comprehensive survey, we believe it establishes a sound baseline and foundation on which future studies might build in an effort to better characterize the diversity, natural history, and biogeographical parameters of this poorly known taxon.

***D30*. Forage plants and associated native bees of Parker County, Texas**

Camille Carey (camille.carey@okstate.edu)[1], David H. Kattes[2] and W. Wyatt Hoback[1], [1]Oklahoma State Univ., Stillwater, OK, [2]Tarleton State Univ., Stephenville, TX

There are growing concerns about declines of native insects which have been linked to habitat losses, pesticides, and global climate change. However, relatively few baseline data exist for many regions of the United States. The purpose of this research was to assess plant species and the bees associated with them in Parker County, Texas. Parker County is a rural county that is becoming more developed with the expansion of Fort Worth, TX. Surveys took place from February through August 2018 with bees collected when they were observed on a plant for at least 3 seconds and the plant species was then identified. Over 1,800 bees were collected and keyed to species. Bee species were compared for the number of plant species from which they were collected. 22% of collected bees were generalists, visiting more than 20 plant species, while 88% were specialists. The most generalist bee was the introduced European honey bee *Apis mellifera*and was collected from 124 plant species. This collection provides a baseline dataset of bee species, and the plants they feed on, from North Central Texas and

suggests that *A. mellifera*may be competing with native species in prairie areas.

***D31*. A survey of Wisconsin *Ischnosoma* (Coleoptera: Staphylinidae: Tachyporinae)**

Ann Marsh (amarsh3@wisc.edu) and Dan Young, Univ. of Wisconsin, Madison, WI

Surveys are critical to enhance our knowledge of diversity, natural history, habitats, and distribution of a given taxon. Such knowledge, in turn, underpins our general taxonomic knowledge which is the basis for all ecological and related studies including biodiversity, invasive species research, ecosystem services, and conservation biology to name a few. This holds true in Wisconsin as well. A survey of Wisconsin *Ischnosoma*, has increased the known species count from two to five, an increase of 150%, from the previously recorded species. Several collection methods were used for this study, but the most successful, for this genus, was using a hand sifter for various types of deciduous leaf litter, in several states of decay.

Student Poster Competition: Master's Session II - P-IE

***D32*. Insect-plant interactions in native but invasive silver leaf nightshade (*Solanum elaeagnifolium* Cav.)**

Jesus Chavana (jesus.chavana01@utrgv.edu), Univ. of Texas RIo Grande Valley, Edinburg, TX

Silver leaf nightshade (*Solanum elaeagnifolium*) is a herbaceous perennial that is highly invasive worldwide. The species does extremely well, because it is versatile and can live in poor soil and nutrient conditions. In addition, it also has extraordinary defense mechanisms that include structural defenses such as trichomes and spines, and chemical defenses such as alkaloids and phenolics. We are currently exploring how herbivores, pollinators, and predators affect multi trophic interactions in the species, and using this as a model to understand insect community dynamics in natural and agricultural ecosystems. The main herbivores found were Texas potato beetle (*Leptinotarsa texana),* green peach aphid *(Myzus persicae),* tobacco horn worm *(Manduca sexta,* and flower weevil (*Trichobaris texana)*.

D33*. The effects of caffeine on the activity levels of honey bees, *Apis mellifera

Johana Castro (johana.castro01@utrgv.edu) and Julie Mustard, Univ. of Texas Rio Grande Valley, Brownsville, TX

Caffeine is a bitter secondary compound produced by plants to provide protection against herbivores and pathogens. Interestingly, low dosages of the compound have been detected in floral nectar, which serves a vital role in attracting pollinators. Previous studies have shown that caffeine consumption increases alertness and activity levels in both mammals and invertebrates. An increase in activity may consequently enhance pollinator productivity and benefit plants. Here we examined the impact of caffeine consumption on the motor behavior of the honey bee, *Apis mellifera*. Forager bees were collected from the colony entrance and fed 1 M sucrose solution until satiation. The next day, bees were fed 10 µl of either 1.0 M sucrose alone or a combination of 1.0 M sucrose and caffeine with dosages over a range of 10^{-6} to 10^{-3} M, which reflects the concentrations naturally present in nectar. Individual subjects were then transferred to a petri dish either 5 minutes, 30 minutes, or 60 minutes after caffeine consumption. After a 5 minute adjustment period to get used to the environment, each bee was observed continuously for 10 minutes and the amount of time spent walking, flying, fanning, stopped, and grooming, was recorded using The Observer 5.0. Each behavior was mutually exclusive, so that the bee could only be performing one behavior at a time. Using honey bees as a model can help us gain a better understanding of the effects of caffeine on pollinators and its ecological role in plants.

***D34*. Re-designing agricultural landscapes: The effect of habitat on arthropod communities**

Aleksandra Dolezal (adolezal@uoguelph.ca), Andrew MacDougall and Ellen Esch, Univ. of Guelph, Guelph, ON, Canada

Arthropods are critical components of agricultural landscapes, representing most of the biodiversity and providing important ecosystem services. Large declines of arthropods are reported, but we lack knowledge of key limiting factors in agricultural regions-especially habitat. Habitat is critical to arthropod populations, providing stable food resources, nesting sites, and overwintering refuge. I examined drivers of habitat on arthropod abundance and richness in an agricultural region of Southern Ontario, Canada at two scales: landscape, based on the isolation of habitat and local, based on farm cover type (crop, prairie, forest). Additional analyses were conducted on arthropod communities among cover types, prairie addition affects on crop damage, the effect of crop type on arthropods, and arthropod richness between farm and non-farm sites. I found that locally, prairie produced greater arthropod abundance than crop or forest. Prairie addition did not affect crop damage but influenced the spatial distribution of herbivores in crops. Crop type influenced arthropod groups, especially herbivores, which preferred the mixed organic crop. Lastly, farm sites had similar arthropod richness as non-farm sites, suggesting that even conventional farms can support arthropod biodiversity if habitat is not limiting. Understanding how habitat influences arthropod groups will aid in management and redesign of our agroecosystems to best support biodiversity and ecosystem services.

D35. Efficacy of insecticides for control of grasshoppers in Bermuda grass pasture in Oklahoma

Grace Levy (gracej67@gmail.com), Ali Zarrabi, Tom Royer, S. Seuhs, Kristopher Giles and Jacquie Pruit, Oklahoma State Univ., Stillwater, OK

Grasshoppers are well-known, easily- identified pest insects in many areas of the world. They have been documented to damage crops in Oklahoma since it was settled and crops began being planted in the area. There are 4 major pest species in Oklahoma, including Migratory, Differential, Two-striped, and Redlegged grasshoppers. Both the nymphs and the adults of these grasshopper species damage crops through their feeding on the plants, causing defoliation and competing with cattle for forage. Scientists at OSU have conducted several efficacy trials for control of this pest in the past. For the 2019 study, insecticides were evaluated for grasshopper control in a Bermuda grass pasture at the Wes Watkins Research and Extension Center located in Lane, Oklahoma. In this experiment, insecticides were applied to plots in the pasture using a bicycle sprayer with a 12 ft boom. After the insecticide treatment was allowed to dry, a plastic cage measuring 1 m^2 x 30 cm tall and covered with fine mesh netting was installed in each plot. Ten live 2^{nd} or 3^{rd} instar grasshoppers were collected from an untreated pasture and placed in the cages. Each plot was evaluated using two collection methods: 1) Counts of live grasshoppers collected in 15 sweeps per plot and 2) visual counts of the live grasshoppers in each cage. Data collected at 4, 7, 14, and 21 days after treatment were analyzed using ANOVA and the means were compared according to Fisher's LSD (P = 0.05).

D36. Eating your greenbugs with a side of veggies: A diverse diet improves reproductive performance and life history in *Hippodamia convergens* (Coleoptera: Coccinellidae)

Hannah Stowe (hstowe@ksu.edu)[1], J. P. Michaud[2] and Tania N. Kim[1], [1]Kansas State Univ., Manhattan, KS, [2]Kansas State Univ., Hays, KS

Predatory insects encounter various animal prey and plant-derived resources during development and reproduction in the field but are often reared on monotypic diets in the laboratory. We assessed a monotypic diet (greenbugs, *Schizaphis graminum* Rondani) for development and reproduction of *Hippodamia convergens* Guerin-Meneville in comparison to a mixed diet including greenbugs, fresh wheat leaves, *Triticum aestivum* L., *Ephestia kuehniella* Zeller eggs, sunflower stems, pulverized bee pollen and diluted honey, combined appropriately for different life stages in order to simulate the range of resources available to larvae and adults during their spring generation. In addition, adults from each larval treatment were split into two parts, diapausing and non-diapausing, as first-generation adults may spend extended periods in reproductive diapause after leaving wheat fields. Fecundity and fertility were recorded for 21 days from first oviposition and data were analyzed as planned pairwise comparisons between treatments. We hypothesized that the nutrient variety provided in the mixed diet treatment would result in higher individual fitness and improved life history parameters, such as greater fecundity and increased egg clutches, and that these benefits would be more pronounced in the treatments including a period of reproductive diapause. We found that diet compensation during reproductive diapause increased fecundity in diet restricted treatments such that no lasting effect on fecundity of the diapausing treatments was observed relative to continuous mixed diet treatments. This result suggests that monotypic diet decreases fecundity in *H. convergens,* but adult diet compensation can overcome negative impacts of larval diet restriction.

D37. Soybean gall midge: Evaluating the efficacy of insecticide timing relative to adult emergence

Vilma Montenegro (vilma.montenegro.c@gmail.com), Anthony McMechan, Robert Wright and Débora Montezano, Univ. of Nebraska, Lincoln, NE

Soybean gall midge (SGM) *Resseliella maxima* Gagné was described in 2018 as a new species causing significant injury to soybean and its presence has been documented in 92 counties across five midwestern states. Yield losses from SGM are attributed to its three larval instars that feed primarily at the base of soybean plants. Adult trapping methods for SGM were recently developed and have the potential to assist clientele with the timing of insecticide applications. Currently, no information exists on how the timing of these treatments could impact efficacy against SGM. Therefore, an experiment was conducted near Mead, Nebraska in 2019. The objective was to evaluate the efficacy of two different insecticides (Hero (bifenthrin+zeta cypermethrin; pyrethroid) and Dimethoate (organophosphate)) applied to separate plots at four different times (2 days prior, 1 day after, 6 days after, and 11 days after first adult emergence) relative to overwintering emergence of SGM adults. Soybean was planted on May 2^{nd} into a soybean-soybean rotation field, which had significant SGM injury in the previous year. Plots were evaluated for the percentage of infested plants, the number of larvae per plant, yield components and whole plot yields. Yields were significantly greater than untreated plots for Hero for all application timings whereas Dimethoate was only significantly greater at 5 and 9 days after first adult emergence. Significant SGM injury was observed in all plots regardless of treatment. These results may vary depending on the duration of adult emergence at a site and further studies are needed.

D38. Change in mesquite organic volatile profile and natural herbivore response after herbicide application

Lovely Adhikary (lovely_a@nmsu.edu) and David C Thompson, New Mexico State Univ., Las Cruces, NM

Mesquite (*Prosopis* spp.) occurs naturally throughout semiarid and arid rangelands in the southwestern US. This common, many times dominant, leguminous shrub found on over 38M hectares, inhibits growth of grass and other plants, by competing for available water and nutrients. There is a rich fauna of insects that feed of mesquite, unfortunately, their actual impact is rarely studied. While herbicides are commonly used to manage mesquite populations, the interaction with mesquite-feeding insects is unknown. Many insects require volatile cues to identify their potential hosts, so, the first objective was to access the volatile organic compounds (VOCs) emitted by mesquite before and after herbicide treatment. Two common commercial herbicides, Sendero® and Remedy®, were used at the upper end (2.05 liters/ha and 1.17 liters/ha, respectively) and lower end (2.05 liters/ha and 0.58 liters/ha, respectively) of the labeled rate to spray nine individual mesquite trees. Mesquite trees emit many VOCs including Benzaldehyde, 3-hexen 1-ol acetate, β-ocimene, Linalool oxide, and Benzyl nitrile. Concentration and composition of VOCs changed after treatment. In an effort to understand herbivore response, VOCs were used in Y-tube bioassays of mesquite seed beetle, *Neltumius arizonensis*. Beetles responded to VOCs of untreated trees when given a choice against control and selected VOCs from low dose trees when given choice over either control or untreated.

The effect of physiological or physical changes of the plant on VOCs requires further investigation. We plan to evaluate the behavioral response of other native herbivorous insects to herbicide treatments in the laboratory and in the field.

Student Poster Competition: PhD

D39. Using front-end evaluation to identify audiences for science communication

Joan King (joanie_king@tamu.edu), Edward Vargo and Rhonda Struminger, Texas A&M Univ., College Station, TX

Communicating scientific research and findings to the general public is a challenge because poor communication efforts can lead to misunderstandings and mistrust of scientists. Part of this challenge is due to not understanding audiences. Studies show that when scientists take the time to know the public and their interests, they have a better chance of making scientific findings more relevant and impactful for their audience. According to the National Academies of Sciences, public communication and inclusion are especially important with respect to emerging genetic engineering (GE) technologies because of implications for regulation and use including food production and pest control. Genetically modified insects (GMIs) are such a technology and can be used, for example, to control pest mosquito populations. GMIs also occur without human intervention because gene expression can be altered in nature (e.g., parasites that manipulate their hosts). The public is often confused about GMOs and may not consider GMIs in their thinking about GE technologies. This poster presents adults' perceptions and understandings of GE technologies, and GMIs in particular, as indicated on a survey administered at various locations in Texas. Preliminary findings indicate that some demographic groups lack an understanding of GMIs and/or distrust such technologies. The results gained from this study will help design a SciComm (i.e., communicating) and outreach (i.e., teaching) program for adults who distrust or want to learn more about GMIs. This front-end evaluation is useful for developing relevant outreach projects because identifying audience characteristics, beliefs, and values allows communicators to develop successful SciComm.

D40. Analysis of Bryan/College Station *Solenopsis invicta* (Hymenoptera: Formicidae) colonies to evaluate presence of *Solenopsis invicta* Viruses -1 and -3

Valerie Holmes (vrh0933406@tamu.edu), Texas A&M Univ., College Station, TX

The red imported fire ant *Solenopsis invicta* Buren (Hymenoptera: Formicidae) is among the most widely recognized and ubiquitous insect invaders in North America. To date, the exceptionally successful species inhabits millions of hectares of American range with billions of dollars in annual economic impact to Texas. The limitations of current control efforts have led to the ongoing search for effective, self-propagating control measures, which have facilitated the discovery of an increasing number of viral pathogens infecting *S. invicta*. Of these, *Solenopsis invicta* virus-3 (SINV-3) has shown promising potential as a biological control agent. Studies have implicated the pathogen in colony collapse, decreased queen fecundity, and significant mortality across castes in laboratory colonies. Previous work has identified *Solenopsis invicta* viruses including SINV-3 at varying levels in United States localities, and it is clear that SINV-3 infected colonies do not thrive. This led us to ask the question: "What is happening in Texas, where fire ants remain a significant problem?" Despite the documented presence of SINV-3 in Texas, finer scale information is not available for many areas including College Station, TX. To assess this issue, we sampled colonies in the Millican Reserve locality of College Station, TX, as this area is heavily impacted by *S. invicta* colonization and plays a critical role in maintenance of local biodiversity. We employed molecular techniques to evaluate the prevalence of SINV-1&3.

D41. Investigating stress driven altruistic self-removal of honey bee (*Apis mellifera*) workers from the colony

Jordan Twombly Ellis (jt574@tamu.edu) and Juliana Rangel, Texas A&M Univ., College Station, TX

The honey bee (*Apis mellifera*) is an economically important pollinator and a tractable system for studying the behavioral consequences of eusociality. As a eusocial species, honey bees live in colonies of thousands of sterile female workers with only one reproductively active female. Therefore, a sterile worker's own genetic fitness is best served by acting in the interest of her colony, even if that behavior sharply curtails her own lifespan. In this study, we test the hypothesis that developmentally stressed worker bees altruistically remove themselves to protect their colony from the negative costs of an inefficient workforce. We found that up to 30% of adult honey bees that pupated while being parasitized by multiple adult *Varroa destructor* mites left the colony prematurely (2 to 7 days after eclosion) and subsequently died. To confirm that this behavior is a reaction to severe stress, and not a result of bees trying to rid the colony of parasites, treatment bees will be exposed to temperature stress during pupation. Temperature stressed and control bees will be tagged upon emergence and introduced to a common observation hive. We will take daily attendance of the focal bees as well as check a trap engineered to capture self-removing bees every hour. Physiological evidence of precocious development will be collected by dissecting and measuring the relative size of worker hypopharyngeal glands of both self-removing and control bees. These studies will shed light on the self-removal behavior of honey bees as a mechanism for reducing fitness costs to the colony.

D42. Interspecies virus transmission between ants and honey bees (*Apis mellifera*)

Alexandria Payne (alexnpayne@gmail.com) and Juliana Rangel, Texas A&M Univ., College Station, TX

Many ant species are considered pests of managed honey bee (*Apis mellifera*) apiaries within the southern United States. Previous research has shown that ants collected from within or near honey bee colonies are frequently detected to have honey bee-associated viruses. The most commonly encountered ant species within apiaries in Texas is the red imported fire ant (*Solenopsis invicta*) which was found to have a high prevalence of the honey bee-associated Deformed wing virus (DWV). The purpose of this study was to determine if/how DWV could be transferred between fire ants and honey bees. In this study, fire ants were observed preying on honey bee brood, scavenging dead adult bees, and robbing food resources from within hives. Following these observations, DWV-free fire ant colonies were fed honey bee pupae infected with a purified inoculum of DWV. Using RT-PCR, it was determined that fire ant colonies fed DWV-infected pupae tested positive for the virus. These ants were then fed a DWV-free sucrose solution that was subsequently collected. This sucrose solution will be screened for DWV and fed to caged cohorts of newly emerged honey bee workers to test if DWV is cable of foodborne transmission between these two eusocial insects.

D43. Interaction between defoliation and stink bug economic thresholds in soybean

Rafael Hayashida (hayashidarafael@gmail.com)[1], Adeney Bueno[2] and W. Wyatt Hoback[3], [1]Federal Univ. of Paraná, Curitiba, Brazil, [2]Embrapa Pesquisa e Desenvolvimento, Londrina, Brazil, [3]Oklahoma State Univ., Stillwater, OK

The establishment of Economic Thresholds (ET) is fundamental for Integrated Pest Management programs. In Brazil, soybean ETs exist for stink bugs and caterpillars, however, although these two types of injuries often occur concomitantly, previous research has evaluated only one type of injury in isolation. Therefore, the objective of this work was to evaluate ETs for feeding injury for combinations of defoliation and stink bug feeding in soybean. The study was conducted in Londrina-Parana, Brazil, in field conditions, using three defoliation levels (0, 7.5 and 15%) and three stink bug density (0, 1 and 2 insects per m). The experiment was carried out in factorial randomized block design (3x3) with four replications. The parameters evaluated were: Oil and protein content, number of seeds per pod, number of pods per plant, mass of 1,000 seeds and overall yield ($kg.ha^{-1}$). In every parameter evaluated, there was no interaction between defoliation levels and stink bug density, so only their simple effects were analyzed. No significant differences in oil or protein content was observed. Higher numbers of pods without soybeans and pods containing only one and two seeds were observed as the density of stink bug increased. However, there was no significant difference in the total amount of pods, mass of 1,000 seeds, and overall yield, which indicates soybean compensates for these injuries. Thus, we conclude that the ETs are appropriate and insecticides should be applied only when reaching the ET for either pest.

D44. Reciprocal benefits to cotton and bee pollinators in a cotton agroecosystem

Isaac Esquivel (iesqu002@tamu.edu)[1], Michael Brewer[2] and Robert Coulson[1], [1]Texas A&M Univ., College Station, TX, [2]Texas A&M AgriLife Research, Corpus Christi, TX

Despite the overall simplification of agricultural landscapes, we postulate that landscape structure can have significant effects on ecosystem processes such as natural pest control and pollination. In addition to natural habitat fragments providing these ecosystem services, the agricultural crop itself may provide reciprocal benefits. This study focuses on native bees found in and around cotton, representing the less understood process of pollination in this system and the national threat to pollinators in agroecosystems. We hypothesize that 1) landscape structure affects the species composition and abundance of the native bees within the agroecosystem and 2) cotton provides a resource for local native pollinators which in turn provide pollination services to the cotton plant. Across two years of study, we found that native bee diversity, abundance and visitation in cotton is increased when cotton was in proximity to other crops. Out of 4041 individuals, greater than 30 species and morphospecies were detected and 78% consisted of the species *Melissodes tepaneca (Hymenoptera: Apidae)*. In two replicated cage experiments, we examined potential cotton benefits from pollination via native bees facilitating cross-pollination resulting in increased yield. In cotton bolls that were caged and hand-crossed and bolls on uncaged plants exposed to pollinators had higher pre-gin weight and post gin weight than caged bolls excluded from pollinators. When cotton plants were caged with the local native bee *Melissodes tepaneca,* pre-gin (seed cotton) lint weight was 0.8 grams higher than cotton plants excluded from bees, representing a 14.5% increase from the excluded pollinator treatment. This information can provide insight into future conservation benefits provided to native pollinators and the return services they provide to agriculture in the cotton agroecosystem, and the extent to which landscape structure facilitates such reciprocal benefits

D45. The first record of *Halictophagus acutus* Bohart (Strepsiptera: Halictophagidae) from Wisconsin with COI barcode

Bonnie Ohler (bjohler@wisc.edu)[1], Samuel DeGrey[1], Matthew Kamiyama[2] and Dan Young[1], [1]Univ. of Wisconsin, Madison, WI, [2]Kyoto Univ., Kyoto, Japan

Halictophagus includes 13 species in the USA, all of which are parasites of Hemiptera. *Halictophagus acutus* parasitizes species of *Draeculacephala* (Hemiptera: Cicadellidae). It has previously been collected primarily from the southern and east-central US and Mexico. We report the first collections of *H. acutus* from Wisconsin; a considerable northwestern range extension for this species. This represents the first record of Halictophagidae in Wisconsin. Observations on life history, distribution, host associations, and a COI barcode for the species are also provided.

