PROGRAM & PROCEEDINGS

of the

70TH ANNUAL MEETING

of the SOUTHWESTERN BRANCH of the

ENTOMOLOGICAL SOCIETY OF AMERICA

and the ANNUAL MEETING of the

ENTOMOLOGICAL SOCIETY OF AMERICA
SOUTHWESTERN BRANCH

SOCIETY OF SOUTHWESTERN ENTOMOLOGISTS

April 18 – 20, 2022

Radisson Hotel Fort Worth North at Fossil Creek

Fort Worth, Texas

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SPONSORS

We thank the following people and organizations for their generous donations in support of the 2022 SWB-ESA meeting.

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Meeting Information

MEETING WEBSTIE

https://www.entsoc.org/membership/branches/southwestern/meeting

REGISTRATION:

Below are the registration rates for the 2022 Southwestern Branch Meeting.

REGISTRATION TYPE	ADVANCE REGISTRATION RATE (THROUGH MARCH 21, 2022)	REGULAR REGISTRATION RATE (STARTING MARCH 22, 2022)
ESA Regular Member	$295	$395
ESA Early Professional Member	$245	$345
ESA Student Transition Member	$245	$345
ESA Student Member	$95	$130
ESA Emeritus Member	$95	$95
ESA Honorary Member	$95	$95
Non-member	$450	$550
One Day	$295	$295
Guest*	$60	$60

REGISTRATION POLICIES:

Guests are defined as a spouse, significant other, or family member who is not a member of ESA and who may not have an interest in entomology but will attend purely to accompany a family member or friend. Professional colleagues must register independently.

The deadline to cancel and receive a refund is April 4, 2022. After that date, no refunds will be issued.

HOTEL LOCATION:

Radisson Hotel Fort Worth North at Fossil Creek
2540 Meacham Boulevard
Fort Worth, TX 76106
(817) 769-4023

PROGRAM SCHEDULE AND MODERATORS:

Speakers are limited to the time indicated in the schedule.

Moderators are responsible for keeping the program on schedule, introducing speakers, and reporting any audio-visual or equipment issues. Moderators for all symposia, student competition sessions, and ten-minute papers sessions should arrive in their session rooms 10-15 minutes prior to the start of the session.

In the case of an omitted presentation, the moderators will hold the time slot where that speaker should have presented and not advance to the next speaker until the designated time.

INFORMATION FOR ORAL PRESENTATIONS AND POSTERS

Browse to the URL below or scan the QR code with your device's camera:

https://www.entsoc.org/membership/branches/southwestern/meeting/presenter-information

ESA CERTIFICATION BOARD INFORMATION:

Information regarding the ESA Certification Board is available at the Registration Desk.

JOB OPPORTUNITY BOARD:

The Student Affairs Committee will host a Job Opportunities Board during the meeting. Employers are encouraged to post copies of available opportunities for prospective students. Prospective employees/students should bring multiple copies of CV or résumé to the Board for review by potential employers. Volunteers operating the Board will serve as liaisons to arrange interviews if needed. The Job Opportunities Board will be located in the Barons Room, along with the presentation upload.

LOST AND FOUND:

Articles should be turned in or reported to the Registration Desk or hotel main desk.

MESSAGES:

A message board is at the Registration Desk.

CODE OF CONDUCT

By attending the 2022 Southwestern Branch 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 Stacie East, ESA's Director of Diversity, Equity, and Inclusion at +1 (301) 731-4535 x3030 or seast@entsoc.org.

Program Information

ENTOMOLOGICAL SOCIETY OF AMERICA SOUTHWESTERN BRANCH

2021 – 2022 Executive Committee

Wizzie Brown, President
ebrown@ag.tamu.edu

Wyatt Hoback, Past-President
whoback@okstate.edu

Scott Ludwig, Vice- President
Scott.Ludwig@upl-ltd.com

Juliana Rangel, Secretary
jrangel@tamu.edu

Laura Weiser Erlandson, Secretary-elect
laura.erlandson@tamuct.edu

Bob Davis, Treasurer
robert.davis@basf.com

Jesus Esquivel, Representative to the Governing Board
Jesus.Esquivel@usda.gov

2021 – 2022 Committees

AUDIT COMMITTEE
Scott Armstrong (Chair)
Bruce Noden
Adam Mitchell
Mickey Eubanks

AWARDS AND HONORS COMMITTEE
Sonja Swiger (Chair)
Laura Weiser-Erlandson
Jesus Esquivel
Kristopher Giles
Bruce Noden
Carolina Nunez
Santos Portugal
Robert Puckett
Brandon Smythe

BRANCH ARCHIVIST
Gregory Cronholm

FRIENDS OF THE SOUTHWESTERN BRANCH COMMITTEE
Scott Ludwig (Chair)
Wyatt Hoback
Wizzie Brown

***IN MEMORIAM* COMMITTEE**
Edmond Bonjour (Chair)
David Thompson
Allen Dean
Scott Bundy

INSECT DETECTION, EVALUATION, AND PREDICTION COMMITTEE
(Chair)
Charlie Konemann
Kristen Bowers
Xanthe Shirley

INSECT EXPO COMMITTEE
Andrine Shufran (Chair)
Tracey Payton
Wizzie Brown
Molly Keck

ENTOMOLOGY GAMES COMMITTEE
Tracey Payton (Chair)
Wizzie Brown (Gamesmaster)
Adam Mitchell
Cheri Abraham
Wyatt Hoback
Juliana Rangel Posada
Alvaro Romero
Joni Blount

LOCAL ARRANGEMENTS COMMITTEE
Laura Weiser-Erlandson (Chair)

MEMBERSHIP COMMITTEE
Justin Talley (Chair)
Manuel Campos
Jesus Esquivel
Sergio Sanchez-Pena

Astri Wayadande

NOMINATING COMMITTEE
Wyatt Hoback (Chair)
Wizzie Brown
Molly Keck
Eric Rebek
Bob Davis

PROGRAM COMMITTEE
Sonja Swiger (Chair)
Milo Lewis (Vice-Chair)

PUBLIC INFORMATION COMMITTEE
Tom Royer (Chair)

SITE SELECTION COMMITTEE
Wyatt Hoback (Chair)
Wizzie Brown

STUDENT RESEARCH PAPER AND POSTER AWARDS COMMITTEE
Joni