Regular Posters

Regular Poster Session

D48. Sugarcane aphid *Melanaphis sacchari*, (Hemiptera: Aphididae) development over temperature ranges with thresholds for fecundity

J. Scott Armstrong (scott.armstrong@ars.usda.gov)[1], Misael de Souza[2], W. Wyatt Hoback[3], Sulochana Paudyal[3] and Phil Mulder[3], [1]USDA - ARS, Stillwater, OK, [2]Oklahoma State Univ., STILLWATER, OK, [3]Oklahoma State Univ., Stillwater, OK

Because survival and reproduction of aphids is dependent on access to appropriate nutrition and temperatures at which metabolic processes are maintained, we evaluated the growth, reproduction and survival of sugarcane aphids at constant temperatures (5, 10, 15, 20, 25, 30, 35°C) on three known hosts, sorghum, Johnsongrass, and Columbus grass. Longevity, fecundity, number of female nymphs/d, reproductive period in d, and intrinsic rate of increase were measured at 24 h intervals. At temperatures below 10°C and above 30°C, reproduction did not occur on any of the hosts. Longevity was maximal at 15°C and thereafter decreased with increasing temperatures. The intrinsic rate of increase was highest between 15°C and 25°C on all host plants, while maximum fecundity differed by host plant and highest on sorghum. For aphids feeding on sorghum, the Weibull and Natural models were used to estimate lower and upper thresholds for development based on daily fecundity. The lower threshold for fecundity was 9°C, while the upper threshold for fecundity was 32° C. These results suggest that sugarcane aphid can use alternate hosts for survival and reproduction, but both low and high temperatures limit its reproductive capacity. Higher temperatures may trigger dispersal, while lower temperatures should limit sugarcane aphid fecundity and survival in most of the U.S.

D49. Evaluating sivanto in-furrow at planting for season long control of the sugar cane aphid, *Melanaphis sacchari*, in grain sorghum and impacts for silage and hay sorghums

Blayne Reed (blayne.reed@ag.tamu.edu)[1], Suhas Vyavhare[2], Patrick Porter[3] and Russ Perkins[4], [1]Texas A&M Univ., Plainview, TX, [2]Texas A&M AgriLife Research and Extension Center, Lubbock, TX, [3]Texas A&M AgriLife Extension, Lubbock, TX, [4]Bayer, Idalou, TX

Previous results of testing Sivanto in-furrow at planting for aphid control in sorghum indicated an 80-day window of pest protection from the Sivanto in-furrow. In 2019, two rates of Sivanto in-furrow at planting, 4 and 5 ounces per acre, were tested alongside an at threshold over-the-top treatment of Sivanto at 7-ounces and an untreated check for season long economic sugarcane aphid control viability in an CRBD with four replications. Aphids were counted weekly per leaf once detected until the untreated plots neared desiccation. After untreated plot desiccation, aphid damage ratings were used to continue data collection until the aphid population crashed. At the conclusion of the trial, 1/1000th of an acre was hand harvested per plot and grain threshed for yield data. Significant differences (P<0.05) between the in-furrow treatments began just a few weeks after infestation. Once the over-the-top treatment was applied, it joined the in-furrow treatments in significance compared to the untreated check. The 5-ounce Sivanto in-furrow rate began significantly outperforming the 4-ounce rate and the over the-top-rate at 54 DAP/2 DAT and continued until 83 DAP/24 DAT when all aphid treatments began losing control just before the population crash. In terms of grain yield per acre, the untreated check yielded 37.83 (b) pounds, the 4-ounce rate 4,487.5 (a) pounds, the 5-ounce rates 4,888.88 (b) pounds, and the OVT 4,177.7 (a) pounds (P=0.0003). Sivanto in-furrow again proved at least 80 days aphid control for both treatments enough for silage and hay sorghums, but questionably hopeful for grain production.

D50. Identifying efficient attractants for overwintering *Drosophila suzukii*

Ariana Hernandez (herna403@msu.edu), Juan Huang, Larry Gut and Matthew Grieshop, Michigan State Univ., East Lansing, MI

Spotted wing drosophila, *Drosophila suzukii* (Matsumura), is an invasive fly pest that has become a leading threat to cherry orchards. Pest severity is highly variable depending on when landscape populations of the pest develop, thus early detection of *D. suzukii* is critical for cherry growers. *D. suzukii* have a seasonal dimorphism that allows them to successfully overwinter in the cold, harsh temperatures northern regions experience. This winter morphotype differs in size and behavior compared to the summer morphotype seen during the growing season for soft fruits. Determining an appropriate bait for trapping winter morphotype *D. suzukii* is vital for monitoring population levels and targeting their populations during their most vulnerable state in winter. Both winter and summer morphotype *D. suzukii* were released in a mesh cage with the choice of three baits: water, crushed raspberries, and sugar yeast, for a three-choice test in the laboratory. Our experiment showed that yeast-sugar based baits are more consistently attractive for both winter and summer morphotypes, especially for females. This would suggest that yeast-sugar based baits should be used for winter and spring trapping for *D. suzukii.*

D51. Diversity of floral visitors in *Bursera linanoe* and *B. copallifera* in a protected natural area, Mexico

Rubén Hernández Tapia (ruben.hernandezt@uaem.edu.mx)[1], Ma. Rosas Echeverría[2] and Concepción Martínez Peralta[2], [1]Universidad Autónoma del Estado de Morelos, Cuernavaca, MR, Mexico, [2]Universidad Autónoma del Estado de Morelos, Jojutla, MR, Mexico

Knowing and documenting which insects pollinate wild plants is essential, particularly those at risk of disappear or has economic importance such as the *Bursera* genus, which depends on pollinators for sexual reproduction. Since knowledge about sexual reproduction and pollinators of the genus *Bursera* is scarce, this project aims to characterize and analyze the types of biological interactions in the community of visiting insects associated with two species of the genus *Bursera* in the locality (Chimalacatlán), of the Protected Natural Area, REBIOSH. To answer this question, we collect of floral visitors (insects) for ten trees, for each species within the locality. The collection was made while the trees were in bloom.Three different collection strategies were used: a) By capture with entomological network and b) with video camera recording and c) By water traps. Currently the identification of the individuals collected is carried out. In total under the three sampling strategies, seven different orders have been found: Coleoptera, Lepidoptera, Hymenoptera, Diptera, Psocoptera, Dermaptera, Hemiptera. The most common species were: Hymenoptera and Coleoptera. The most dominant species were: *Apis mellifera* in *B. linanoe* and *Nicrophorus sp.* in *B. copallifera*. Regarding the types of biological interactions in the two species of *Bursera*, have been found as visitors' insects of the Apidae, Megachilidae, Vespidae families, some of the Tenebrionidae family and some of the Nymphalidae family. As possible nectar thieves, some individuals of the Formicidae family were recognized, also specimens of the Asilidae family, identified as species that use inflorescences as strategic hunting sites.

D52. Insecticide efficacy for controlling pecan aphids, 2018

Phil Mulder (phil.mulder@okstate.edu) and S. Seuhs, Oklahoma State Univ., Stillwater, OK

Aphid feeding can reduce leaf efficiency and persistent infestations can defoliate trees. This leaf injury and loss can reduce current and subsequent yields and quality because of lower carbohydrate production. A field trial was established at the Cimarron Valley Research Station in Perkins, Ok to evaluate the efficacy of insecticide tank mixes for aphid suppression in pecan. Three insecticides at varying rates were evaluated for control of yellow aphid and blackmargined aphid on pecan. The trial was conducted in a 24 year-old pecan orchard (cv. Kanza and Pawnee) in a RCB design with two replicates within each cultivar (4 reps total) and 12-20 trees in each of the four treatments and an untreated check. Sampling for aphids was conducted on 27 Aug (pre-treatment) then 2, 7, and 12 DAT. Analysis of data was performed on the square root transformed aphid counts on the sum of the subsamples per tree per date. Throughout the sampling period, across both cultivars, with the exception of Movento (2DAT) and Carbine (12DAT), treatments provided significantly lower aphid suppression than areas not receiving an aphicide. Based on the fact each aphicide tested represents a different mode of action and are currently labeled for use, they could provide an acceptable rotation to aid in aphid insecticide resistance.

D55. Efficacy of insecticides for control of pecan weevil in Oklahoma, 2019

S. Seuhs (k.seuhs@okstate.edu) and Phil Mulder, Oklahoma State Univ., Stillwater, OK

The pecan weevil, *Curculio caryae* (Horn) is a key pest responsible for yield reduction of pecans *Carya illinoinensis* (Koch). Control recommendations rely on broad spectrum chemicals. Due to regulatory and environmental concerns, effective alternatives for *C. caryae* control must be sought for pecan production in conventional and organic systems. A field trial was established at the Cimarron Valley Research Station in Perkins, Ok examining efficacy of standard products for weevil control compared to microbial biopesticides for control of *C. caryae* in Oklahoma. Three insecticides at varying rates were evaluated for control of C. *caryae* on pecan. Trees identified for the trial were selected from an established orchard (24 yrs.) under optimum management. The trial was a RCB design replicated four times for each treatment and an untreated check and consisting of four trees per treatment. Samples were inspected for damage and cracked for larvae presence. Percent infestation analyzed using ANOVA with differences among means separated by Fisher's LSD (P = 0.05). Infestation of *C. caryae* were at 4.2% in the untreated check. Analysis showed no significant difference among treatments. However, these initial results provide evidence that microbial biopesticides can potentially reduce pecan weevil infestations in organic and nonorganic systems.

D57. New geographic distribution records of the gall midge, *Cystiphora sonchi*, in the United States

Louis Hesler (louis.hesler@usda.gov), USDA-ARS, North Central Agricultural Research Laboratory, Brookings, SD

An extended geographic distribution for the gall midge, *Cystiphora sonchi*, is newly recorded for three Northern Plains states in the U.S. Galls of *C. sonchi* were found on annual sowthistle, *Sonchus arvensis*, at multiple locations in these states. This gall midge is previously known from several Canadian provinces following its establishment from introductions for classical biological control of annual sowthistle. Various galls of the midge were parasitized by two types of hymenopteran parasitoids. These records demonstrate an expanded southward distribution of this gall midge.

D60. Assessment of distribution of Turbocide® inside a building by measuring aerosol concentration in conjunction with bioassay data on *Tribolium confusum*

Srinivas Lanka (slanka@ksu.edu)[1], Fei Asuncion[1], Aminu Owonikoko[1], Daniel Brabec[2], James Campbell[3], Frank Arthur[3] and Kun Yan Zhu[1], [1]Kansas State Univ., Manhattan, KS, [2]USDA-ARS Center for Grain and Animal Health Research Center, Manhattan, KS, [3]USDA - ARS, Manhattan, KS

Spatial variation in the efficacy of aerosol applications has been demonstrated in several studies by using bioassay data; however, limited information is available on how the actual measurements in aerosol concentrations during applications are related to the bioassay data on insects. In spray trials conducted during September-October 2019 at USDA-CGAHR, spatial pattern in aerosol concentration during aerosol spray of methoprene IGR ((Turbocide ® Advanced Fogging Product) was measured by Aerodynamic Particle Sizer (APS) units in conjunction with placement of bioassay arenas long the transect down the middle of the room in a building at USDA-CGHAR. Spatial variation in aerosol distribution of aerosol particles in the room was accomplished by using different spray release times (1, 4 or 12 s) , two different spray nozzles (cone and fan) and two spray release distances (9.1 m and 18.2 m) for a total of 48 spray trials. Five APS units, each positioned at 1.7 m distance, were used to sample and characterize aerosol particles in each spray trial. Aerosol particle data was collected for over 90 min per trial, including -10 min for pre-spray (background data), -60 min for spray and aerosol settling, and -20 min of exhaust and ventilation. The cumulative aerosol particle concentrations (mg/m^3) for different size fractions (small: 0.6-5.0; medium: 5.1-10.4 and large: >10.4 µm) in 60 minutes were used to correlate with efficacy index values obtained from larval bioassays against *Tribolium confusum* late larvae (efficacy index values range from 1-66). Spatial pattern of aerosol concentration will be represented by constructing contour maps based on Kriging using Surfer Software.

D62. Maintaining biodiversity of ant communities in the Crocker Range, Malaysian Borneo

Lilly Germeroth (lgm9d@mst.edu), Missouri Univ. of Science and Technology, Rolla, MO

Borneo is home to 1/16th of the world's ant diversity; however, intensive land use and agricultural practices are destroying forests at an accelerating pace. In 2014, UNESCO designated the Crocker Range as a Man and Biosphere region, which restricted development in core forests entirely and minimized development and impacts in surrounding buffer forests. We examined the efficacy of these zones in maintaining leaf litter ant biodiversity core and buffer highland rainforests in Summer 2019. We sampled leaf litter ant communities at twelve sites (N = 6 buffer; N = 6 core). Each grid was separated by > 50 m and consisted of 16 one-meter quadrats. Leaf litter was sifted using leaf litter extractors and then hung in Berlese funnels for 48 hours. Extracted ants were stored in ethanol, point mounted, and identified to genus using local taxonomic keys. Ant biodiversity in core and buffer forests was similar, and ant activity was highest in buffer forests. Species richness among sites was patchy. Our data support the continued use of zone stratification in these forests as an effective means of maintaining biodiversity reserves. Beta diversity analyses were conducted to assess spatial relationships between sites and treatments.

D63. The ecology of ants (Hymenoptera: Formicidae): urban versus rural assemblages of eastern New Mexico

Dennis Tinucci (dennis.tinucci@gmail.com), Eastern New Mexico Univ., Portales, NM

With over 55% of the world's population residing in urban centers the encroachment of humanity upon undeveloped areas is accelerating. Meanwhile, the study of urban ecology has grown apace, and investigation of ants in urban settings has become an increasingly important component of ant ecology research. The ecology of ants in urban areas is in part about exposing how they adapt to disturbance and fragmentation, and the tangled structure of urban settings provides a prime example of modern habitat trends. More myrmecologists, however, have chosen to broaden their study to encompass ant assemblages in the immediate countryside, and this project takes a similar approach. In the placement of pitfall traps not only within the city, but in undisturbed plots in the countryside, this study adopts a comparative approach that serves to measure ant assemblages between disturbed and undisturbed areas. Over the course of one summer three treatments covering plots within backyards and fields in the city proper and a country native patch were employed in mid-June and mid-August. Research to date has revealed the distribution of ant genera representing four subfamilies, namely Myrmicinae (5) with 58% of total species, Formicinae (3), with 21%, Dolichoderinae (2) with 16% and Dorylinae (1) with 5%. There was little difference in genera between city and country, but species count, namely for small ants, was higher in the city. As the parameters of this study includes two summers of ant-trapping these data remain preliminary. However, as soil types between the two separate study areas are similar, final results are predicted to remain near present findings.

D64. Bexar County bees: An assessment of family richness of bees using citizen science and bee bowls

Sally Lent (sallylent@yahoo.es)[1], Jessica Beckham[2] and Jeff Jackson[1], [1]Univ. of Texas at San Antonio, San Antonio, TX, [2]Univ. of North Texas, Denton, TX

Bees are important pollinators in both agricultural and natural systems. Understanding native and non-native bee communities will help provide baseline data for future studies**.** In this study, three major questions are addressed: 1) What is the taxa richness of bees at the family level in Bexar County? 2) Are honey bees (*Apis mellifera*) more abundant than native bees? 3) Are field collection methods comparable to citizen science methods? Two methods were utilized to quantify family richness of bees in Bexar County: countywide citizen science data collected from iNaturalist, and field collections of bees at the University of Texas at San Antonio (UTSA) using standard bee bowl collection methods. Both methods resulted in the following families: Apidae, Halictidae, and Megachilidae, however, the citizen science method recorded a greater diversity of bees. Results from both methodologies show that there were fewer *A.mellifera* observations than native bee observations. The methodologies used in this study provided an overall view of bee family richness in Bexar County, however, in both methods utilized here drawbacks were observed. The citizen science method was more likely to record larger bee observations and may be biased to record unusual bees rather than *A.mellifera*. In addition, the bee bowl method was better at catching small bee genera compared to larger bees. These studies indicate that both methods should be used to provide a more complete understanding of bee communities. Future research may consider including netting sampling methods to their methodology when investigating family richness of an area.

D65. Meet them where they think: Engaging business majors in an undergraduate entomology course

Bruce Noden (bruce.noden@okstate.edu), Oklahoma State Univ., Stillwater, OK

Engaging the general public in entomological-focused learning is not always easy, especially for business majors in a general science course. The Insects in Global Public Health course at Oklahoma State University connects non-major undergraduates with how arthropods have significantly shaped history and still impact the world through vector-borne diseases. Finding ways to stimulate students to link new information with what they are most passionate about can be challenging. The last two-page assignment (of five throughout the course) comes after 4 lectures featuring the use of entomology in food, forensics, and medicine. Students choose a topic and, based on their concentration, develop an advertising campaign, business plan, or entrepreneurial idea that involves selling arthropods to the general public. In Fall 2019, 91 of 125 (72.8%) students participated in the assignment with concepts involving bees (31%), crickets (28%), flies (7%), ants (6%), scorpions (4%), mealworms (4%), cockroaches (4%) and a wide variety (16%) including ticks, stink bugs and kissing bugs, American burying beetles and blister beetles, and Mopane worms. The majority of ideas (52%) focused on food followed by medical treatments (37%), cosmetics (6%) and weight loss products (4%). The fun flows from the innovative ideas occurring within these subject areas involving catchy selling phrases and eye-catching ads, simple business plans, and novel approaches to attract customers. By tapping into their interests and skill sets, this approach allows each student consider how entomology can apply practically to their own lives – and hopefully, engage their interests to learn more.

Regular Ten-Minute Paper Oral

Regular Ten Minute Papers Session I - PBT & SysEB

40. Susceptibility and attraction of stored product pests to fungal mycotoxins

Valerie Nguyen (ngueyval@ksu.edu)[1], Matt Bakker[2], Susan McCormick[2], Tom Phillips[1], Frank Arthur[3] and Erin Scully[3], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Peoria, IL, [3]USDA - ARS, Manhattan, KS

Deoxynivalenol (DON) and diacetoxyscirpenol (DAS) are mycotoxins that are predominantly produced by the fungal pathogen Fusarium graminearum and represent some of the most common contaminants of stored grains. These mycotoxins are recalcitrant to decontamination and can have negative impacts on human and animal health. However, many stored product pests actively feed on moldy products and may have the capacity to degrade mycotoxins. To determine whether these pests can withstand DON and DAS, we performed bioassays on species that commonly feed in high moisture environments, including *Tribolium castaneum, Typhaea stercorea, Rhyzopertha dominica, Sitophilus oryzae, Sitophilus zeamais*, and *Tyrophagus putrescentiae* and observed mortality and fecundity. In addition, we tested for attraction to trichodiene, which is a conserved volatile intermediate in the synthesis of mycotoxins. No mortality in response to DON was observed, even at high concentrations reaching 10,000 parts per million (PPM), and all produced viable progeny. No mortality was observed in response to DAS but decreases in progeny production were observed at concentrations higher than 100 PPM. Because trichodiene is emitted at high levels by fungi during mycotoxin production, we also measured behavioral responses to this compound alone or in combination with food and/or pheromone in a wind tunnel study. Our results suggest that some stored product pests have resistance to DON and DAS and that trichodiene is attractive to *Tribolium castaneum*. Analysis of biotransformation products will allow us to determine how mycotoxins are metabolized, which could lead to the discovery of enzymes that can be used to treat mycotoxin-contaminated grain.

43. What's that bug? Annual report from your SWB Branch Insect Detection Committee

Carol Sutherland (csutherl@nmsu.edu)[1], Xanthe Shirley[2] and Charles Konemann[3], [1]New Mexico Dept. of Agriculture, Las Cruces, NM, [2]USDA - APHIS, College Station, TX, [3]Oklahoma State Univ., Stillwater, OK

All three of us are identifiers for arthropods submitted to our respective institutions. This Insect Detection Report features some of 'The Most...' Outstanding specimens we identified in 2019 in our respective states.

Regular Ten Minute Paper Session II - MUVE

44. Thermal tolerance of the larval stadia of two forensically important blow fly species, *Chrysomya rufifacies* (Macquart) and *Cochliomyia macellaria* (Fabricius) (Diptera: Calliphoridae)

Lauren Beebe (lbeebe@tamu.edu), Travis Rusch and Aaron Tarone, Texas A&M Univ., College Station, TX

The growth and development of insects are heavily temperature dependent. Generally, development time decreases as temperature increases, up to an optimal temperature. Beyond the optimal temperature development and performance slow until a knockdown temperature or critical thermal maximum (CT_{max}) is reached, or enough time is spent at stressful temperatures resulting in death. Forensic entomology relies on this temperature-development relationship for estimating postcolonization interval (PCI) / minimum postmortem intervals (mPMI). This research focuses on two forensically important blow flies, *Chrysomya rufifacies (Macquart)* and *Cochliomyia macellaria (Fabricius)* (Diptera: Calliphoridae). Both flies are currently found in Texas; *C. macellaria* is a native species, while *C. rufifacies* is an invasive species from the Eastern Hemisphere. Temperatures in Texas can exceed 40˚C, which often results in maggot die offs. Knowledge of a species' thermal tolerance is important to forensics as a heatwave could easily disrupt estimates of PCI and mPMI. The purpose of this research was to observe the thermal tolerance using the ramping and the static method, for all larval instars of *C. rufifacies* and *C. macellaria*.

45. Investigating aggregation cues of *Reticulitermes flavipes* in relation to food discovery

Tae Lee (lee.8230@buckeyemail.osu.edu) and Paul Phelan, The Ohio State Univ., Columbus, OH

Termites are major structural pests worldwide, and their ability to effectively exploit resources is attributed to utilization of chemical communication cues. Chemical cues serve as gateway for regulating the complex social behavior displayed by termites, such as aggregation. Aggregation is a major component of termite social behavior, yet little is known about the associated chemical cues. A feeding-stimulating arrestant has been suggested to be a major inducer of aggregation at a food source, yet termites have been observed aggregating in absence of food as well. In addition, volatile compounds emanating from resources and nestmates may serve as aggregation inducing attractant. To investigate termite aggregation behavior and associated chemical cues, y-tube bioassay was conducted to observe termite response to chemical cues from wood and nestmates was conducted. Interestingly, termites did not form aggregation in response to volatiles or volatile extracts. Instead, termites displayed stronger response when capable of making physical contact with the source of cue.

This was concurrent with gas chromatography-mass spectrometry did not yield any result suggestive of the presence of volatiles. This is an indication to better utilize arrestant cues to induce termite aggregation. This information will further enhance management methods seeking ways to attract termites to a site of interest.

46. Effect of gut symbionts on presoldier differentiation in the eastern subterranean termite (*Reticulitermes flavipes*)

Rajani Sapkota (rsapkota@purdue.edu) and Michael Scharf, Purdue Univ., West Lafayette, IN

Lower termite workers show unique polyphenism. The workers can successfully molt into a soldier or a reproductive caste. The caste differentiation into a soldier is regulated by juvenile hormone (JH) at an endocrine level and hexamerin genes at genetic level. Since the hindgut of termite is a sink of microbiomes, we were interested in studying the possible impact of gut symbionts in presoldier differentiation in lower termites. For this study, we used the antibiotic-drug kanamycin to reduce the symbiont load in the hindgut and a juvenoid- methoprene to mimic the action of JH. Eastern Subterranean termites were exposed to methoprene, kanamycin, methoprene + kanamycin, and control treatments. We found that, the methoprene treatment had significantly higher survivorship and presoldier initiation than the methoprene + kanamycin treatments. Methoprene + kanamycin treatment resulted in significant mortality of workers, possibly during ecdysis. The kanamycin and control treatments didn't exhibit any presoldier initiation but the mortality in kanamycin treatment was statistically significant to control but similar to methoprene treatment. These results suggest the crucial role of gut symbionts during the presoldier differentiation and in survivorship of lower termites.

47. Therapeutic efficacy of a botanical acaricide against the southern cattle tick, *Rhipicephalus microplus* (Acari: Ixodidae)

Guilherme M. Klafke (gmklafke@gmail.com)[1], Donald B. Thomas[1], Robert J. Miller[1] and Adalberto A. Pérez de León[2], [1]USDA - ARS, Edinburg, TX, [2]USDA - ARS, Kerrville, TX

Reintroduction of the southern cattle tick (*Rhipicephalus microplus*) can be economically devastating for the cattle industry in the USA. Its parasitism is responsible for billions of dollars of annual losses worldwide in endemic areas and novel methods of control are necessary to overcome acaricide resistance. The efficacy of plant-derived compounds against ticks have been extensively demonstrated in laboratory tests, showing good potential as alternatives to synthetic acaricides. However, its efficacy needs to be validated in the field before recommendations of use are made. Our objective was to demonstrate the therapeutic efficacy of a botanical acaricide (Essentria®IC3) against *R. microplus* in a controlled study with artificially infested cattle. Twelve head of tick naïve cattle were weekly infested three times (~2000 larvae), randomized based on pre-treatment tick counts and separated in 3 treatment groups: i) water (untreated control); ii) coumaphos 0.3% in water (positive control); and iii) Essentria®IC3 6.25% in water. Eighteen days after the first infestation, the animals were dipped in a spray-chamber and moved to individual stalls to allow tick collection. Comparing to the untreated group, coumaphos treatment caused complete suppression of tick development (100% efficacy). Essentria®IC3 reduced 51% of ticks counts after 21 days, with 95% efficacy against larvae. Fecundity of females was reduced in 64.4%. Whereas Essentria®IC3 cannot be recommended for cattle tick eradication, it can be adopted in acaricide rotation strategies against acaricide resistant tick strains in other locations where *R. microplus* is endemic. Funding: USDA-ARS; ORISE.

48. The impact of avian malaria (*Plasmodium relictum*) on the flight activity of *Culex quinquefasciatus* (Culicidae)

Dayvion Adams (ajadams968@tamu.edu), Andrew Golnar and Gabriel Hamer, Texas A&M Univ., College Station, TX

Pathogen infection has been shown to impact the biology of arthropod vectors which can influence vector-borne disease transmission. For example, Human malaria can alter the feeding behavior of *Anopheles gambiae* in a variety of ways that benefits the pathogen's transmission to additional hosts. While non-pathogenic to humans, Avian malaria may also alter the biology of its vector, *Culex* mosquitoes, by altering its flight and feeding activity. If behavioral modification occurs, these same Culex mosquitoes are often vectors of West Nile virus so the co-circulation of malaria could modulate WNV transmission dynamics. Here we identify what affect *Plasmodium relictum* has on the flight activity of *Culex quinquefasciatus* by monitoring infected mosquitoes daily in a flight activity monitor for ten days post-infection, egg laying, and during the subsequent gonotrophic cycle. We find that contrary to human malaria, *Plasmodium relictum* overall decreases the flight activity of *Culex quinquefasciatus* during this host-seeking period. This has the potential to influence WNV transmission and warrants further inquiry into the influence of *Plasmodium* on other aspects of *Culex* mosquito behavior.

49. The residual effect of some selected acaricides against *Tyrophagus putrscentiae* (Shrank) on three different surfaces

Naomi Manu (nmanu30@ksu.edu)[1], M. Wes Schilling[2] and Thomas Phillips[1], [1]Kansas State Univ., Manhattan, KS, [2]Mississippi State Univ., Mississippi State, MS

Methyl bromide was the most effective chemical used to protect arthropod infestation over the past years until its use was disapproved and banned as an ozone-depleting agent. Dry cured ham is one of the most valuable stored product meats, however

Tyrophagus putrescentiae, also known as ham mite and cheese mite, decreases its quality and quantity during the aging process. This poses an economic threat to the dry-cured ham producers. In order to develop effective, economically feasible and safe alternatives to methyl bromide, the use of some approved and recognized acaricides have been researched in this study. Preliminary data after screening twenty residual acaricides in 11.8 cm^2 glass vial at recommended application rates showed flumethrin, acequinocyl, amitraz, novalrun/pyriproxyfen, methoprene and cyfluthrin have potential of killing mites. These chemicals were experimented to assess their residual effect on three different surfaces, namely concrete, wood and metal for one and 24 hrs. Results indicate amitraz, acequinocyl, novalrun/pyriproxyfen, methoprene and cyfluthrin are the most effective with average toxicity percentage of 97.5 ± 5.0, 98.68 ± 2.6, 100 ± 00, 99.23 ± 0.05, 98.23 ±1.77, respectively at concentration of 0.05mg /cm^2. Further studies to assess these acaricides on different surfaces at different times of exposure are ongoing. Treated surfaces will be evaluated after 2, 4, 6, 8 and 10 weeks of application to find the chemicals that are potent after many days of exposure. The information from these experiments will provide baseline data on which other exclusion programs will be built on to control ham mites in ham plants.

50. Feast or famine: Food availability affects the growth, development, and survival of *Cochliomyia macellaria* (Fabricius), secondary screwworm

Eric Bright (brighte@ou.edu) and Heather R. Ketchum, Univ. of Oklahoma, Norman, OK

Forensic Entomologists determine postmortem interval (PMI), time since death, for decedents in criminal cases. This determination requires use of blowfly development data collected during laboratory studies and hence consistency in methods in forensic entomology laboratories. One of the best practices used by forensic entomologists is the food source used to rear maggots. Pork, beef liver, and chicken are the standard food sources. However, there is no best practice for developmental studies in terms of food quantity. Hence, we sought to determine if there was a need to implement best practices for the quantity of food for developmental studies that use the data to determine PMI. We examined the effects of food quantity on *Cochliomyia macellaria* (Diptera:Calliphoridae), secondary screwworm, maggot, pupal, and adult length and weight, as well as adult eclosion, egg weights and adult survival. We placed 0.6g (approximately 4700 eggs) of *C. macellaria* eggs on three different treatments of blended liver (125g, 250g, and 500g). Maggots reared on the greatest quantity of food weighed more in all life stages (larva, pupa, and adult) and had greater adult eclosion. The amount of food ingested by the maggots did not affect the total egg weight laid as adults. The larval, pupal, and adult lengths, as well as adult survivorship is pending, as this study is ongoing. The significant differences in larval, pupal and adult weights, indicates the need for food quantity implementation as best practices for blowfly developmental laboratory studies, especially those studies where the data will assist in PMI determination.

51. Incidence of the brown dog tick, *Rhipicephalus sanguineus* and its parasitoid, *Ixodiphagus hookeri* on dogs in South Texas

Alejandro Vasquez (alejandro.vasquez.pi@iblamar.org), Univ. of Texas Rio Grande Valley, Edinburg, TX

The southern cattle fever tick, Rhipicephalus microplus, is a livestock pest worldwide, including South Texas, and can vector Babesia spp.; the causal agents of bovine babesiosis. Its congener, the brown dog tick, Rhipicephalus sanguineus, is also common worldwide and is frequently parasitized by a wasp, Ixodiphagus hookeri. To better understand the life history and host location cues of parasitic wasps of ticks, which supports the cattle fever tick eradication program for R. microplus, we examined the incidence of R. sanguineus and its parasitoid I. hookeri. Dogs in Hidalgo County, TX were observed (n=624) from Oct 2018 to April 2019. Our results show that the sampled dogs had very low levels of R. sanguineus (1.89%) with 219 nymphs, and no parasitoids were recovered. We also found that R. sanguineus nymph incidence is significantly higher on female dogs and puppies than other classes of dogs.

Regular Ten Minute Paper Session III - P-IE

53. Do pollinators prefer pesticide-free plants? Experimental test with monarchs and milkweeds

Paola Olaya Arenas (polayaar@purdue.edu), Michael Scharf and Ian Kaplan, Purdue Univ., West Lafayette, IN

Hundreds of recent studies have voiced concern over the negative impacts of non-target pesticides on pollinator health. However, pesticide loads are highly variable across agricultural landscapes and it is unclear whether pollinators exhibit behavioral responses (e.g., aversion) that mediate their exposure risk under realistic foraging environments. We tested whether monarch butterfly (*Danaus plexippus*) adults and larvae base their oviposition and foraging decisions, respectively, on the presence and concentration of pesticide residues on their milkweed host-plant, *Asclepias syriaca*. Using a published two-year dataset that quantified pesticides on milkweeds bordering corn or soybean fields, we simulated field-realistic levels for six of the most commonly detected pesticides—one insecticide, two herbicides, and three fungicides—either alone or in combination. Butterflies placed fewer eggs on milkweeds treated with a cocktail containing four out of the six pesticides at mean concentrations above the ones in the field. Data from the field were consistent with this pattern. Neonate (1st instar) larvae also showed a preference for pesticide-free leaves in paired disc assays for most compounds tested, with feeding aversion observed at both mean and maximum concentrations. Later instars showed

feeding deterrence to leaf discs treated with acetone (pesticides solvent) but not with pesticides. Our data provide evidence that monarchs are capable of adaptively adjusting their oviposition and foraging behaviors based on which pesticides are present on their host-plants and the larvae stadia.

54. Creating education programs to address agribusiness professional's perception of pesticide effects on non-target species and the environment

Matt Hamblin (mkhamblin@ksu.edu)[1], Sarah Zukoff[2], Kun Yan Zhu[1] and Brian Spiesman[1], [1]Kansas State Univ., Manhattan, KS, [2]Kansas State Univ., Garden City, KS

In the United States, the number of agricultural acres that are treated with pesticides continue to increase annually. While the application of pesticides can often be necessary for the protection of agricultural commodities, there are often unanticipated short- and long-term effects on non-target species of arthropods and the environment, including the upper levels of the food chain. Unfortunately, we have found that there are gaps in the general knowledge base of agribusiness professionals when it comes to the effects of pesticides on beneficial arthropod species and the environment. Our goals are to identify these knowledge gaps as they relate to different groups of agribusiness professionals in Kansas and focus on the human perception of the direct effects (including mortality), indirect effects (including reduced fecundity) of non-target species and the long-term effects of pesticides in the environments surrounding farm landscapes. We will use surveys to quantify the initial levels of base knowledge and identify potential knowledge gaps surrounding pesticide usage and non-target effects. Identifying these knowledge gaps will allow us to develop continuing education programs and quick reference materials for agribusiness professionals that will work in conjunction with current pesticide applicator education programs.

55. Impact of arthropod predators on cotton aphid abundance in Texas High Plains cotton

Dol P. Dhakal (dol.dhakal@ag.tamu.edu), Megha N. Parajulee, Abdul Hakeem and Ziyan NanGong, Texas A&M AgriLife Research and Extension Center, Lubbock, TX

The aphids monitoring study was conducted in Texas A&M AgriLife Research Farm in the late planting (June 7, 2019) cotton field in Lubbock. 5 Plants were selected and caged, and another 5 plants were selected and tagged from each three water labels (High, Low and Dry). Approximately 50 aphids were released in each caged and tagged plants totaling 30 plants for this study. The cotton aphid, Aphis gossypii Glover, prevalence was found greatly depending on the presence or absence of Predacious lady beetle, Hippodamia convergens Guerin-Meneville, in cotton field. When the plants were caged, there is no activities of predators and found significant numbers of aphids whereas the plants without caged and released same number of aphids were found free of aphids after couple of weeks.

56. Diversity and dynamics of honey bee pollen forage across an urbanization gradient

Rodney Richardson (rtr87@yorku.ca)[1], Tyler D. Eaton[2], Chia-Hua Lin[2], Garrett Cherry[2], Reed Johnson[3] and Douglas Sponsler[4], [1]York Univ., Toronto, ON, Canada, [2]The Ohio State Univ., Columbus, OH, [3]The Ohio State Univ., Wooster, OH, [4]Pennsylvania State Univ., Univ. Park, PA

Despite widespread agreement concerning the importance of local landscape composition in shaping pollinator health and fitness, few studies have investigated how pollinator foraging ecology relates to variation in land use. In this work, we sampled honey bee-collected pollen from late spring to late fall over two seasons at four apiaries situated along an urban-agricultural land use gradient in central Ohio, USA. Using molecular pollen analysis, we characterized the taxonomic composition of these samples and tested for associations between urbanization, forage diversity and temporal turnover.

57. A comprehensive review of maternal age effects on offspring fitness in insects

Shannon Murphy (Shannon.M.Murphy@du.edu), Claudia Hallagan and Robin Tinghitella, Univ. of Denver, Denver, CO

Parental age can affect offspring fitness across taxa and through various mechanisms. However, the effects of advanced maternal age on offspring fitness, particularly in insects, has not been reviewed since 1964, at which time aging research was only available for a single insect species. With such limited information, it has been impossible to draw conclusions in insects about how maternal aging affects their offspring. Here we review what fitness effects have been measured and the results of maternal aging studies in insect systems from 75 papers that have been published in the last 55 years. We analyze which taxonomic orders were represented in the current literature, how authors measured offspring fitness, how offspring fitness is affected by advanced maternal age, and important features of the experimental design that the authors implemented. We found that maternal age generally has a negative effect on offspring fitness, but that these negative results were often confounded with other aspects of the experimental design, like using heavily inbred populations or failing to control for paternal age. Thus, the negative trend may not solely be due to maternal age effects. We found that certain taxa, life stages, or fitness measures are underrepresented in the literature, highlighting opportunities for improvement in the maternal aging field. Numerous challenges exist in aging research and we offer suggestions for future investigators to avoid past pitfalls and gain a more inclusive understanding of how advanced maternal age affects offspring fitness.

58. Community-based collaboration - implementing IRM and IPM one conversation at a time

Clinton Pilcher (clint.pilcher@corteva.com), Corteva Agriscience, Johnston, IA

In 2019, ESA and WSSA hosted the Science Policy Experience in Iowa. Very diverse stakeholder groups convened to discuss the socio-economic influences on decision making related to pest resistance management. The learning's from this event will be discussed in the context of two key insect pests, corn rootworm and corn earworm. Implementing resistance management (RM) and IPM can be very difficult. There are critical considerations that need to be considered beyond the biology of the insect or economics of the pest control options. These considerations will be discussed.

59. Buzz pollination - An alternative method of artificial pollen extraction along with studying pollination biomechanics using different buzz pollinator species

Mandeep Tayal (mandeep.tayal01@utrgv.edu)[1], Jesus Chavana[2] and Rupesh Kariyat[3], [1]Graduate Assistant, Edinburg, TX, [2]Graduate Assistant, EDINBURG, TX, [3]Assistant Professor, Edinburg, TX

Breeding programs and research activities where artificial buzz-pollinations are required have primarily relied upon using tuning forks, and bumble bees. However, these methods can be expensive, unreliable, and inefficient. To find an alternative, we compared the pollen collection efficiency of electric toothbrushes and tuning forks at three vibration frequencies- low, medium, and high and two extraction times at 3 seconds and 16 seconds- from two buzz - pollinated species (*Solanum lycopersicum* and *Solanum elaeagnifolium*). Our results show that species, and extraction time significantly influenced pollen extraction, while there were no significant differences for the different vibration frequencies and more importantly, the use of a toothbrush over tuning fork. More pollen was extracted from *Solanum elaeagnifolium* when compared to *Solanum lycopersicum*, and at longer buzzing time regardless of the instrument used. Furthermore, the field data collected on buzz pollination biomechanics showed an interesting buzzing pattern from different but related pollinator species. We found multiple buzzing lags within their single visit, and different bee species varied in their buzzing time, frequency and duration of visit. Taken together, understanding the biomechanics of buzz pollination in relation to body mass, length of buzzing time and pollinator species are critical for understanding of the reproductive ecology of buzz pollinated plant species that are about 6% of all flowering plants.

60. Development of a laboratory assay to determine susceptibility of Western corn rootworm larvae to soil-applied insecticides

Ram B. Shrestha (shrestrb@iastate.edu) and Aaron J. Gassmann, Iowa State Univ., Ames, IA

Western corn rootworm adults have developed resistance to various insecticides. However, the larval stage is the most damaging to corn roots. We developed a soil-based insecticide assay to determine the susceptibility of rootworm larvae to various insecticides in laboratory conditions that approximate a field environment. We tested six field populations and four laboratory populations against four formulated soil-applied insecticides (Aztec 2.1G, Lorsban 15G, Force 3G, and Capture LFR) and determined their LC_{50} values. There was some variation in the level of susceptibility to soil-applied insecticides among rootworm populations. We also tested the susceptibility of third instar rootworm larvae to four active ingredients (bifenthrin, chlorpyrifos, tebupirimfos and tefluthrin) in three rootworm populations using a topical assay. The patterns of susceptibility to insecticides were mostly similar between the two assay methods although some differences were observed.

61. Electropenetrography of the CRISPR Cas9 mutant planthopper, *Peregrinus maidis* (Hemiptera: Delphacidae)

Astri Wayadande (a.wayadande@okstate.edu)[1], Marcé Lorenzen[2], William Klobasa[2], Ordom Huot[3] and Anna Whitfield[2], [1]Oklahoma State Univ., Stillwater, OK, [2]North Carolina State Univ., Raleigh, NC, [3]Texas A&M Univ., College Station, TX

Genetic alteration of insects is now a common pathway for discovery of gene function or to create designer phenotypes. CRISPR Cas9 mutation of the planthopper, *Peregrinus maidis*was done to create red-eye mutants as part of a proof-of-concept strategy that will lead to conditional lethal mutants that are still able to function as plant virus vectors. In this study, CRISPR Cas9 red-eye mutant planthoppers were electronically monitored for 6 hours by electropenetrography (EPG) and compared to wild-type planthoppers. EPG revealed no differences in waveform appearance, type, frequency or durations. Both cohorts performed typical pathway (stylet penetration) to the plant vasculature and subsequent xylem and phloem ingestion. These data suggest that mutant *P. maidis* will retain the ability to transmit the pathogen, Maize mosaic virus, to plants.

Symposia

Enhancing Ecosystem Services with Sustainable Pest Management

64. Maximizing agricultural productivity through the conservation of pollinators

Jacob Pecenka (jacob.pecenka@gmail.com), Laura Ingwell, Rick Foster, Christian Krupke and Ian Kaplan, Purdue Univ., West Lafayette, IN

Efforts towards conservation is Midwestern agroecosystems are associated with coming at a cost to productivity of agricultural products. The use of insecticides as an "insurance mentality" leads to widespread use of products without responding to pest outbreaks. This can come at a cost to beneficial insects leading to economic losses; especially in crops dependent on insect pollination for fruit set. Experimental sites across Indiana provided "a snapshot of agriculture" by surrounding watermelon plots with corn, simulating high-value specialty crops surrounded by row crops. In half the plots prophylactic insecticide use served as a conventional treatment while being contrast with plots only applying insecticides following IPM principles. Insecticides provided no benefit to yield in either crop while watermelon yields in the IPM treatment had high fruit production compared to the conventionally managed plots. This was driven by an increase in the number of visiting pollinators to IPM watermelon flowers with nearly 70% more observed visits. This illustrates that making management decisions to benefit pollinators can simultaneously provide economic advantages to growers.

65. Does integrated pest management enhance natural enemy biocontrol of cucumber beetles in commercial watermelon production?

Paola Olaya-Arenas (polayaar@purdue.edu)[1], Amanda Skidmore[2], Iván Grijalva[1], Rick Foster[1] and Steve Yaninek[1], [1]Purdue Univ., West Lafayette, IN, [2]New Mexico State Univ., Los Lunas, NM

Integrated pest management maximizes the benefit of natural enemies for managing pests while minimizing the need for non-sustainable pesticides. Natural enemies provide pest suppression services in crops that can help mitigate reliance on agrochemical inputs that pose a threat to humans and the environment. Watermelons in the US are produced in mainly 4 states on 20+ acres with an annual value of $ $14.90 per 100 pounds. Growers manage an array of pests and diseases by regularly spraying a mixture of pesticides without regard to pest numbers. Among the most important insect pests are the striped and spotted cucumber beetles (Chrysomelidae). To motivate farmers to modify their pest management practices, we evaluated the pest control services provided by the community of natural enemies found in commercial watermelon production by quantifying the ground beetles, spiders and tachinid parasitoids found in production managed with either conventional pest management (CPM) or integrated pest management (IPM) practices in 2018 and 2019. We observed higher natural enemy abundance and diversity (ground beetles) in the IPM treatments, and significant negative correlations between cucumber beetles and certain taxonomic subgroups of the spiders. Tachinid parasitism was positively correlated to cucumber beetle densities which were significantly higher in the IPM treatments. A concurrent study in the same trial found field predation to be significantly higher in the IPM compared to conventional pest management fields corroborating our findings. These results show that growers who adopt IPM practices can manage cucurbit pests and save money on unnecessary insecticide applications.

66. Using native plant mixes to promote beneficial insects

Miranda Kersten (mkersten@nmsu.edu) and Amanda Skidmore, New Mexico State Univ., Los Lunas, NM

The goal of this study is to identify native plant mixes that can be used to attract and support pollinators and other beneficial insects in New Mexico. We evaluated seven combinations of native plants designed to attract different groups of beneficial insects, such as bumble bees, solitary bees, and natural enemies. During the summers of 2018 and 2019, we conducted weekly visual observations of insect groups (ex. bumble bee, large bee, green bee, etc.) and vacuum sampling. Preliminary analysis shows that some flower species and mixes are more attractive to some beneficial insect groups than others and made provide more resources to different native bee groups.

67. Farm management decisions with repercussions for natural pest biocontrol, pollination, and human welfare

Scott Swinton (swintons@msu.edu), Michigan State Univ., East Lansing, MI

Farm management choices can strongly affect insect populations in agricultural regions. Drawing on economic research into how farmers balance income earning goals with personal ethics and social objectives, this presentation will outline why farmers manage ecosystems as they do. In particular, it will examine evidence on incentives and barriers that affect farmer decisions to adopt practices related to insects, focusing on pest control (chemical and biological), and pollinators (native and commercial).

68. The bioeconomics of integrated pest and pollinator management: The case of neonicotinoid insecticides

Linghui Wu (lw1063@wildcats.unh.edu) and Shadi Atallah, Univ. of New Hampshire, Durham, NH

Pollination services are declining globally. Among the various factors causing this decline, agricultural insecticides, especially a class called neonicotinoids, have been shown to have detrimental effects on wild and managed pollinating insects, which imposes a tradeoff between pest control and pollination. Mitigation of this tradeoff can be achieved by a combination of three strategies: (1) Moving away from preventative neonicotinoid calendar sprays and towards sprays based on integrated pest management (IPM) or integrated pest and pollinator management (IPPM) principles; (2) Renting honey bee colonies to compensate for the decline in pollination; (3) Setting aside habitat for wild pollinators who need more diverse floral resources than what intensive cropping systems can provide. Previous literature that has analyzed this tradeoff assumes that honeybees and wild pollinators are perfect substitutes in the provision of pollination services, which leads to a result of optimal wild bee extinction and full mitigation of pollination decline through honey bee rentals. However, ecological field research suggests that wild bees and honey bees are not perfect substitutes and that wild bees are more productive than honey bees. We propose to relax this assumption of perfect substitution and analyze its consequences for management. We develop a field-level spatial-dynamic model of pest control, and pollination services provision on a pollinator-dependent farm to find the optimal mix of mitigation strategies. We also provide an estimate of the negative externality generated by neonicotinoid drift from neighboring farms. We find that the yield and profit-maximizing strategy consists of scouting-based spraying, setting aside unproductive land for habitat and renting honey bee colonies. These results suggest that considering pollinators health and pollinator diversity that are necessary to achieve maximum yields are more cost-effective, compared to renting honeybee colonies alone without investing in wild pollinator health, as suggested elsewhere in the literature. We find that the external neonicotinoid damages from neonicotinoid aerial drift from a neighboring field amount to a 25.8% decrease in a farmers net present values, compared to a case with no pesticide drift. We also find that the IPPM spraying threshold increases in presence of aerial neonicotinoid drift.

70. The benefits and perceived risks of wooded hedgerows

Hannah Penn (hannahjpenn@gmail.com), Univ. of Texas, Edinburg, TX

Beneficial insect conservation in agriculture is often studied in the context of integrated pest management. For instance, vegetative field edges or hedgerows may provide valuable habitat for pollinators and natural enemies of crop pests. In two related studies, we elucidated the potential role of these wooded hedgerows in relation to spider abundance and spatial association to pests within soybean fields. We also developed a survey of Kentucky soybean farmers to determine their field management practices relating to field edge management and insecticide use, as well as their opinions on how farmers influence other beneficial insects groups such as pollinators. We found that spider abundance and spider-pest spatial associations (an indication of potential predation events) within fields were positively correlated with wooded hedgerows, indicating that conservation biological control in addition to cultural control might be contributing to diminished pest abundance in fields with these hedgerows. However, in the survey, growers were hesitant to consider maintaining wooded hedgerows as habitat for natural enemies and pollinators out of concern for weed and insect pest spread. Growers also acknowledged that, nationally, farmers have an influencing role on pollinator populations and that a portion of soybean yield is due to pollinator activity they observed within crop fields. Given these data, we need to evaluate the perceived and actual trade-offs of weed and pest management in future on-farm conservation efforts for beneficial insects such as pollinators and natural enemies.

71. Re-designing agricultural landscapes: The effect of habitat on arthropod communities

Aleksandra Dolezal (adolezal@uoguelph.ca), Andrew MacDougall and Ellen Esch, Univ. of Guelph, Guelph, ON, Canada

Arthropods are critical components in agricultural landscapes, representing most of the biodiversity and provide important ecosystem services. Habitat is critical for sustaining arthropod spatial structure, but its influence in agricultural landscapes where arthropods are declining is unclear. To understand the spatial structure that influences patterns of arthropod diversity in agricultural landscapes, we investigated the effect of local cover type, farm and regional diversity of four agricultural important arthropod functional groups: predators, parasitoids, pollinators, and herbivores. In a heavily farmed area of Southern Ontario, Canada, we conducted a comprehensive survey of arthropod communities within three major habitat types of Southern Ontario farmed landscapes, including prairie grasslands, crop fields, and woodlots. We analyzed multiple diversity components (alpha, beta, gamma diversity). Results showed a strong relationship between habitat and arthropod functional group composition. Each habitat contributed to different community composition which was a result of plant tissue quantity and quality factors within prairie cover. Overall, prairie grassland habitat had the greatest arthropod abundance and richness. From our regional species pool analysis, farm and non-farm sites revealed similar family-level richness, suggesting that conventional farms can support arthropod biodiversity if habitat is not limiting.

Regular Ten-Minute Paper Oral

Regular Ten Minute Paper Session IV - P-IE

72. Landscape-scale effects of insecticide drift on monarch butterfly (*Danaus plexippus*) populations in an Iowa agroecosystem

Tyler Grant (tgrant@iastate.edu), Niranjana Krishnan and Steven Bradbury, Iowa State Univ., Ames, IA

Spray drift from foliar insecticide application can cause mortality in monarch butterfly (*Danaus plexippus*) larvae near agricultural fields. In Iowa, foliar insecticides are used to control late season soybean aphids (*Aphis glycines* Matsumura) and early season true armyworms (*Mythimna unipuncta* Haworth). Laboratory studies conducted to determine the 96-hour larval mortality dose-response curves for beta-cyfluthrin, chlorpyrifos, imidacloprid, thiamethoxam and chlorantraniliprole indicate that larval mortality after a spray drift event may be high in downwind milkweed patches. However, landscape-scale effects on monarch populations have not been estimated. We combined several tools to estimate the effect of spray drift on a landscape-scale monarch population in Story County, Iowa. An agent-based model simulated the number of eggs laid on the landscape. Monarch populations were projected to the adult stage using new life-stage specific survival rates from a recently developed Bayesian model. In areas subject to spray drift, the egg population was projected to a realistic mix of instars and then a spray drift event was simulated. Mortality rates from laboratory studies were applied to the population and the surviving larvae were projected to adult stage. To assess the risks and benefits of augmenting milkweed habitat in agricultural landscapes, we analyzed four augmentation scenarios with two factors: 1) maximum or realistic milkweed habitat establishment on the landscape and 2) milkweed establishment within or outside a 38m buffer surrounding agricultural fields. Our results indicate that despite some mortality from spray drift, augmenting milkweed adjacent to agricultural fields results in a net benefit to monarch populations.

73. Four years of West Texas efficacy trials on the BASF experimental insecticide, Sefina, for sugarcane aphid, *Melanaphis sacchari*, control in High Plains grain sorghum

Blayne Reed (blayne.reed@ag.tamu.edu)[1], Suhas Vyavhare[2], Patrick Porter[3], Adam Hixson[4] and Jacob Reed[5], [1]Texas A&M Univ., Plainview, TX, [2]Texas A&M AgriLife Research and Extension Center, Lubbock, TX, [3]Texas A&M AgriLife Extension, Lubbock, TX, [4]BASF, Lubbock, TX, [5]BASF, Wolfforth, TX

Between 2016 and 2019, the BASF product, Safina, was evaluated for efficacy on the sugarcane aphid, Melanaphis sacchari, in West Texas during 5 separate small plot CRBD trials at the Halfway Experiment Station and Helms Farm in Hale County. Safina was evaluated for: aphid control and plant phytotoxicity at differing rates, with differing surfactants at differing rates, against its potential contemporary products Transform and Sivanto, on differing varieties and types of sorghums with varying levels of aphid resistance, with differing application techniques, including chemigation, all while utilizing the Texas High Plains post boot stage ET for sugarcane aphids of 30% infested plants. While representing a unique sugarcane aphid MOA compared to its contemporaries, Sefina in all trials and all rates and with or without surfactant outperformed the untreated check and, in many cases, outperformed Transform. In all trials, the higher rate of Sefina with a higher rate of surfactant performed statistically similar to the best treatment (all $P<0.05$). This includes a 2017 chemigation trial where Sefina performed equal to all other chemigation treatments, which all outperformed all other methods of application in aphid control and yield. At no point in any trial, on any type of sorghum, including the 2019 trial on sweet sorghum, was any phytotoxicity or damaging impact on beneficial insect populations noted from Sefina. Pending EPA labeling targeted during the summer of 2020, Sefina should be considered as a viable sugarcane aphid chemical control option.

74. Parasitism of a novel host, *Diatraea indigenella* (Lepidoptera: Crambidae), by the gregarious parasitoid *Cotesia flavipes* (Hymenoptera: Braconidae)

Carolina Londono-Sanchez[1], James Montoya-Lerma[2], **J. P. Michaud** (jpmi@ksu.edu)[3] and German Vargas[4], [1]Universidad de Valle, Cali, Colombia, [2]Universidad del Valle, Cali, Colombia, [3]Kansas State Univ., Hays, KS, [4]Colombian Sugarcane Research Center, Cali, Colombia

Cotesia flavipes Cameron (Hymenoptera:Braconidae) is often augmented against *Diatraea* spp. (Lepidoptera: Crambidae) stem borers in the Americas. *Diatraea indigenella* Dyar and Heinrich, an endemic pest of sugarcane in southern Colombia, represents a novel host for *C. flavipes*. We examined the development of *C. flavipes* on *D. indigenella* and *D. saccharalis*, a familiar host, when larvae were stung by one, two or three wasps. Host species had no effect on parasitism success, immature parasitoid mortality, parasitoid developmental time, adult emergence, or female size. Superparasitized *D. indigenella* hosts yielded more cocoons, more adults, and more female wasps than those parasitized with a single sting, or from *D. saccharalis* hosts. However, wasp survival and longevity declined when host larvae were stung three times. Thus, *D. indigenella* was a more suitable host for *C. flavipes* when superparasitized, and appears suitable for augmentation against this emergent pest and other *Diatraea* species attacking sugarcane.

77. Soybean gall midge: Impact of infestation at different plant developmental stages

Débora Montezano (deiagm@gmail.com)[1], Anthony McMechan[2], Robert Wright[1] and Thomas Hunt[3], [1]Univ. of Nebraska, Lincoln, NE, [2]Univ. of Nebraska-Lincoln, Ithaca, NE, [3]Univ. of Nebraska, Concord, NE

Soybean gall midge (SGM) (*Resseliella maxima* Gagne) was recently identified as a new species in 2018 and has been causing injury to soybean since then. Five Midwestern states have already reported the occurrence of this pest. Due to the recent discovery and rapid development as a pest, knowledge on behavior, biology and pest interaction with soybean is largely unknown. Such information is necessary to develop an IPM program. To better understand insect infestation relative to plant development stages, a study was conducted in Nebraska, consisting of five planting dates beginning in early May separated by a period of two weeks each. Adult SGM activity was monitored throughout the entire season. Evaluations were made on July 12th and July 26th, 24 and 40 days after overwintering adult emergence. Plots were evaluated for infestation; yield components and whole plot yields. First evaluation after overwinter emergence shows significantly greater infestation on first and second planting date coinciding with plants that were at or after V2 and V3 stage. Second evaluation presented significantly less infestation only for the 5th planting date, and injury was observed in all plots regardless of planting date by the end of the season, most likely related to a small plot design. Results show that early plant development stages (V2 and V3) can play an important role in determining SGM infestation. Such information will provide stakeholders with an understanding of the risk and value plant development stages have for SGM infestation as part of IPM program.

78. The very hungry caterpillars: Influences of tillage and rotation on plant-insect interactions

Emily Althoff (era2n4@missouri.edu) and Kevin Rice, Univ. of Missouri, Columbia, MO

Tillage and crop rotation are important practices in maintaining soil health and nitrogen content. As nitrogen is a limiting factor to plant and insect growth, changes in soil nitrogen will likely affect plant-insect interactions. Practices that promote soil health such as no-till, to reduce soil erosion, and rotation, to increase soil nitrogen, have been widely adopted in recent years. However, changes in management practices could affect insect herbivory. The plant vigor hypothesis predicts herbivores prefer vigorous plants growing in fertile soil, whereas, the plant stress hypothesis predicts increased herbivore performance on stressed plants. We examine the effects of long-term no-till, annual till and crop rotation on plant defense, foliar nitrogen content, and photosynthetic capacity. Additionally, we compare herbivore growth and consumption on soybean and corn growing in these soil treatments.During 2018 field trials, we found fall armyworm and soybean looper feeding on continuously planted, tilled soybean had greater relative growth and consumption rates than those feeding on rotated, no-till soybean. Our results provide additional benefits for adopting no-till and rotation in field crops.

79. Synergism between local and landscape-level pesticides reduce wild but not honey bee floral visitation in pollinator-dependent crops

Elias Bloom (bloomel1@msu.edu)[1], Thomas Wood[1], Keng-Lou Hung[2], John Ternest[3], Laura Ingwell[3], Ashley Leach[4], Karen Goodell[5], Ian Kaplan[3] and Zsofia Szendrei[1], [1]Michigan State Univ., East Lansing, MI, [2]The Ohio State Univ., Columbus, OH, [3]Purdue Univ., West Lafayette, IN, [4]Cornell Univ., Geneva, NY, [5]The Ohio State Univ., Newark, OH

1. Threats to pollinators posed by pesticides are well known under laboratory conditions. However, the population-level response of pollinators to pesticide use in agroecosystems is not well established, nor is it clear whether pesticides used across agroecosystems can synergize resulting in non-additive, exponential, declines in plant-bee interactions.
2. Here, we evaluated if fungicides and insecticides posed a hazard to wild and honey bees at 87 cucurbit—pumpkin, cucumber, watermelon—farms in the Midwestern United States. We also tested the relative importance of and potential for interactions between local (i.e., focal cucurbit field) and landscape-level (i.e., surrounding corn, soybean, and other crops) pesticide exposure to influence the frequency of wild and honey bee visitation to cucurbit flowers.
3. We found that bees were exposed to pesticides above regulatory levels of concern for both insecticides and fungicides. However, synergisms between only a select few local insecticides and landscape-level fungicides reduced wild bee-plant interactions. Importantly, honey bee foraging was not influenced by any of the pesticides at either spatial scale.
4. *Synthesis and applications*: Our findings suggest that, while pesticides may ultimately pose a hazard to managed pollinators, they are less likely to affect short-term foraging rates compared with wild bees in pollinator-dependent crops. More broadly, our research indicates the need for changes in pesticide use at large spatial scales to promote crop pollination by wild bees.

Keywords: pesticides, synergisms, pollinators, honey bees, wild bees, landscape-scale, agroecosystems

80. Influence of aerosol application methods on spatial variability in the efficacy of methoprene against late larvae of *Tribolium confusum* and *Trogoderma inclusum*

Srinivas Lanka (slanka@ksu.edu)[1], James Campbell[2], Frank Arthur[2] and Kun Yan Zhu[1], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS

Aerosol insecticides are widely used in food industry to suppress insect activity inside facilities such as mills, processing plants, and warehouses; however, the spatial pattern in the efficacy of aerosol treatments can be influenced by several factors such as duration of spray release, spray release distance from the wall and the type spray nozzle employed. Present studies were conducted to understand how these factors will influence the spatial pattern in the efficacy of methoprene IGR formulated for cylinder release (Turbocide ® Advanced Fogging Product) by spraying in an enclosed room of a building (21.0 x 4.5 x 6.7 m) at USDA-CGHAR during September-October, 2019. Different treatments employed in this experiment were two spray release distances (9.1 m and 18.2 m), two types of spray nozzles (fan and cone) and three spray release durations (1, 4 and 12 s) in four replicates for a total of 48 spray trials. The spatial pattern in the efficacy of methoprene aerosol treatments was measured against late larvae of the confused flour beetle, *Tribolium confusum* and the larger cabinet beetle, *Trogoderma inclusum* by employing concrete arenas for an exposure time of one hour in nine different locations along the transect down the middle of the room. All bioassays were conducted one week after the application of each aerosol spray. Multi-way analysis of variance on efficacy index by using generalized linear mixed model in SAS revealed significant effects of nozzle type, duration of spray and spatial position of arenas; however, the influence of spray release distance was marginally significant.

81. Evaluating the effects of insecticide use on predation in watermelon systems / Evaluando los efectos del uso de insecticidas sobre predación en producción de sandía

Iván Grijalva (grijalva@ksu.edu)[1], Amanda Skidmore[2], Steve Yaninek[3] and Ricky E. Foster[3], [1]Kansas State Univ., Manhattan, KS, [2]New Mexico State Univ., Los Lunas, NM, [3]Purdue Univ., West Lafayette, IN

Commercial watermelon (*Citrullus lanatus*) production in the Midwest typically relies on neonicotinoid and pyrethroid insecticides to manage insect pests, particularly for striped and spotted cucumber beetles (*Acalymma vittatum* and *Diabrotica undecimpunctata howardi* Barber, respectively). Common cucumber beetle predators include coccinellid beetles found on plants, ground-dwelling carabid beetles (Coleoptera: Carabidae) and lycosid spiders on the soil surface. However, these predators and the ecosystem services they provide (e.g., pest predation) are at risk from pest management practices used without regard to economic pest threshold levels. Our study compared field predation under two treatments 1) watermelons treated with neonicotinoid soil drench at planting followed by regular pyrethroid sprays surrounded by neonicotinoid treated corn seeds (Conventional Pest Management - CPM), and 2) watermelons treated with pyrethroid sprays only when economic pest thresholds were reached surrounded by untreated corn seeds (Integrated Pest Management - IPM). We measured field predation in three locations across the state of Indiana during the 2019 growing season. Waxworm larvae (*Galleria mellonella*) and adult striped cucumber beetles (*Acalymma vittatum* F.) were used as surrogate prey to measure field predation in replicated 24-hour assays through the season. Insecticide inputs significantly decreased cucumber beetles managed with CPM treatment; however, field predation was higher in the fields managed with IPM. While the source of the field predation observed in these studies remains to be determined, the final research objective was to provide pest management recommendations to growers that maximize insecticide efficacy while minimizing their negative impacts on natural enemies and their ecosystem services.

Regular Ten Minute Paper Session V - P-IE

83. Root symbionts boost grass defense against fall armyworm (Spodoptera frugiperda; Lepidoptera: Noctuidae)

Chase Stratton (stratton@landinstitute.org)[1], Swayamjit Ray[2], Jason Kaye[2], Jared Ali[3] and Ebony Murrell[4], [1]The Land Institute, Salina, KS, [2]Pennsylvania State Univ., Univ. Park, PA, [3]Univ. of Florida, Lake Alfred, FL, [4]Univ. of Wisconsin, Madison, WI

The majority of land plants form symbiotic relationships with arbuscular mycorrhizal fungi (AMF). Research with corn (*Zea mays*) has demonstrated that AMF associations can increase induced plant defenses to insect herbivory. While we know that AMF affect plant chemistry both by taking up additional soil nutrients (e.g. N and P) and via their chemical and physical interactions with plant roots, we do not know which of these mechanisms directly or indirectly increase plant induced defense response. To test whether plants with AMF are more resistant to herbivory because of the influx of nutrients and/or physical presence of AMF, we manipulated N and P fertilizer regimes for corn, annual sorghum, and perennial sorghum plants grown with or without AMF. Plants of V5 stage were infested with fall armyworm (*Spodoptera frugiperda*) for 24 hours. Data collections included general plant characteristics (e.g. height, number of leaves), qt-PCR (changes in transcript abundance) of genes along the jasmonic acid pathway (*RIP2, MPI, LOX3*), plant N and P nutrient analyses, and mean change in herbivore mass per plant. Preliminary results indicate that corn and sorghum are taller and have more leaves when grown with AMF and excess P. Furthermore, FAW caterpillars were more cannibalistic on plants grown with AMF. Results of defense gene expressions among treatments, and links between plant nutrients, gene expressions, and caterpillar performance will also be discussed.

86. Evaluation of the *Glance n' Go* binomial sequential sampling system for sugarcane aphid *Melanaphis sacchari* Zehntner (Hemiptera: Aphididae) in grain sorghum

Thomas Hess (tmhess@ostatemail.okstate.edu), Jessica Lindenmayer and Tom Royer, Oklahoma State Univ., Stillwater, OK

The sugarcane aphid (*Melanaphis sacchari*) is a pest of sorghum in the Southern Great Plains. In 2019, a binomial, sequential sampling protocol (Lindenmayer et al. 2020) was evaluated in 39 fields in Oklahoma, Kansas and Texas for accuracy and speediness in making a treatment decision. Three plants were sampled in each of 18 stops. The stops were spaced 30 meters apart, and the field was sampled using a "U" or "V" pattern. For each plant, a low-tier leaf and mid-tier leaf was examined for the presence of sugarcane aphids. A plant was considered infested if the two-leaf sample had 50 aphids, and considered to be uninfested if the two-leaf sample had 50 aphids. The number of infested plants was recorded. The times required to: examine four stops, make a treatment decision, and examine eighteen stops were recorded. The treatment decision (to treat or not) and number of samples required to make the decision were compared to the decision reached after 18 stops. A treatment decision was made after an average of 4.25 stops and 5 minutes of sampling time. The average sampling time for 18 stops was 23 minutes. Results indicated that this protocol could save about 18 minutes of sampling time per field. In 38 of 39 fields, the decision reached agreed with the decision reached after a complete sample of 18 stops with one exception, when a "Treat" decision was changed to "Do not treat" after 18 stops.

91. Transform® WG with Isoclast™ active: A selective insecticide for management of soybean aphid in the Midwest

Laura Campbell (laura.campbell@corteva.com)[1] and Patti Prasifka[2], [1]Corteva Agriscience, Carbondale, IL, [2]Corteva Agriscience, West Fargo, ND

Soybean aphid has become a major pest of soybeans in the midwestern United States. This species causes significant economic damage leading to a reduction of plant health and yield. Synthetic pesticides represent a highly economical and effective group of tools for the sustainable control of this damaging pest. Isoclast™ active is a new and unique chemical class (Group 4C, sulfoximines) of insecticides that targets key sap-feeding insects. The paper will review key uses for Isoclast in soybeans and its safety for beneficial insects.

Student Ten-Minute Paper Competition

Student Ten Minute Paper Competition: Ph.D - MUVE

92. Determining the critical threshold of blood meal reduction to reduce general fecundity in the horn fly (Diptera: Muscidae)

Jesus Zamudio (jjfigz@nmsu.edu) and Brandon Smythe, New Mexico State Univ., Las Cruces, NM

Sustainable and reliable forms of horn fly control are increasingly scarce. Excessive dependency upon insecticidal interventions has led to cyclical issues with field performance and general efficacies of products containing various active ingredients. In response, producers and researchers alike are actively pursuing insecticidal alternatives that may bypass ineffective population control measures. Recently, proteins associated with horn fly saliva have been shown to delay host coagulation thereby reducing blood meal ingestion ultimately decreasing fly fecundity and population expansion. However, the level of reduction in response to an absence of these proteins has yet to be determined. Furthermore, the level in which horn fly fecundity may be negatively impacted remains unknown. Therefore, the objective of the current study was to quantify the effects associated with reduced blood meal acquisition in horn flies and identify a critical threshold capable of inducing general population control. Colonized horn flies were provided blood meals at rates of 100, 80, 60, 40, 20, and 0% citrated bovine blood meal. When fed water alone (0%), horn flies did not live long enough to produce eggs. In general, reduced blood meals resulted in decreased egg production. However, horn flies fed 80% bovine blood meal produced 4.96 ± 1.96 eggs more (P = 0.0301) than when fed full blood meals. Regardless, egg production was lowest (P < 0.0002) at the 20% blood meal acquisition stage. Further research is needed to refine estimates of an effective threshold and evaluate the viability of produced eggs.

93. Plant essential oil constituents synergize deltamethrin toxicity in resistant bed bugs (*Cimex lectularius* L.) by inhibiting cytochrome P450 enzymes

Sudip Gaire (sgaire@purdue.edu), Wei Zheng, Michael Scharf and Ameya Gondhalekar, Purdue Univ., West Lafayette, IN

Alternative approaches that include the use of botanical insecticides such as plant essential oils have been proposed for effective management of insecticide resistant bed bugs (*Cimex lectularius* L.). Plant essential oils are extracts from aromatic plants that contain complex mixtures of different monoterpenoid compounds or constituents. These oils are known to synergize pyrethroid toxicity against resistant mosquitoes by inhibiting cytochrome P450 (P450s) enzymes. However, the ability of essential oil constituents in synergizing pyrethroid toxicity and inhibiting cytochrome P450 enzymes has not been previously investigated in bed bugs. Using insecticide susceptible and resistant bed bugs, the objectives of this research were to (i) evaluate the efficacy of binary mixtures of monoterpenoids (carvacrol, thymol, eugenol, geraniol and linalool) and deltamethrin (pyrethroid insecticide) and (ii) study the inhibitory effects of monoterpenoids on detoxifying enzyme activities (P450s, esterases and glutathione transferases). Topical application bioassays conducted with binary mixtures of essential oil constituents and deltamethrin at the LD_{25} dose (lethal dose that kills 25% of insects) revealed that all monoterpenoids synergized deltamethrin toxicity in resistant bed bugs. Detoxification enzyme assays conducted with protein extracts from monoterpenoid pre-treated bed bugs showed that essential oil constituents significantly inhibited P450 activity (7-ethoxycoumarin *O*-deethylation) in the resistant strain, but esterase (*para*-nitrophenol acetate hydrolysis) and glutathione transferase (chloro-dinitrobenzene conjugation) activity were unaffected. In conclusion, monoterpenoids appear to synergize deltamethrin toxicity by inhibiting P450 enzymes in the resistant strain and can be utilized to overcome pyrethroid resistance in bed bugs.

94. Sub-lethal reproductive effects on *Alphitobius diaperinus* from insecticide and litter amendment treatments

Brandon Lyons (brandon.lyons@okstate.edu), Justin Talley, Tom Royer, Astri Wayadande and Blake Wilson, Oklahoma State Univ., Stillwater, OK

Alphitobius diaperinus is a cosmopolitan pest of poultry facilities. Limited availability of insecticide compounds has led to rampant resistance. While mortality may be lower for many of these treatments, it still may play an important part to the overall pest management program if it still reduces population over time. The organisms that do not succumb to insecticide applications can be inflicted with sub lethal effects that can impact their physiology such as fecundity, development rate, longevity, and immunology. Behavior changes have also been noted in various species from pesticide applications. Litter acidifiers are used to lower the pH of litter to reduce the volatilization of ammonia to improve bird health. Previous research has noted insecticidal activity from litter acidifiers, but there is a need for more knowledge about how the individuals who survive treatments are impacted long-term and if it can impact populations through reproductive losses. A bioassay of young adult lesser mealworms was conducted with several common insecticides used to control the lesser mealworm in broiler facilities as well as PLT, a common litter acidifier. Resistance Ratios (RR) were calculated for field populations compared to the susceptible colony. Surviving adult mating pairs were placed inside

a growth chamber and eggs were counted every 3 days. Percentage of Reproductive Control (PRC) was used to compare the number of eggs laid to a control group. Percentage of Ovicidal Control (POC) was also calculated by counting the number of eggs that hatched.

95. The relationship between insecticide resistance and the gut microbiome of *Blattella germanica*

Zachery Wolfe (wolfez@purdue.edu) and Michael Scharf, Purdue Univ., West Lafayette, IN

The German cockroach *Blattella germanica* is an invasive pest species notorious for its ability to resist and withstand insecticide treatments. While many mechanisms of resistance have been well-studied, little is known about the gut microbiome and how it may contribute towards insecticide resistance or susceptibility. We destructively extracted the gut of insecticide-resistant and susceptible German cockroach populations and performed gut bacterial plating. Additionally, we conducted bioassays on insecticide-resistant and susceptible German cockroach populations by combining insecticide and kanamycin treatments to determine if bacteria in the cockroach guts contribute towards insecticide resistance. Contrary to what would be expected, tolerance to abamectin, fipronil, and indoxacarb increased with antibiotic treatment in both resistant and susceptible strains of German cockroach. However, resistance ratios between resistant and susceptible populations decreased for both abamectin and fipronil when combined with antibiotic treatment. Functional enzyme assays and 16S rRNA sequencing are in progress and the results will be summarized.

96. Thermal stress of eggs differentially impacts larval emergence and survival among multiple hard tick species

Oluwaseun Ajayi (ajayiom@mail.uc.edu), Kennan Oyen and Joshua Benoit, Univ. of Cincinnati, Cincinnati, OH

Ticks are blood-feeding arthropods that serve as vectors for many pathogens that have negative impact on human and animal health and, consequently, are among the most costly ectoparasites in the world. Climate change, habitat variation, and host population shifts are among factors known to influence tick abundance and disease transmission. Of interest, extreme low and high temperatures have been shown to cause reduction in tick populations and limit distribution. However, little is known on how exposure to thermal stress during egg development alters tick survival. In this study, early and late egg stages (before and after fecal pellet observation) of *Amblyomma maculatum*, *Ixodes scapularis*, *Dermacentor variabilis* and *Rhipicephalus sanguineus* were subjected to different temperatures; which included exposure to cold-shock (-12.5 to -27.5°C), cold acclimation (0°C; then -15 to -27.5°C) and heat shock (42 to 45°C) for specific durations. Larval emergence was assessed, and subsequent survival was measured for 9 – 10 months. We found that larvae from eggs exposed to low or high temperatures, particularly those late in development, had differing survival probabilities compared to larvae from unexposed eggs. Furthermore, we show that this difference in survival probabilities is significantly dependent on the severity of treatment and tick species. This study confirms that in hard ticks, effects of stress encountered early in life as a developing embryo or pharate larvae are carried over to the next developmental stage, significantly influencing subsequent survival.

97. Temporal changes in knockdown resistance-associated mutations in bed bug populations across the United States

Cari Lewis (cdl5261@utulsa.edu)[1], Coby Schal[2], Edward Vargo[3] and Warren Booth[1], [1]Univ. of Tulsa, Tulsa, OK, [2]North Carolina State Univ., Raleigh, NC, [3]Texas A&M Univ., College Station, TX

Over the last three decades, the bed bug, *Cimex lectularius*, has made a global resurgence as a pest in human dwellings. While factors such as global trade and international travel have been implicated in the resurgence, the evolution of insecticide resistance mechanisms has likely played a considerable role. Knockdown resistance (*kdr*) to pyrethrin, pyrethroids, and organochlorides, was first reported in bed bug populations within a few years following the widespread use of dichloro-diphenyl trichloroethane (DDT) for insect control. The molecular mechanism for this has been linked to mutations within the voltage-gated sodium channel gene. The frequency and distribution of two of these mutations (V419L, L925I) has previously been reported in the United States, however contemporary data is lacking; hence a study of the current state of resistance in the United States is warranted. Here, we report on the temporal change in the frequency and distribution of the V419L and L925I mutations over a ten-year period (2009 - 2019) within the United States, and show a dramatic shift towards insecticide resistance-associated *kdr* haplotypes. The proliferation of *kdr*-associated resistance among bed bug populations indicates a high selective pressure has been imposed by pesticide use, resulting in the need for alternative management strategies.

98. Exposure to a reduced-risk insecticide on maize reduces movement by the stored product pests, *Prostephanus truncatus* and *Sitophilus zeamais*

Hannah Quellhorst (hquellho@ksu.edu)[1], Frank Arthur[2] and Rob Morrison[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS

Every year, 10–30% of cereal crops such as maize, are lost to insects after harvest. The two major stored products pests of maize are the larger grain borer (*Prostephanus truncatus*) and the maize weevil (*Sitophilus zeamais*). The weight loss in grain from *P. truncatus* and *S. zeamais* is about 34–40% and 10–20%,

respectively. With the phase-out of the most effective fumigant (methyl bromide), and a stark rise in resistance to the primary remaining fumigant (phosphine), there is a critical need to develop diversified pest management programs for the post-harvest supply chain. Evaluation of reduced-risk insecticides may combat the loss of fumigants by providing additional chemical control tools in the toolkit of stakeholders. In this study, we investigated the efficacy of a new reduced-risk insecticide, containing the insect growth regulator (IGR), methoprene, combined with the pyrethroid, deltamethrin and the synergist piperonyl butoxide (Central Life Science, Schaumberg, IL, USA), at inducing mortality and sublethal changes in movement on treated grains. Mortality of adults was assessed visually, while movement was tracked with a network camera coupled with Ethovision software that automatically recorded velocity and distance moved by insects. The novel formulation significantly induced mortality and reduced movement for exposed adults compared to controls. In fact, the novel formulation was just as effective as an older formulation and may be more cost-effective. Overall, the novel reduced-risk insecticide is a promising tool for controlling these species in bulk storage of grain.

99. Raising the “anty” in decomposition ecology: Effect of vertebrate carrion on fire ant colony performance

Constance Lin (clin75@tamu.edu), Aaron Tarone and Micky Eubanks, Texas A&M Univ., College Station, TX

Insects are one of the most important facilitators of vertebrate carrion decomposition. Decaying flesh is usually associated with the conspicuous flies and beetles as they are prolific biomass consumers, some can be primary colonizers, and they play obvious roles in decomposition ecology and forensic entomology. In current literature, ants are not usually associated with vertebrate carrion. However, after conducting a literature review, it was revealed that over 150 ant species have been observed to visit vertebrate carrion. Though ants seem to be actively removing tissue and consuming exuded liquids, there is no definitive consensus on how ants are utilizing these resources. The function and significance of ants recruiting to vertebrate carrion is also poorly understood. We conducted controlled laboratory experiments to determine whether a dietary supplement of vertebrate carrion is beneficial to colony performance (i.e. survival, brood production, lipid stores). Our results suggest that dietary supplement of vertebrate carrion does not increase overall colony performance with lower survival rates, brood production and lower lipid stores.

Student Ten Minute Paper Competition: Ph.D - PBT & SysEB

100. Biorational tick repellents: Differences in response by species

Colin Wong (cwong1@iastate.edu), Kylie Crystal and Joel Coats, Iowa State Univ., Ames, IA

Purpose: Ticks are a major vector of arthropod borne diseases in the US and around the world. Several diseases including Lyme (*Borrelia burgdorferi*) and Rocky Mountain Spotted Fever (*Rickettsia rickettsii*) are spread to humans by ticks and cause thousands of infections each year in the United States. The use of personal repellents such as DEET on the clothes and skin is a way to prevent disease spread by ticks. However, consumers are seeking new “green” alternatives to current repellents. This study evaluates “green” biorational chemistries for their effectiveness as repellents on two species of ticks. Methods: Ticks of two species, *Dermacentor veriabilis*, and *Ixodes scapularis*, were tested. Potential repellent chemicals were dissolved in acetone and applied to a surface with a space cut out of the center. Ticks were placed in the untreated center of the Petri dish whereupon they had to cross the repellent treated surface to escape. Time until the ticks crossed onto the treated surface was recorded and compared. Results: For both species, several biorational compounds had significantly greater repellent time than the vehicle control and even the positive control, DEET. *I.s*. ticks were significantly more responsive to the repellent than *D.v*. ticks, sometimes up to 100 times more sensitive. Conclusions: Biorational molecules, based on terpenes from natural plant oils, show promise as personal repellents against ticks. A product using those could be a consumer friendly tool against the spread of vector borne disease.

101. Determining how honey bee (*Apis mellifera*) nurse visitation rates and brood type might facilitate larval cell invasion by the mite *Varroa destructor*

Taylor Reams (tdreams@tamu.edu) and Juliana Rangel, Texas A&M Univ., College Station, TX

Parasitization of honey bees (*Apis mellifera*) by the mite *Varroa destructor* is one of the main causes for the decline of honey bee health. To begin its reproductive cycle, a gravid female mite enters the comb cell of a bee larva just before it is capped, undergoes development and reproduction within the pupal cell, and exits the cell (along with its offspring) as the adult bee emerges. Investigating how *Varroa* finds and selects its larval bee host for reproduction is crucial for understanding how mite parasitization can lead to colony collapse, which occurs if colonies are kept untreated. In this ongoing study, we are measuring nurse bee visitation rates for both drone and worker larvae to determine whether and how visitation rates and larval type affect the likelihood of *Varroa* invasion. This study will uncover the behavioral and chemical factors that influence

Varroa cell invasion, providing the foundational knowledge for future mite control efforts.

102. Osmoregulation and thermoregulation in *Amblyomma americanum:* The lone star tick sucks and sweats!

L. Paulina Maldonado-Ruiz (lpmaldonado@ksu.edu)[1] and Yoonseong Park[2], [1]Kansas State Univ., Manhattan, KS, [2]Dept. of Entomology/Kansas State Univ., Manhattan, KS

Lone star ticks (*Amblyomma americanum*) are very common in the Midwest and eastern United States and vectors of diseases to humans and animals worldwide. Although they are important blood-feeding ectoparasites, they spend over 90% of their life time off of the host. Their survival during non-feeding periods largely depends on the osmoregulation. Major mechanisms involved in osmoregulation studied in our laboratory include; drinking water, sweating through the dermal glands, and excretion. We also observed that they excrete liquid through their numerous dermal glands located under the cuticle, which is similar to "sweating" in higher animals. This response was observed after mechanical stimuli and exposure to high temperatures, thus we hypothesize that ticks utilize evaporative cooling at the expense of water loss. To avoid desiccation by the loss of water, ticks drink water as a compensatory mechanism to maintain water homeostasis. Using water drinking biology as delivery route for a combination of environmentally friendly inorganic compounds (phosphate-rich solution); we were able to achieve 100% tick mortality at 3 days post-treatment. In addition, we identified that sweating is elicited by serotonin and the process is inhibited by ouabain (Na/K-ATPase inhibitor) revealing molecular components involved in the sweating response. Combinatory effect of induction of sweating and feeding solution were found to be efficiently killing ticks. We are currently working on the molecular components involved in sweating mediated through the dermal glands. Combining these two strategies, induction of sweating and dehydration by phosphate-rich solution, we aim to disrupt water homeostasis leading to tick death.

103. Surveying termite communities in primary and secondary neotropical rainforest

Mark Janowiecki (janowiecki@tamu.edu) and Edward Vargo, Texas A&M Univ., College Station, TX

Termite diversity and abundance is greatest in tropical rainforests. However, rainforests are quickly disappearing, and more than half of current rainforest land is secondary growth. While a portion of the fauna is able to quickly return, some species require decades to recover. In this study, we quantify the termite species diversity in primary and secondary tropical rainforest plots to determine if termite diversity can recover in secondary forests. Using standard transect methods, we collected from three 100 x 2 m transects of primary and secondary (30-40 years old) forests in La Selva Biological Station, Costa Rica. In each transect, tree size, leaf litter depth, and tree density were measured. Termites were identified morphologically and genetically with 16S mtDNA sequencing. We found 17 species of termites from three families (Kalotermitidae, Rhinotermitidae, and Termitidae). Tree density was lower in primary forests than secondary forests ($P = 0.0005$), but there was no difference in tree size or leaf litter depth. Generally, there were more soldier-less soil feeding termites (Apicotermitinae) in the primary forest and more nozzle-head termites (Nasutitermitinae) in the secondary forest. One species of drywood termite was only found in the primary plots, while a different drywood termite species and two nozzle-head termite species were only found in the secondary forest. Overall, the termite communities in primary and secondary forests are different and some species are exclusively found in one type of forest. However, the general species composition does rebound after 30-40 years of regeneration.

104. Identification and expression profile of putative double-stranded RNA-degrading enzymes in the biting midge, *Culicoides sonorensis* (Diptera: Ceratopogonidae)

Cameron Osborne (cjosborne@ksu.edu)[1], Lee Cohnstaedt[1,2] and Kristopher Silver[1], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS

The biting midge, *Culicoides sonorensis*, is a vector of livestock pathogens that are not only detrimental to herd health, but impact animal trade. Broad-spectrum insecticides have typically been used to control these insect pests, but the increasing incidence of insecticide resistance limiting insecticide efficacy, as well as off-target effects on beneficial insects and aquatic ecosystems are constant worries for commercial livestock farmers. RNA interference (RNAi) offers the potential of a highly specific, environmentally benign control method to supplement those already in place for livestock pests. Unfortunately, the efficiency of RNAi is limited in many insect taxa, including *Culicoides*, and a better understanding of mechanisms that limit the efficiency of RNAi are needed. In particular, degradation of double-stranded RNA (dsRNA) by dsRNases limits RNAi efficiency in many insect species, though little is known about the contribution of these enzymes to RNAi efficiency in *C. sonorensis*. Accordingly, we used bioinformatic techniques to identify three putative double-stranded RNases in *C. sonorensis* and subsequently evaluated their expression in different tissues and life stages using qRT-PCR to help determine their role in limiting RNAi efficiency. Our efforts provide a foundation for understanding the limitation of RNAi in dipteran insects as well as for developing strategies to enhance RNAi in *C. sonorensis* for use in future control strategies.

105. Estimating risks of insecticide exposure on different life stages of monarch butterfly (*Danaus plexippus*)

Niranjana Krishnan (nkrish@iastate.edu), Melanie Aust, Joel Coats and Steven Bradbury, Iowa State Univ., Ames, IA

North American monarch butterfly populations have declined significantly in the last two decades and its potential listing as a threatened species is currently under review. To increase the eastern monarch population, milkweed species (*Asclepias* species) need to be established in agricultural landscapes of the U.S. Midwestern states. As insecticides are often used in corn and soybean production, it is important to assess the risks of insecticide exposure on monarchs at the crop field and landscape scales. Monarch eggs, larvae, and pupae could be topically exposed to spray drift from foliar insecticide applications. Monarch larvae could be orally exposed to insecticide residues on or in milkweed leaves following use of foliar and seed treatment insecticides. Monarch adults could consume nectar from wildflowers that contain systemic insecticides. To assess risks from different routes of exposure and to different life stages, we have undertaken toxicity bioassays with six representative insecticides used in corn and soybean: beta-cyfluthrin (a pyrethroid), chlorpyrifos (an organophosphate), chlorantraniliprole (an anthranilic diamide), and imidacloprid, clothianidin, and thiamethoxam (neonicotinoids). Generated dose-response curves were compared with exposure estimates from a spray drift model (AgDRIFT) and residues from milkweed and nectar plants sampled near treated agricultural fields. These derived field-scale risk assessments were incorporated into a population model to predict the number of adult monarchs recruited at the landscape-scale. This research will help inform the conservation costs and benefits of establishing milkweed habitat in Midwestern agricultural landscapes.

106. Avoiding delay tactics: Improved student insect collections by assembling the parts

Melissa Reed (mleath@okstate.edu) and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK

Every fall the Department of Entomology and Plant Pathology at Oklahoma State University offers a majors course, Insect Biology and Classification. In this course, students turn in a properly curated insect collection that is worth approximately half of the total points available in the course. In addition, students take lab practical exams to evaluate their knowledge of common insect orders and families. In past years, students worked on their insect collection throughout the semester and turned in the one large project at the end in the semester. When this class was taught in 2018, approximately 75% of the class turned in their insect collection late. We hypothesized that students turned their collection in late due to procrastination. Research has shown that breaking large projects into smaller objectives, cuts down on procrastination and increases project completion rates. As a solution, we divided the collection into three smaller insect collections that had due dates that coincided with lab practicals for the 2019 class. We measured student procrastination by recording the number of students who turned in collections late and student performance by grades on the insect collection and lab practicals. The 2019 students were asked to complete a questionnaire indicating their agreeance with statements using a Likert scale and answering questions about their experience working on their insect collection. In addition, students from previous years were asked to complete a similar survey. Results showed that breaking this large project into smaller assignments drastically reduced student procrastination. In addition, most students believed that turning in their insect collection in three parts helped them to avoid becoming overwhelmed and that working on their insect collection helped them to study for their lab practicals. This strategy can be used in any course that requires students to turn in large, extensive projects.

107. Larvicide activity and oviposition deterrence of *Aedes aegypti* mosquitoes to cajeput oil chemistries

Ellis Johnson (ellisjamesj@gmail.com) and Troy Anderson, Univ. of Nebraska, Lincoln, NE

The yellow fever mosquito, *Aedes aegypti*, is a major concern to human health. Insecticides are highly effective for mosquito management. However, the emergence of insecticide-resistant mosquito populations is an ongoing threat to current management strategies. Research studies focusing on biorational chemistries, such as plant essential oils (EOs), suggest them to be effective for managing insecticide-resistant mosquitoes. This study was initiated with the screening of 25 EOs with larvicide activity to *Ae. aegypti* larvae, with cajeput oil and the isolated chemistries eucalyptol and D-limonene having appreciable efficacy against insecticide-resistant individuals. We have further explored the application and delivery of cajeput-derived chemistries to deter oviposition and reduce olfaction for the adult mosquitoes. Here, we will report cajeput oil, eucalyptol, and D-limonene to have varying degrees of larval toxicity both between and within *Aedes aegypti* strains. Cajeput oil and eucalyptol had comparable toxicity with D-limonene being the most toxic in the susceptible strain. Both the individual isolates showed increased toxicity compared to cajeput oil in the resistant strain. Next, we show cajeput oil, eucalyptol, and D-limonene to reduce egg oviposition and larval development in the susceptible strain. Little effect was observed from cajeput oil, eucalyptol, and D-limonene treatments on egg oviposition in the resistant strain. However, the treatments showed to have a negative impact on larval development in the resistant strain. Lastly, this study will discuss olfactory behavior of adult mosquitoes in response to cajeput oil, eucalyptol, and D-limonene.

Student Ten Minute Paper Competition: Ph.D - P-IE - Session I

108. Robustness of biological control using multiple natural enemies against whitefly influx or delayed natural enemy releases

Erfan Vafaie (erfanv@tamu.edu)[1], Brent Pemberton[2], Mengmeng Gu[3], Micky Eubanks[3], David Kerns[3] and Kevin Heinz[3], [1]Texas A&M Univ., Overton, TX, [2]Texas A&M AgriLife Research, Overton, TX, [3]Texas A&M Univ., College Station, TX

Augmentation biological control, the regular release of natural enemies to suppress a target pest population, is a promising strategy for *Bemisia tabaci* Gennadius (Hemiptera: Aleyroididae) management in color poinsettia production. The viability of biological control can be compromised by delayed natural enemy releases and influx of *B. tabaci*. In this study, we investigate whether adding a predatory mite, *Amblyseius swirskii* Athias-Henriot (Acari: Phytoseiidae), to the regular release of a parasitic wasp, *Eretmocerus eremicus* Rose & Zolnerowich (Hymenoptera: Aphelinidae), can increase the robustness of an augmentation biological control program of *B. tabaci* on color poinsettias in the face of delayed natural enemy releases or *B. tabaci* influx. Natural enemy releases result in significant *B. tabaci* suppression compared to the untreated control. The combination treatment (*E. eremicus* + *A. swirskii*) consistently provided equivalent or superior suppression of *B. tabaci* compared to either *E. eremicus* or *A. swirskii* treatments alone. Delayed natural enemy releases increased mean and variation in *B. tabaci* nymph populations by week 10 for single natural enemy treatments (*E. eremicus* alone), but not the combination treatment (*E. eremicus* + *A. swirskii*) for the duration of the trial (16 weeks). Both early (week 4) and late (week 8) *B. tabaci* influxes resulted in increased variation in *B. tabaci* nymph populations in single (*E. eremicus*), but not combination (*E. eremicus* + *A. swirskii*), treatments. Our results support that adding *A. swirskii* to *E. eremicus* can increase robustness of *B. tabaci* suppression in the face of missed natural enemy shipments and whitefly influx.

109. Using geospatial tools to quantify continuous corn in landscapes surrounding fields with a history of injury to Cry3 corn by Western corn rootworm

Coy St. Clair (cstclair@iastate.edu) and Aaron J. Gassmann, Iowa State Univ., Ames, IA

Western corn rootworm, *Diabrotica virgifera virgifera* LeConte (Coleoptera: Chrysomelidae), is a major pest of corn in the United States and is reliant on at least two consecutive years of corn for reproduction and population growth. Transgenic corn expressing insecticidal proteins derived from the bacterium *Bacillus thuringiensis* (Bt) is an important tool used to manage rootworm populations. The first Bt trait, Cry3Bb1, was introduced in 2003, but greater-than-expected injury appeared northeastern Iowa in 2009. Using geospatial tools and publicly-available land use data, we examined the circular areas (buffers) surrounding these early field failures at radii of 1.6, 3.2, and 16.1 km. We calculated the proportion of area inside each buffer planted to first through ninth-year continuous corn, and compared these values to the same proportions calculated for randomly-selected control points throughout the state. We also calculated the proportion of the state planted to corn for at least three consecutive years for 2003 through 2016. We found areas surrounding problem fields had significantly more continuous corn compared to controls, with the most continuous corn in 1.6 km buffers. At 1.6 km radius, all problem fields had significantly more continuous corn up to sixth-year corn compared to controls. These results suggest that continuous corn growth in the surrounding landscape was associated with the development of resistance to Cry3Bb1 corn, and that areas beyond the individual field may act as habitat patches for rootworm.

110. Monarch butterfly (*Danaus plexippus*) host plant selection and the effects of aphid competitors

Katie LaPlante (kmlaplante@mail.missouri.edu), Terryl L. Woods and Debbie Finke, Univ. of Missouri, Columbia, MO

Insect pollinators play an important role in our natural ecosystem. To sustain these beneficial insects, we must understand their habitat preferences, resource requirements, and community-level interactions. The objective of this study was to determine optimal strategies for improving monarch butterfly (*Danaus plexippus*) habitat in Missouri. Milkweed plants (*Asclepias*) are a necessary resource for ovipositing monarchs, but monarch success varies across milkweed species and may be influenced by the location of patches in the landscape, the proximity of nectar resources, and colonization by competitors, like the oleander aphid (*Aphis nerii*). We assessed monarch usage and aphid colonization of swamp (*A. incarnata*) or common (*A. syriaca*) milkweed plants established in plots surrounded by either nectar plants or fescue grass and located in open field crop habitats or along wooded edges. We found a shift in monarch oviposition preference for common milkweed over swamp milkweed following the natural colonization of the oleander aphid. Of the swamp milkweed plants during the colonization of the oleander aphid, the highest number of monarch eggs were found on plants with a moderate density of aphids. Our results suggest that the oleander aphids affect oviposition choice of adult monarch butterflies. Understanding the interaction of these natural community members may be important for monarch butterfly conservation and future habitat restoration efforts.

111. Seasonal relationships between naturally occurring entomopathogenic nematodes and Asiatic garden beetle, *Maladera castanea*, in Ohio agroecosystems

Adrian Pekarcik (pekarcik.4@osu.edu) and Kelley Tilmon, The Ohio State Univ., Wooster, OH

The Asiatic garden beetle, *Maladera castanea* Arrow, was introduced to the United States in 1921 in New Jersey and has since been confirmed in 24 states and 2 Canadian provinces. This generalist species has historically caused sporadic problems in turf grasses, ornamentals, and vegetables, but recently it emerged as a significant early-season pest of corn in sandy soils of Indiana, Michigan and Ohio. Management tactics include insecticides; however, they are either largely ineffective or have not yet been evaluated for Asiatic garden beetle. Biological control agents like entomopathogenic nematodes (Steinernematidae and Heterorhabditidae) cause disease in annual white grub species like Asiatic garden beetle and are naturally occurring in the soil. Does the presence of entomopathogenic nematodes in the landscape reduce Asiatic garden beetle densities? The overall goal of this research is to understand whether the presence or absence of entomopathogenic nematodes is influencing the distribution of Asiatic garden beetle in Ohio corn and soybean fields. The objective of this study was to establish a sampling network throughout northern Ohio in 2018 and 2019 to understand the seasonal population dynamics and geographical distribution of Asiatic garden beetle grubs and adults, and entomopathogenic nematodes in agricultural fields.

112. Bee community form and function in urban vacant land: Implications for managing pollinator friendly cities

Katherine Turo (kjtodd91@gmail.com), MaLisa Spring, Frances S. Sivakoff, Yvan Delgado de la Flor and Mary Gardiner, The Ohio State Univ., Columbus, OH

Cities often contain reduced biodiversity, with consequences for urban ecosystem functioning, however, some urban areas document rich pollinator assemblages. This discrepancy suggests that urban landscapes can be manipulated to serve as pollinator refuges. Future bee habitat development depends on synthesizing urban bee community patterns into actionable guidelines. Thus, we established seven potential greenspace designs across a network of 56 vacant lots in Cleveland, Ohio, in order to investigate how seeded vegetation and landscape context influence bee community structure and foraging. We assessed the distribution of several bee functional traits, diversity, and abundance with pan and malaise traps. Foraging preferences were determined with plant-pollinator networks derived from vacuum collections of bees from flowers. We found that bloom abundance but not bloom identity influenced bee community structure, with increasing bee diversity, richness, abundance, and renter-bee abundance in sites with greater floral resources. Likewise, sites surrounded by larger patches of greenspace were associated with increased bee diversity and smaller sized bees. Plant-pollinator networks were dominated by exotic species, illustrating that weeds have an important role in sustaining urban bees. Together, these results suggest several recommendations for urban conservation habitat's development and management. Whenever possible, site placement should be optimized so that new sites are in closer proximity to larger greenspace patches. Moreover, as weeds can provide valuable forage, limited management for weeds may improve bee outcomes. While we did not observe our seeded native plants enhancing the bee community, we expect that future establishment of prairie plants will enhance their influence on pollinators.

113. Honeydew microbiota of the invasive sugarcane aphid

Jocelyn Holt (holtjocelyn@tamu.edu)[1], Antonino Malacrinò[2], Crys Wright[1] and Raul F. Medina[1], [1]Texas A&M Univ., College Station, TX, [2]Linköping Univ., Linköping, Sweden

The sugarcane aphid (*Melanaphis sacchari* Zehntner, SCA) is a serious pest of sorghum in twenty-two states across the continental USA. Biocontrol of SCA is actively being studied as a way to prevent SCA outbreaks. Before SCA populations show up in sorghum they can be found feeding in Johnson grass. Interestingly, SCA populations seem to be attacked less by predators and parasitoids in Johnson grass than in sorghum. Recent studies have shown that honeydew microbiota may influence its attractiveness of predators, parasitoids and ants. We have found that honeydew from SCA fed on sorghum and Johnson grass show significant variation in sugar and amino acid concentration. We hypothesize that microbial differences in honeydew from SCA feeding on sorghum and Johnson grass may explain its differential attractiveness to natural enemies. In this study we compare the bacterial composition of honeydew between sorghum fed and Johnson grass fed SCAs. A better understanding of the role of the honeydew microbiota in mediating tri-trophic interactions may increase biological control effectiveness.

114. Effects of lifetime dietary exposure to SmartStax PRO® in the F_0 generation on life history traits of western corn rootworm (Coleoptera: Chrysomelidae) F_1 progeny

Jordan Reinders (jordan.reinders3@gmail.com)[1], William Moar[2], Paula A. Price[2], Sean Evans[2], Graham P. Head[2] and Lance J. Meinke[1], [1]Univ. of Nebraska, Lincoln, NE, [2]Bayer Crop Science, Chesterfield, MO

The western corn rootworm (WCR, *Diabrotica virgifera virgifera* LeConte) is a significant pest of corn (*Zea mays* L.) across the U.S. Corn Belt. Field-evolved resistance to crop rotation, insecticides, and *Bacillus thuringiensis* (Bt) proteins has made WCR management

increasingly difficult. New products with novel modes of action are needed to complement current tactics in WCR management programs.

SmartStax PRO®, containing two rootworm-active Bt proteins and DvSnf7 dsRNA, is the newest transgenic technology for WCR management to be deregulated in the U.S. An experiment was conducted to characterize life history traits of F_1 progeny from WCR surviving lifetime dietary exposure to SmartStax PRO® or isoline (non-rootworm active) corn. In 2019, viability of WCR eggs from survivors of each lifetime diet treatment was assessed in the laboratory. Larvae were subsequently reared to adulthood on isoline corn and individual male/female pairs from each treatment were placed in polystyrene boxes and provided isoline food and soil for oviposition. Life history parameters measured included lifetime egg production, head capsule width, and longevity.

Results indicate lifetime dietary exposure to SmartStax PRO® did not significantly impact egg viability. Also, average F_1 female head capsule width and longevity were not significantly different between diet treatments. However, a significant decrease in F_1 female egg production was observed after dietary exposure to SmartStax PRO® in the F_0 generation. The results increase our understanding of the potential impact of WCR sublethal dietary exposure to SmartStax PRO® in the field and are discussed within the framework of resistance management.

115. Making scents of host preference in *Lygus lineolaris*

Matthew Hetherington (mhetheringto@wisc.edu) and Christelle Guédot, Univ. of Wisconsin, Madison, WI

Lygus lineolaris, the tarnished plant bug (TPB), is a persistent pest of strawberry (*Fragraria* x *ananassa*) production in Eastern North America, and the primary concern of Wisconsin strawberry growers. In this study, we applied a binary choice assay to examine host preference in TPB, before conducting electrophysiological experiments to identify plant volatiles that may mediate this behavior. We found that TPB prefers alfalfa (*Medicago sativa*) to strawberry, and that TPB antennae respond to several monoterpenoids and green leaf volatiles. However, sex differences in responsiveness were also observed. Females tended to be more responsive to terpenoids than males, suggesting a potential role in oviposition site selection. By demonstrating that TPB exhibits a preference for alfalfa over strawberry, this work suggests that incorporating an alfalfa trap crop into strawberry production may improve TPB management. Furthermore, we elucidate the mechanisms underlying this behavior, facilitating future work on augmented trap cropping and mass trapping strategies for sustainable TPB management.

116. The behavioral response of two cosmopolitan stored product beetles to microbial-produced volatiles

Marco Ponce (marco26@k-state.edu)[1], Tania N. Kim[1] and William Morrison III[2], [1]Kansas State Univ., Manhattan, KS, [2]USDA - ARS, Manhattan, KS

Every year, humans lose 30% of their food to insects and microbes. Understanding insect-microbe-food interactions will help to shape the world that humans inhabit, as well as how we store our food. There is an abundant amount of anecdotal evidence suggesting that when insects infest grain, they change the microclimate to benefit both themselves and microbes. Likewise, managers of food facilities report that when grain becomes colonized by microbes, it may be more readily exploitable by the insect community, especially if microbes compromise the integrity of a grain kernel to allow easier access by primary pests' insects. However, there is lack of understanding about how stored product insects respond to microbially-produced volatiles. In this study, we asked if insects are either attracted, repelled or simply do not respond to microbially-produced volatiles emitted from grain. To address our question, we first sterilized, then inoculated 300 g of wheat with one of the following treatments: fixed amounts of *Aspergillus* spp (microbe pest); *Sitophilus oryzae* (Motschulsky) (Coleoptera: Curculionidae) (insect pest); both pests, or neither (control). We tested attraction by *S. oryzae* and *Lasioderma serricorne* (F.) (Coleoptera: Ptinidae) to volatiles from these treatments in a wind tunnel assay as well as characterized the headspace volatiles being emitted. In particular, we found significantly unique blends of volatiles being emitted for each treatment, as well as significantly different levels of attraction by *S. oryzae* and *L. serricorne* suggesting that the interaction between the insect and the fungal community may be important for foraging responses by both species. These data have potential implications for improving behaviorally-based management strategies in IPM programs for post-harvest food facilities.

117. How do plant-associated microbes modify host-plant selection for insect herbivores?

Morgan Thompson (mthompson@tamu.edu), John Grunseich, Natalie Aguirre and Anjel Helms, Texas A&M Univ., College Station, TX

Plants associate with numerous microorganisms. Beneficial microbes typically form mutualisms with plants, increasing plant growth, nutritional quality, and defensive status, whereas plant pathogenic microbes cause disease. Both types of microbes alter plant cues (olfactory, gustatory, visual), which insect herbivores rely on to locate suitable host-plants. How microbe-altered plant cues modify herbivore foraging and oviposition behavior, however, remains less clear. We surveyed scientific literature to 1) synthesize what is known about how plant-associated microbes influence insect herbivore host-plant selection, and 2) identify research gaps

and areas for future work in plant-microbe-insect interactions. We investigated what is currently known about how beneficial microbes influence host-plant selection, identifying a bias in the literature towards arbuscular mycorrhizal fungi (AMF) and foliar endophytes but growing research on plant growth-promoting rhizobacteria (PGPR). We also examined how plant pathogenic microbes modify herbivore host-plant selection, determining mode of pathogen transmission played a significant role in shaping insect behavior. Overall, insect vector-borne phytopathogens increased attraction of vector-herbivores to host-plants and often influenced dispersal to uninfected plants. Non-vectored phytopathogens and beneficial microbes, in contrast, showed inconsistent and context-dependent indirect, plant-mediated effects on insect herbivore foraging and oviposition behavior. We advocate for future research to compare insect responses to plant-associated microbes of wild and cultivated plants, elucidate the influence of abiotic stressors, and include insect-associated microbes in studies on these interactions.

Student Ten Minute Paper Competition: Ph.D - P-IE - Session II

118. The use of a relay cropping system to improve biological control

Jeffrey Cluever (cluever.jeffrey@huskers.unl.edu)[1], Nevin Lawrence[2], Robert Wright[3], Julie Peterson[4] and Jeffrey Bradshaw[1], [1]Univ. of Nebraska, Scottsbluff, NE, [2]Univ. of Nebraska-Lincoln, Scottsbluff, NE, [3]Univ. of Nebraska, Lincoln, NE, [4]Univ. of Nebraska, North Platte, NE

Relay cropping is the practice of planting a crop into an already established crop, such as dry bean into a crop of winter wheat. Advantages gained from this may include more efficient use of land, a reduction in nitrate leaching, increase in harvestability, improvement in weed control, and biological control. Weed control is improved through the increased competitiveness of the crop with the weeds and biological control is improved by the early establishment of natural enemies in the crop.

To assess the benefits of a dry edible bean-winter wheat relay system for biological control of arthropods and cultural control of weeds, trials were carried out near Scottsbluff, Nebraska. A dry bean-winter wheat relay cropping system was compared with conventional dry bean and winter wheat cropping systems. To assess the presence of natural enemies, vacuum samples were taken on a weekly basis. The numbers of coccinellids, chrysopids, and aphids were counted. To evaluate weed control, density assessments and biomass samples were taken.

Lower densities of lambsquarters (*Chenopodium album*) were seen in the relay crop compared to conventional dry bean. During the earlier sampling dates no statistical difference was seen among treatments in the number of coccinellids, chrysopids, or aphids. However, the aphids tended toward being higher in the relay and wheat plots. Thus, these plots may prove more attractive to beneficial arthropods and later sampling dates may see this.

119. Fungal volatiles as semiochemicals for ambrosia beetles in mixed hardwood forests

Matthew W. Ethington (methingt@purdue.edu) and Matthew Ginzel, Purdue Univ., West Lafayette, IN

Invasive ambrosia beetles (Coleoptera: Curculionidae: Scolytinae) threaten the health and productivity of natural and managed forest systems worldwide, however there is a lack of effective tools and tactics to manage these pests. Although these beetles have a nutritional symbiosis with fungi that produce volatiles, little is known about their behavioral responses to these compounds in field settings. Semiochemical-based tools utilizing fungal volatiles may improve early detection of incipient pest populations and support efforts to mitigate economic and environmental damage.

In this study, we conducted experiments to test the extent to which a suite of fungal compounds modify the attraction of ambrosia beetles to a known attractant (i.e., ethanol). We focused on the response of two common invasive ambrosia beetle species (*Xylosandrus crassiusculus* (Motschulsky) and *Xylosandrus germanus* (Blandford)) to multi-funnel traps baited with ethanol and fungal volatile lures in mixed-hardwood forests in Indiana over two years (2018-2019). While none of the fungal volatiles increased attraction of adult beetles to ethanol-baited traps, several compounds reduced the number of beetles captured. Both beetle species were repelled by isobutyl alcohol and benzyl alcohol, while *X. crassiusculus* was also repelled by isoamyl alcohol. These fungal alcohols may be used as signals of host suitability to colonizing females. The use of repellants may hold promise to increase the efficacy of ambrosia beetle management, such as in push-pull systems, to protect vulnerable nursery stock and forest trees.

120. Investigating the effects of *Rice hoja blanca virus* on the insect vector *Tagosodes orizicolus*

Jaclyn Martin (jaclyn.martin@tamu.edu) and Ismael E. Badillo-Vargas, Texas A&M Univ., College Station, TX

The rice delphacid, *Tagosodes orizicolus*, represents a threat to the Texas rice industry by causing direct damage from ovipositing in and feeding on rice leaves and by transmitting *Rice hoja blanca virus* (RHBV) to rice. *T. orizicolus* is the most damaging pest of rice in the tropical regions of Latin America, and, when combined with RHBV, can cause up to 100% yield loss. *T. orizicolus* was found in the United States in the 1950s, 1960s, and 1980s. This pest was not detected again until the falls of 2015, 2018, and 2019 when it was found in ratoon rice fields near Houston, TX. During the 2015 outbreak in Texas, *T. orizicolus* caused up to 25% yield loss on ratoon rice from feeding and oviposition. RHBV is a negative sense single-

stranded RNA virus and viral transmission by the insect vector is under genetic control. In addition, RHBV has deleterious effects on *T. orizicolus* such as decreased life expectancy and reduced oviposition. The details on how and if RHBV affects *T. orizicolus* is unknown. In this study, transmission electron microscopy (TEM) is being used to explore if and how RHBV might affect different internal structures and organs of *T. orizicolus*. Non-viruliferous females and males as well as viruliferous females and males were examined under TEM. Ultimately, this study is expected to increase the knowledge of this pathosystem and might lead to future research on potential control methods against this insect vector and virus threatening our rice industry in Texas and beyond.

121. Application of protein immunomarking in understanding dispersal of woodboring beetles

Scott Gula (sgula@purdue.edu)[1], Vanessa Lopez[2], Ann Ray[3], Scott Machtley[4], James Hagler[4] and Matthew Ginzel[1], [1]Purdue Univ., West Lafayette, IN, [2]USDA - Forest Service, Washington, DC, [3]Xavier Univ., Cincinnati, OH, [4]USDA - ARS, Maricopa, AZ

Invasive woodboring beetles are among the most destructive pests of natural and managed forests worldwide. The success of eradication efforts and quarantines to limit the spread of incipient populations of these pests is dependent on understanding their dispersal behavior. Most previous dispersal research involved capturing or rearing beetles en masse, marking them in the laboratory, releasing them in the field, and capturing them again. This process is labor intensive, time consuming, expensive, and human handling during the application of the mark can affect the behavior of the insects. There is a critical need for an affordable, efficient, and non-invasive marking technique to improve research on woodborer dispersal. We tested the efficacy of protein immunomarking for use in understanding the dispersal of woodboring beetles. Specifically, we tested the extent to which an ovalbumin mark adheres to the cuticle of emerald ash borers (*Agrilus plannipennis* Fairmaire) (Coleoptera: Buprestidae) as beetles emerge from protein-treated logs. To test the persistence of the mark, we applied varying concentrations of ovalbumin to freeze-killed beetles, mounted them on pins, and placed them over various time intervals in an exposed outdoor location. Adult EAB self-marked as they emerged from protein-treated logs, with higher protein concentrations persisting for longer on the cuticle when exposed to sun and rain. This novel use of protein immunomarking has potential as an effective and reliable marker, and the operational capacity of this technology to management efforts of invasive woodborers will be discussed.

122. Sorghum tolerance to sugarcane aphids

Sajjan Grover (sajjan.grover@huskers.unl.edu)[1], Earl Agpawa[1], Scott E. Sattler[2] and Joe Louis[1], [1]Univ. of Nebraska, Lincoln, NE, [2]USDA - ARS, Lincoln, NE

Aphids are important pests of plants that cause substantial loss in plant productivity. The sugarcane aphid (*Melanaphis sacchari* Zehntner; SCA) is a relatively new and devastating pest of sorghum (*Sorghum bicolor*) in the United States. Even though there is extensive natural variation for resistance against insect pests in sorghum, much of it remains undiscovered and under-utilized. Tolerance is considered as the most durable and promising category of host plant resistance. In the present study, we screened nested association mapping (NAM) founder lines for tolerance against SCA and have identified SCA-tolerant line (SCT) as most tolerant genotype to SCA. Aphid counts were higher on SCT after 14 days of SCA infestation, while having lesser reduction in plant growth parameters such as damage rating, chlorophyll loss index, plant biomass, height loss and number of leaves compared to other sorghum lines. In response to SCA infestation, plants induced various phytohormones which may help condition tolerance to herbivory. Phytohormone analysis revealed significantly higher basal levels of 12-oxo-phytodienoic acid (OPDA) in SCT line compared to the wild-type and susceptible sorghum plants. Collectively, our results indicate that the elevated basal levels of OPDA in SCT contribute to sorghum tolerance to SCA. This present study would help us to understand the underlying mechanisms of sorghum tolerance to SCA and aid in developing novel and sustainable strategies for managing this pest.

123. Density-dependent mortality of larval Western corn rootworm in Bt and non-Bt corn

John McCulloch (johnmcc@iastate.edu) and Aaron J. Gassmann, Iowa State Univ., Ames, IA

Western corn rootworm (*Diabrotica virgifera virgifera*) is a major pest of corn in the US. Larval density-dependent mortality can confound mortality estimates of Bt traits and soil-applied insecticides used to manage western corn rootworm. This study evaluates the effect of larval density-dependent mortality of western corn rootworm in Bt and non-Bt corn using artificial infestation at six egg densities ranging from 25 to 800 eggs per 30 cm of row.

124. Everything's sweeter in Texas? A chemical and palynological analysis of honey in Texas

Pierre Lau (plau0168@tamu.edu), Vaughn Bryant and Juliana Rangel, Texas A&M Univ., College Station, TX

Honey bees (*Apis mellifera*) use nectar as their main source of energy to fuel colony growth and development. Nectar is converted to honey, which is increasing in demand for their health benefits in humans. Understanding the floral resources collected by colonies in different regions will aid in the promotion of plant species to enhance honey bee colony health and honey production. The significance of this research is two-fold. First, this study will help us identify and promote important plant species that honey bees forage on. This study will also help local beekeepers by establishing a baseline for detecting adulterated honey, as honey is commonly mixed with foreign products to improve economic yield. We conducted a palynological analysis of 119 honey samples provided by participating beekeepers whose colonies were located throughout Texas. The pollen in each honey sample was extracted, acetolyzed, identified, and classified in frequency categories depending on each taxon's relative abundance. The water content, pH, and sugar spectrum were also analyzed with Nuclear Magnetic Resonance (NMR) spectroscopy. We have found at least 121 unique pollen types in honey including *Triadaca*, *Mimosa*, *Ulmus*, *Prosopis*, and *Rhus*. The water content in honey ranged from 14% to 20.6%, the pH ranged from 3.6 to 5.4, and the combined fructose and glucose content ranged from 50.7% to 77%. This information will help us better understand honey bee nectar foraging preferences in their environment. This will also serve as a foundation for future studies on promoting pure, unadulterated honey.

125. Locally adapted predator defense and eclosing behavior of the fall webworm (*Hyphantria cunea*)

Amy Adams (amy.e.adams@ou.edu), Univ. of Oklahoma, Norman, OK

Traditionally, ecosystem modeling and management have emphasized uniform species responses to environment, disregarding intraspecies variation due to local adaptation. Previous work with red-headed fall webworms (*Hyphantria cunea*) indicated that desiccation and plant toxin tolerances are coupled, and that there is a trade-off between heat and plant toxin tolerances. Unique cooperative eclosing behavior was also detected for this species, and it was 20% more likely to occur following dry pupation conditions. However, this was found exclusively for moths from central Oklahoma, which receives 71-91 cm of annual rainfall. This presentation features findings from a follow-up common garden experiment that included moths from drier and wetter regions: western Oklahoma, which receives less than 71 cm of annual rainfall, and eastern Oklahoma, which receives 101-111 cm of annual rainfall. *Hyphantria cunea* appear to be locally adapted to rainfall conditions. Moths from drier regions exhibited cooperative eclosing behavior more often than moths from wetter regions. Unexpectedly, there were also pronounced differences in the defensive emesis behavior of larvae from each region. Emesis was more common in larvae from wetter regions, while larvae from drier regions were more likely to exhibit alternative predator defense strategies. It follows that modeling and management of plant-insect ecosystems such as this one will be more effective when accounting for local adaptation instead of assuming uniform species response.

126. Parasitism of stink bugs by native parasitoids in Nebraska

Blessing Ademokoya (bademokoya@huskers.unl.edu)[1], Thomas Hunt[2] and Robert Wright[1], [1]Univ. of Nebraska, Lincoln, NE, [2]Univ. of Nebraska, Concord, NE

This study investigated the parasitoid complex of stink bug (Hemiptera: Pentatomidae) in Nebraska. Three locations across eastern Nebraska were sampled for eggs, nymphs and adults. In adults and nymphs, parasitism was determined by the presence of dipteran egg and/or puparium. Two tachinid flies; *Euthera* and *Cylindromyia* species emerged from adult stink bugs. Out of 3,315 adults examined in three years, only 49 were parasitized (~1.5%). Total number of dipteran eggs recorded was 61, with some individuals carrying multiple eggs. Approximately 60% of egg allocation was on the ventral side of hosts, which consist of the abdomen, thorax and limbs. Of the 21 species of stink bug identified so far in Nebraska, adult parasitism was observed in only *Euschistus variolarius*, *Thyanta custator*, *Chinavia hilaris* and *Podisus maculiventris*. The most parasitized species was *T. custator*, making up ~57%. Nymph parasitism was not observed in this study. To check for the presence of egg parasitoids, wild eggs were routinely collected from the field and placed in a growth chamber [25 ± 1°C, 75 ± 5% RH and 14:10 h (L:D)] until eclosion. Sentinel eggs that were deployed in the field for 72 hours were also observed for parasitism. The species of parasitoid, parasitism and emergence rates were recorded. *Telenomus podisi* Ashmead (Hymenoptera: Platygastridae) was the only parasitoid that emerged from all parasitized eggs. Mean parasitism was 87.3 ± 11.03 in wild eggs and 89.74 ± 6.3 in sentinel eggs. Results suggest that parasitoids are a viable option for stink bug control in Nebraska.

Symposia

Ecology and Management of Sucking Bugs in Cotton Agroecosystems

127. **Hemipteran mouthpart morphology and its role in pathogen transmission**

Jesus Esquivel (jesus.esquivel.phd@gmail.com), USDA - ARS, College Station, TX

Hemipterans - stink bugs and other related species - continue to plague cotton. Producers can experience losses in lint and seed quality and quantity due to feeding damage. Stink bugs have also been shown to introduce bacterial and fungal pathogens that cause rotting of the lint and seed. Recent work on mouthpart (stylet) morphology and feeding mechanics has yielded new information, including: pathogens can reside in the rostrum; shape of the food canal is funnel-shaped but does not deter pathogen ingestion and transmission; labial segment lengths affect stylet penetration; cotton bolls are susceptible to stylets breaching the boll wall at boll set; and individual stink bugs can infect successive bolls. Future research plans will also be discussed.

On the Road Again: Management and Conservation of Migratory Insects

136. **Tracking migration of red admiral and painted lady butterflies: Weekly surveys, flight direction monitoring, citizen science observations, mark-recapture studies, and stable isotope analysis**

Royce Bitzer (mariposa@iastate.edu), Iowa State Univ., Ames, IA

Although the butterflies of the genus *Vanessa* are not as familiar or as well-studied in North America as the Monarch, their migration is likewise worthy of study. Much remains to be discovered about how their seasonal distribution and migration varies by geographic location and from year to year. I will discuss spring and fall migratory activity of both the Red Admiral (*V. atalanta*) and the Painted Lady (*V. cardui*) from observations from weekly population surveys, from flight direction monitoring, from citizen science reports, and from mark-recapture studies and stable isotope analysis of Red Admirals. Both species migrate generally northward in spring and southward in the fall; my results suggest that North American Red Admirals, like their European counterparts, make a return trip southward, several generations after the first migrants arrive in the upper Midwest in the spring. Surprisingly, even the relatively stationary summer generations of Red Admirals may sometimes migrate when the winds are favorable for them to do so.

Things They Don't Teach You in Grad School

142. **The secret to work-life balance is to stop searching for it**

Jody Green (jgreen17@unl.edu), Univ. of Nebraska, Lincoln, NE

One thing that is never taught in graduate school, but is mentioned constantly as a professional, is the importance of work-life balance. In our lives at work, we set goals for ourselves and receive evaluations of our skills, effort, and impact. This is not always true of our personal lives, and too often we neglect personal commitments for the sake of professional ones. There is no fine line between work and the other areas of our lives, which must also include ourselves. We may be scientists, but there is no single method or system that results in the perfect work-life situation for all. Wholeness comes from being your authentic self, wherever you choose to show up in your daily life. Integrating the different pieces and passions may help inspire creativity, and ultimately build a more fulfilled, happier, and healthier you in all your roles. In this presentation, I will share some experiences and struggles with integrating personal and professional aspects of life and offer the suggestion that sometimes balance does not mean "all things are equal".

From Molecules to Ecosystems: A Survey of Data Management and Analytical Strategies in Entomological Research

150. **Using functional programming to model population interactions between herbivorous biocontrol agents and their target plant with the Python package, *Generations***

Mary Marek-Spartz (patt0335@umn.edu), George Heimpel and Roger Becker, Univ. of Minnesota, St. Paul, MN

The history of ecology and functional programming are intertwined. The Fibonacci sequence, commonly used to illustrate recursion for learners of functional programming, was initially created to model a population of rabbits. In 1935, the entomologist John Nicholson and the physicist Victor Bailey published The Balance of Animal Populations. They proposed equations to represent the population interaction between a parasitic wasp and its insect host. At the heart of the Nicholson-Bailey model is a mutually recursive relationship. *Generations* is an open-source Python package that models the response of an invasive plant population to an herbivorous parasite, through a set of recursive functions.

151. **Meta-analysis toolbox: Novel approaches for working in the 21st Century's overwhelming amount of scientific literature**

Fabian List (fabian.list@tamu.edu), Texas A&M Univ., College Station, TX

With a staggering total of around 2 million scientific papers published every year, the amount of data available to researches has likely long exceeded any single human's capability of grasping more than a tiny fraction of what is and has been published in their field of interest. With close to 30.000 scientific journals around today this is not going to change any time soon. In fact, the "publish or perish" mentality in the academic culture is guaranteed to keep these numbers up and growing for the foreseeable future. For the most part of scientific history, review articles were a great tool to achieve a good overview over a specific topic, benefitting from the knowledge and experience of specialists in the field. The classic review paper is still an important tool, but meta-analyses are a tool gaining popularity because of its ability to compare large amounts of data from online databases. These meta-analyses are a highly valuable tool to access and compare results from multiple studies. Originating from medical research, they are now applied across research fields and have become more popular in the last few years. With this presentation we will give a meta-analysis walkthrough and talk about possibilities for entomological application. Using R and R-Studio the freely available statistical program with metafor and additional libraries showcasing cantrips and pitfalls to build a meta-analysis.

152. **Metagenetic applications in entomological research: From biosurveillance to trophic ecology**

Rodney Richardson (rtr87@yorku.ca), York Univ., Toronto, ON, Canada

Metagenetic techniques such as metabarcoding or amplicon sequencing are transforming entomological research. Researchers seeking to characterize bee-collected pollen or interrogate niche partitioning among spider guilds can now affordably integrate these next-generation sequencing techniques into their work. However, the methods for doing so remain highly variable, making the choice of laboratory and bioinformatic procedures daunting to newcomers. Here, we review some of the promising applications of this technique, discuss the strengths and weaknesses of various implementations, and provide an example data analysis workflow for arthropod midgut content analysis.

153. **The bioinformatic analysis of the insect microbiome**

Antonino Malacrinò (antonino.malacrino@gmail.com), Linköping Univ., Linköping, Sweden

We have evidence that single microbes can impact insect ecology and evolution. With the continued expansion of sequencing technologies, we can now characterize entire microbial populations, their gene content and expression. Today's sequencing technologies can generate millions of reads in a single run. But, how does the repetition of tons of A, C, G and T in raw sequence reads transform into meaningful results? Here we will explore the recent advances in bioinformatic processing of microbiome data, using High Performance Computing Clusters. We will then use these tools to characterize insect microbial communities.

Extension Delivers: Showcasing Successful Program Delivery Methods for Insects

155. **Broadening our audience by diversifying the messenger - how training agents and volunteers can expand IPM**

Janet Hurley (ja-hurley@tamu.edu)[1], Faith Oi[2], Arthur Appel[3] and Fudd Graham[3], [1]Texas A&M Univ., Dallas, TX, [2]Univ. of Florida, Gainesville, FL, [3]Auburn Univ., Auburn, AL

Structural pests impact everyone, regardless of location, rural or urban. While research indicates that IPM can be successful in housing and residential situations (Miller and Meek 2004, Wang et al. 2009, 2019) with likely positive health outcomes (Levy et al. 2006, Kass et al 2009, Wang and Bennett 2009), IPM adoption by the general public is poor. In 2018, TX, FL and AL were awarded an USDA NIFA grant to help support IPM in homes. This session will touch on some of the implementation programs being conducted by county agents in three states, plus preliminary data from the nationwide survey on people's perceptions about pest control.

161. **Using citizen science to identify pollinator-attractive plants**

Erfan Vafaie (erfanv@tamu.edu)[1], Eric Rebek[2], Scott Longing[3], Adam Mitchell[4], Michael Merchant[5] and Danielle Dunn[5], [1]Texas A&M Univ., Overton, TX, [2]Oklahoma State Univ., Stillwater, OK, [3]Texas Tech Univ., Lubbock, TX, [4]Tarleton State Univ., Stephenville, TX, [5]Texas A&M AgriLife Extension Service, Dallas, TX

Home owners, landscapers, and master gardeners often inquire about pollinator attractive plants, but data on pollinator-attractive plants in southern USA is lacking. In an effort to acquire preliminary data with minimal resources and avoid countless hours (that we don't have) staring at flowers on plants, we engaged master gardeners, master naturalists, and other plant/pollinator enthusiasts to make pollinator observations for us. Using an online form (ona.io), contributors were asked to make 60-second observations for each 2 x 2 ft. patch of one kind of flowering plant and record numbers of different 'types' of pollinators. In 2019, we received over 7,500 observations (125 hours) from over 140 unique observers across Texas and Oklahoma, representing over 213 different flowering plant species from 57 plant families. In this seminar, we will present how we trained observers, collected data, and a snapshot of the results.

Biological Control in Agroecosystems and Natural Areas: Highlighting the Work of a New Generation of Biocontrol Scientists

177. The stresses and successes of leading an international biological control effort

Kenneth Masloski (kemasloski@tamu.edu), Mengmeng Gu and Kevin Heinz, Texas A&M Univ., College Station, TX

Biological control projects are often international endeavors. They rely on acquiring natural enemies from foreign countries and as such depend heavily on collaboration with international partners. Heading such a project requires fastidious attention to detail and an ability to be clear and concise with requests. Because collaborators do not meet face-to-face and often speak different languages, communicating through written instructions can lead to unfulfilled requests. However, when shared goals are understood, the rewards are overwhelmingly positive. Performing an importation biological control experiment with collaborators in China has been both challenging and rewarding. Ultimately, the positive results seen have been worth overcoming the challenges inherent with such a project. Continuing to get positive results will rely on maintaining open communication with collaborators and having a clear understanding of the shared goals.

183. The ecological consequences of hyperparasitoid attacks on two biological control agents of the imported cabbageworm

Dhaval Vyas (dhaval.vyas@du.edu)[1], Paul Ode[2] and Ryan Paul[2], [1]Univ. of Denver, Denver, CO, [2]Colorado State Univ., Fort Collins, CO

Classical biological control programs introduce primary parasitoids into new geographic regions, often exposing them to existing populations of hyperparasitoids. Hyperparasitoids are frequently implicated in the failure of parasitoid biological control agents to establish and provide control of insect pests. The outcome of competition, among two or more parasitoid species, may be altered if the parasitoids are differentially attacked by the same hyperparasitoids. A reliable assessment of the hyperparasitoid community is needed to understand how top-down trophic interactions influence the effectiveness of introduced parasitoids. We examined the diversity of hyperparasitoids attacking *Cotesia glomerata* in Colorado (USA), where the congener *C. rubecula* is absent. We compared this diversity with the hyperparasitoid community of *C. glomerata* and *C. rubecula* from Maryland (USA) where both wasps co-occur and use the imported cabbageworm (*Pieris rapae*) as their main host. Field collected *C. glomerata* broods were analyzed to examine the relationship between brood sizes and the adult sex ratio and the likelihood of attack by different hyperparasitoid species. A total of nine hyperparasitoid species were found in Colorado, of which four species also occurred in Maryland. While larger *C. glomerata* broods experienced increased odds of hyperparasitism, *C. glomerata* developing in larger broods had higher per capita survivorship than those developing in smaller broods. The proportion of adult male *C. glomerata* in a brood increased with brood size in both unparasitized and hyperparasitized broods, suggesting that female *C. glomerata* were not preferentially hyperparasitized. Hyperparasitoids inflicted greater mortality on *C. rubecula* than on *C. glomerata*. This differential hyperparasitism may enable the coexistence of *C. glomerata* with its congener *C. rubecula*, which usually outcompetes and displaces *C. glomerata*.

The Latest Advances in Pollinator Health Research

203. Bee genotype and viral infection impact macronutrient preferences

Hannah Penn (hannahjpenn@gmail.com)[1], Michael Simone-Finstrom[2], Rachel Dickens[3] and Lilia de Guzman[2], [1]Univ. of Texas, Edinburg, TX, [2]USDA - ARS, Baton Rouge, LA, [3]USDA ARS Honey Bee Lab, Baton Rouge, LA, Baton Rouge, LA

The quantity and macronutrients of food resources can contribute to the health of honey bee individuals as well as colony survival by mediating immune responses. We wanted to determine if this held true for honey bee ssRNA viral infections vectored by the *Varroa* mite such as DWV-A and CBPV. We investigated the interaction of these viruses and three honey bee genotypes with different levels of mite resistance (Italian, Pol-Line, and Russian) on pollen patty consumption rates and macronutrient foraging preferences. We found genotype differences in overall consumption where Italian honey bees consumed more pollen than either Pol-Line or Russian bees (both mite resistant). The P:L ratio consumed by the Italian bees was similar to that of the Russian bees and both were greater than that of the Pol-Line. The two viruses had different effects on pollen and sugar solution consumption as well as changes in the P:L ratios of the pollen consumed. DWV-A was not related to changes in consumption rates but increasing levels of DWV-A were correlated with decreases in the P:L ratio. Increasing levels of CBPV were correlated with a decrease in the overall consumption of pollen and sugar solution but an increase in the P:L ratio of the pollen consumed. The differences observed in foraging between the two viruses and among the genotypes might indicate that there are different energetic costs associated with overcoming different viral infections and the physical damage associated with the vector of those viruses (*Varroa* mites).

204. How do bees assess food quality? Taste and nutrition play different roles in learning and memory formation in the honey bee

Julie Mustard (julie.mustard@utrgv.edu)[1], Valerie Alvarez[2], Sofy Barocio[3] and Karin Robles[3], [1]Univ. of Texas Rio Grande Valley, Brownsville, TX, [2]The Univ. of Texas, Brownsville, TX, [3]Univ. of Texas Rio Grand Valley, Brownsville, TX

As with other animals, both taste and nutrition influence learning and memory in the honey bee, *Apis mellifera*. However, unlike other animals, honey bees appear to be unable to learn that tasteless food may be nutritional. The nutritional, but tasteless, sugars xylose, sorbitol and mannitol were used to examine the relationship between gustatory stimulation, learning and memory. When given as a reward during olfactory associative conditioning, sorbitol and xylose were able to produce a robust memory. Mannitol did not rescue memory suggesting that it does not activate the, as of yet unknown, mechanism linking memory and nutrition. In contrast to olfactory conditioning, in a choice test when honey bees were offered solutions with the same level of appetitive value, they were unable to learn to choose the solution that was supplemented with a tasteless but nutritional sugar. These results have important implications for honey bee health as bees may be unable to assess the nutritional value of nectar components that do not make significant contributions to taste. Thus, understanding the factors that contribute to the perception of taste will shed light on honey bee food choice and nutrition.

209. Landscape diversity but not honey bee presence shapes wild bee communities in an agricultural landscape

Ashley St. Clair (astclair@iastate.edu)[1], Ge Zhang[1], Adam Dolezal[2], Matthew O'Neal[1] and Amy Toth[1], [1]Iowa State Univ., Ames, IA, [2]Univ. of Illinois, Champaign, IL

Declines in wild and managed bees are documented worldwide, with a major contributing factor being habitat conversion, primarily for the production of annual crops. Long-term stability of pollination services will likely include integrating wild bees, in addition to honey bees, into crop pollination management plans. However, it is poorly understood whether honey bees near crop fields have an effect on wild bee communities, and whether these effects are further exacerbated by extreme agricultural production. Iowa, USA has committed over 65.5% of the landscape to annual crop production, representing a prime example of a landscape which has undergone an extensive agricultural conversion. Surrounding landscape affects non-pollinator insect communities in soybean, but the extent to which landscape complexity affects wild and managed pollinators is less well understood. To better understand the dynamics between wild and managed bees and the surrounding landscape, we identified soybean fields surrounded by an either high or low proportion of land committed to annual crop production. At a subset of fields, we placed honey bee colonies. Pan traps were used to estimate the diversity and abundance of pollinators. We did not observe an effect of the presence of honey bees near soybean fields on the wild bee community, however, fields surrounded by low proportions of annual crops had a higher richness and diversity of bee species. Specifically, proportion woodland and grasslands surrounding fields were positively associated with greater abundance and richness of bees classified as uncommon and rare, suggesting these cover types may be valuable for pollinator conservation.

New Technologies and Applications for Stored Product Insect Management

228. Using professional weather forecasts to control insects better at lower costs

Brian Adam (brian.adam@okstate.edu), Oklahoma State Univ., Stillwater, OK

Insect control, like most economic decisions, is a compromise – a tradeoff between one kind of cost and another kind of costs. We can reduce cost of insect control to zero – but at the expense of high costs of insect damage. We can reduce insect damage costs (but not to zero) – but at the expense of high treatment costs. Treating too early wastes money, and treating too late risks damage. A real option approach is used to estimate the costs and benefits of waiting, as well as the value of acquiring information (e.g., weather forecasts) to make a better decision.

Plant-Insect Ecosystems Symposium: Integrated Pest Management of Arthropod Pests in Large Scale Agroecosystems

233. Ecology of aphid parasitoids in winter wheat habitats of the Southern Plains: How latitude and crop diversity influence pest management

Kristopher Giles (kris.giles@okstate.edu)[1], Norman Elliott[2] and Haley Butler[1], [1]Oklahoma State Univ., Stillwater, OK, [2]USDA - ARS, Stillwater, OK

In the US Southern Plains, locally-adapted annual winter crops support aphid pests and their parasitoids, but variable climatic conditions and host biology alter temporal interactions, and ultimately pest management recommendations. Native parasitoids are well adapted to finding and attacking aphids from fall planting through spring harvest in Oklahoma and Texas, but the impact of these parasitoids is often negligible north of Oklahoma. Furthermore, parasitoid impact is positively correlated with spatial and temporal vegetation-crop diversity. We report on the results of recent and ongoing research which examined how crop diversity influences aphid parasitism and discuss how future studies will investigate observed variation in parasitism throughout the US Southern Plains.

234. Spatial interactions of the mite-virus complex in winter wheat

Gary Hein (ghein1@unl.edu)[1], Elliot Knoell[1], Anthony McMechan[1], Lindsay Overmyer[1] and Abby R. Stilwell[2], [1]Univ. of Nebraska, Lincoln, NE, [2]USDA - APHIS - PPQ, Raleigh, NC

The wheat curl mite (WCM), *Aceria tosichella* Keifer, transmits three potentially devastating viruses to winter wheat causing significant yield loss across the Great Plains. Management of the green bridge period, or that period between wheat harvest and the subsequent emergence of winter wheat in the fall, is important to reduce virus spread to the new crop. An increased understanding of spatial components of mite movement through the landscape is necessary to determine the risk of serious virus spread into winter wheat. The WCM is very small (ca. 250 mm) making WCM dispersal very hard to monitor. However, the distribution of virus symptoms can be used to determine dispersal potential. Through the last several years we have undertaken a series of studies to provide a better picture of the dispersal potential of the mite and subsequent virus spread. The distribution of virus symptoms extended differentially in all directions from mite-virus sources, and this is influenced by wind direction and speed. However, dispersal potential has been found to be most highly dependent on mite density. Factors that influence mite density, such as host quality and temperature, are important in establishing risk levels for mite dispersal and virus spread.

236. Caterpillars on corn in northern Mexico: Species, natural enemies and biocontrol tests with entomopathogens

Sergio Sánchez-Peña (sanchezcheco@gmail.com)[1], Renato Villegas-Luján[1], Oscar E. Rosales-Escobar[2], Fernando Sanchez-Pedraza[1], Paulina Vega-Aquino[3], Patricia Espericueta-Medina[4], Gabriel Gallegos-Morales[1], Jose Rodriguez-Contreras[5] and Celso Morales-Reyes[2], [1]Universidad Autónoma Agraria Antonio Narro, Saltillo, CU, Mexico, [2]Universidad Autónoma Agraria Antonio Narro, Saltillo, Mexico, [3]Dupont Pioneer, Los Mochis, Mexico, [4]Universidad Autonoma Agraria Antonio Narro, Saltillo, Coahuila, Mexico, [5]Koppert, Saltillo, Mexico

Caterpillar (Lepidoptera) species attacking corn are described for several locations in northern Mexico. The presence of western being cutworm (WBC) *Striacosta albicosta,* is noteworthy as a very late season species occurring at very low densities. The possible causes for these features of WBC are discussed. A diverse complex of parasitoids and entomopathogens attacks fall armyworm (FAW), *Spodoptera frugiperda* there. Bioassays and field applications of fungal entomopathogens demonstrated that *Metarhizium rileyi* (Ascomycota) can infect FAW larvae on whorl-stage plants. Applied entomopathogenic nematodes also infected FAW on plants. Entomopathogens can be a tool for FAW management on corn.

237. Cereal aphids and yellow dwarf viruses with movement among small grains and corn

Louis Hesler (louis.hesler@usda.gov)[1], Marie A. C. Langham[2], Walter Riedell[1] and Shannon Osborne[1], [1]USDA-ARS, North Central Agricultural Research Laboratory, Brookings, SD, [2]South Dakota State Univ., Brookings, SD

Many arthropod pests of agriculture are notorious for migrating among different crops within a large geographic region. Some of these pests also disperse plant pathogens during movement among crops. In the Great Plains of North America, a prominent example involves various cereal aphid species that carry plant pathogens known collectively as yellow dwarf viruses and serve as obligate vectors of these viral pathogens to a variety of grassy crop and non-crop plant hosts. Numerous cereal aphid species, multiple viruses, and a diverse assortment of host plants within the agricultural landscape produce a complex array of interactions that challenge pest management. In this presentation, the aphids, viruses and important plant hosts are identified, and the complexities and implications of various pest-management tactics in wheat and corn are discussed.

238. Geographic patterns of sugarcane aphid infestation risk in Oklahoma and varietal selection guidelines for grain sorghum producers

Norman Elliott (norman.elliott@ars.usda.gov)[1], Kristopher Giles[2], Tom Royer[2] and J. Scott Armstrong[1], [1]USDA - ARS, Stillwater, OK, [2]Oklahoma State Univ., Stillwater, OK

The invasive sugarcane aphid, *Melanaphis sacchari,* was discovered damaging grain sorghum in Texas, Louisiana, Oklahoma, and Mississippi in 2013, and is now widespread in the Southern U.S. Severe injury to sorghum plants caused by *M. sacchari* can cause 25-50% yield loss and in some cases complete crop failure in unprotected fields predicating the need for improved management. Three years of intensive monitoring of sugarcane aphid infestations in grain sorghum fields and stands of alternate host plants throughout Oklahoma have revealed consistent geographic patterns of infestation risk. Infestation risk in Oklahoma is predictable and strongly dependent on geographic location but is unrelated to the presence of stands of the widespread alternate host Johnson grass, *Sorghum halepense*. Knowledge acquired on geographic infestation patterns can be exploited to develop guidelines for varietal selection and deployment of resistant sorghum varieties by Oklahoma grain sorghum producers.

239. Natural enemy regulation of the sugarcane aphid in the southern U.S. Great Plains: Who are the key regulatory agents and where are they?

Ashleigh Faris (ashleigh.faris@ag.tamu.edu)[1], Blake Elkins[2], James Woolley[1] and Michael Brewer[3], [1]Texas A&M Univ., College Station, TX, [2]USDA - ARS, Stoneville, MS, [3]Texas A&M AgriLife Research, Corpus Christi, TX

Sugarcane aphid and natural enemy populations have been monitored annually on grain sorghum in south Texas from 2014-2019. The study locations represent a large-scale production region of the southern reaches of the U.S. Great Plains, where sugarcane aphid first invaded sorghum in North America. Although a large-scale annual system, habitat that harbors aphid natural enemies was an element of the landscape. Common habitats surrounding sorghum fields in south Texas are Johnson grass (*Sorghum halepense*) and riparian areas that includes shrubs and grasses. Johnson grass and remnant sorghum are of special interest due to potential to serve as sources for overwintering sugarcane aphids and natural enemies. The objectives of this study were to identify the natural enemies of sugarcane aphids in the southern Great Plains and to estimate the relative effect of surrounding habitats (remnant grain sorghum, Johnsongrass, and riparian areas) to serve as a source of natural enemies across the annual time period of grain sorghum production. Lady beetle adults were the most abundant predators during and after sorghum cultivation where *Cycloneda sanguinea* (L.) (Coleoptera: Coccinellidae) was the most common species. The most abundant natural enemy was the parasitoid *Apehlinus nigritus* (Howard) (Hymenoptera: Aphelinidae), whose population fluctuations were characteristic of a density-dependent host-enemy system that suppresses the aphid population. These density-dependent trends in sugarcane aphid suppression have repeated annually in years four to six post aphid invasion and support *A. nigritus* as a key component to a sugarcane aphid regulatory system in the southern reaches of the U.S. Great Plains.

Highlights of Successful Entomology Research and Education at Small Colleges and Universities

244. Research and education at a rural four-year comprehensive university: Mistakes, successes, and lessons learned

Kenwyn Cradock (Kenwyn.Cradock@enmu.edu), Eastern New Mexico Univ., Portales, NM

The challenges of conducting research at a four-year comprehensive university are quite different from those faced by colleagues at research-based institutions. Likewise, the student bodies are often distinct from those at larger research-based universities due to differences in mission and admittance policies and requirements. This presents challenges and opportunities in the areas of research and teaching as many graduate programs gear their training of students for the research-emphasis environment. Creativity and a multifaceted approach can contribute to a fruitful career in the classroom, lab, and field. Seek funding from agencies and programs that may not be typical of entomology. Leverage institutional funding opportunities when they are available. Look for collaborations with colleagues in other fields. In the classroom and teaching lab entomology offers rich opportunities in general education as well as major-level classes. A rewarding entomological educational and research career is possible at smaller institutions with a teaching emphasis.

245. Damselfly population genetics as a cure for general biology students at a small university

Ryan Caesar (rmcaesar@schreiner.edu), Schreiner Univ., Kerrville, TX

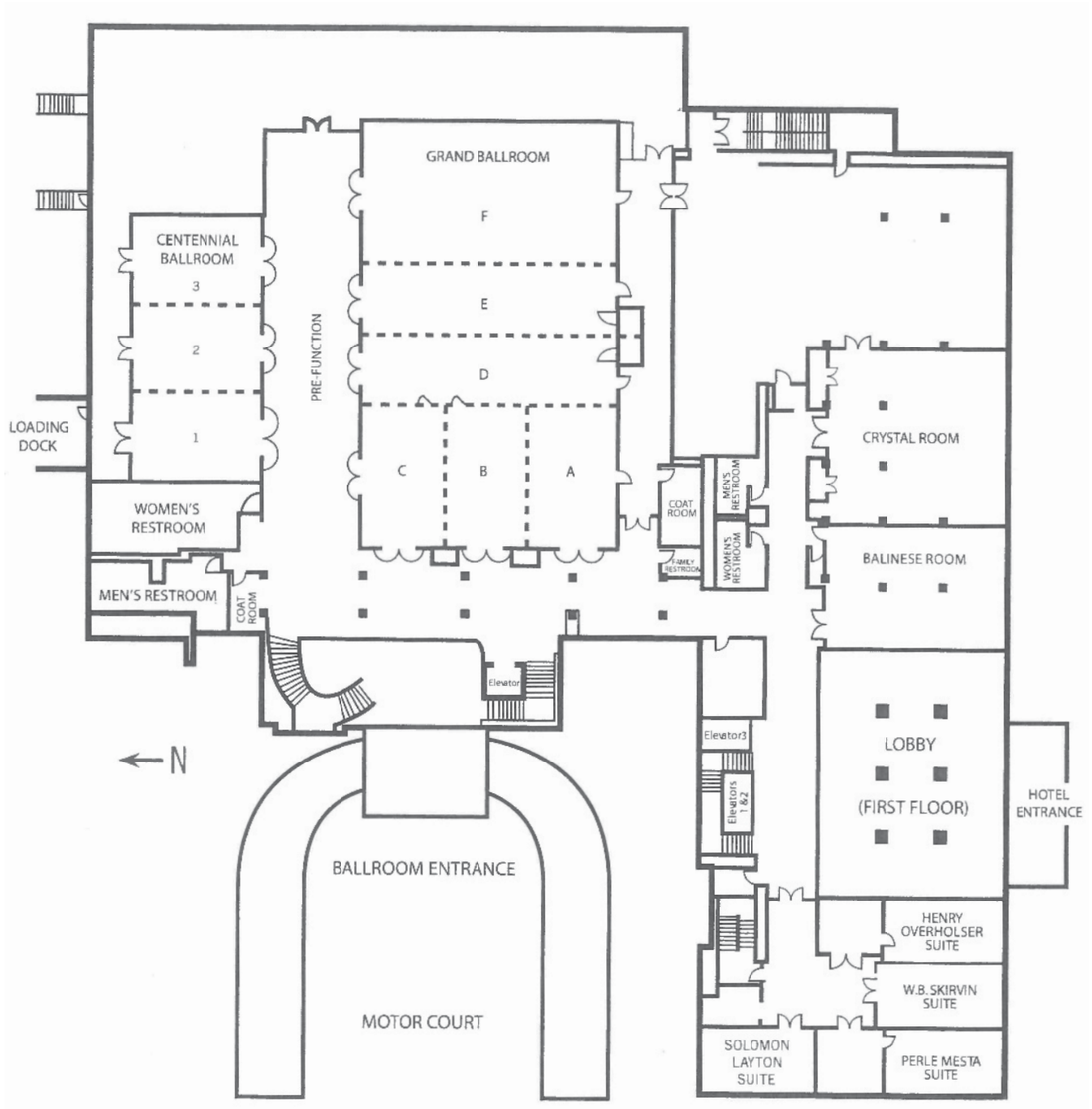
Course undergraduate research experiences (CURE) have become a popular high-impact learning practice in science courses. In particular, they provide a way for students at small institutions to get directly involved in research, when support for research is extremely limited. Provided a small amount of funding for supplies, equipment, and services is available, using damselflies (and other Odonata) as model study organisms can be highly productive and educational. This presentation will review a pilot of a CURE that focuses on population genetics using common of damselflies in central and south Texas. Within this framework, students are able to address questions such as: how much gene flow exists between putative populations?, how do these gene flow patterns compare between different species?, and to what extent does natural and human disturbance affect gene flow? The major benefit of this approach is that students (who often lack a strong interest in organismal biology) are exposed to an integrated approach that involves field work, ecology and behavior of Odonata, molecular lab techniques, data analysis, and bioinformatics. Such a CURE is therefore suitable for use in a variety of courses and can be expanded to span different courses over multiple semesters.

Author Index

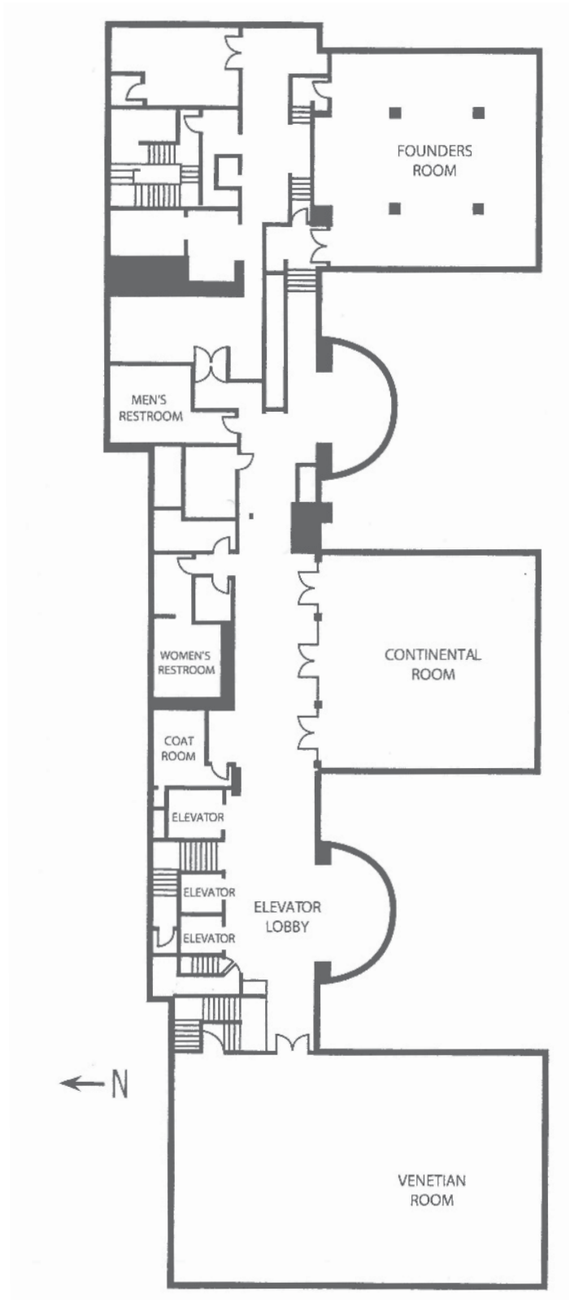
Scientific Name Index

Common Name Index

Floor Plans: 2nd Floor Overview

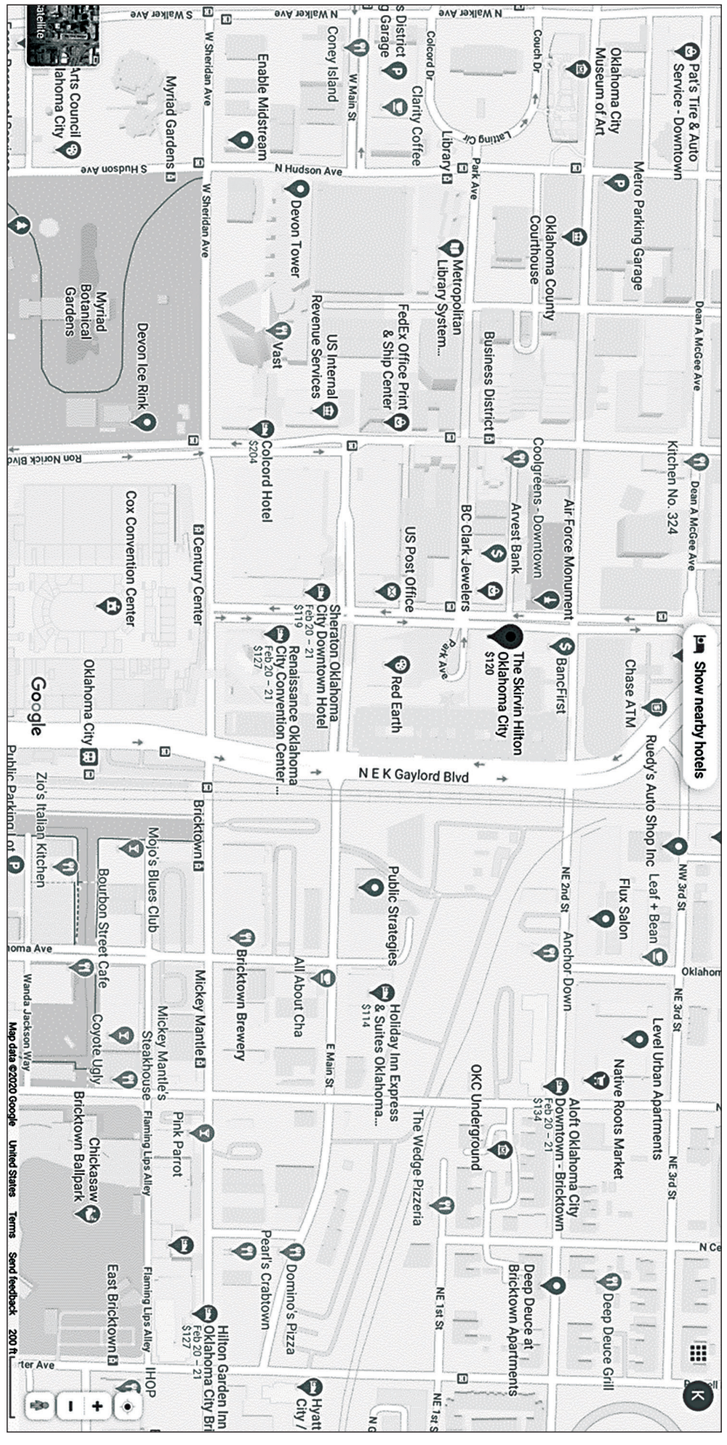


Floor Plans: 14th Floor Overview



Floor Plans

Area Map



Notes

SWB 2021
Save the Date!

April 18-April 2, Forth Worth, Texas

Fort Worth Radisson at Fossil Creek

In addition to an exciting scientific program, there are many entertainment and restaurants options. Visitors can also spend time at the Stockyards with two longhorn cattle drives per day, the Fort Worth Zoo, Water Gardens, Botanic Gardens, ghost tours and the Kimball Art Museum. We will have a longhorn at the Insect Expo for photographs and exclusive use of the on-site hotel nightclub for the student mixer.

Join us in 2021!

SAVE THE DATE!!!

Plan to attend the next NCB-ESA meeting in Minneapolis, MN

21-24 March 2021

NORTH CENTRAL BRANCH

ENTOMOLOGICAL SOCIETY OF AMERICA

2020
ENTOMOLOGY
November 15–18 | Orlando, FL

Submissions due:
May 15, 2020

CALL FOR ABSTRACT SUBMISSIONS

We want **you** to present at Entomology 2020—the Entomological Society of America's Annual Meeting for **all**—all arthropods, all career paths, all people. Help your colleagues advance their work by sharing your diverse research!

The submission site will open in mid-April.
Start planning what you will present now.

Entsoc.org/Entomology2020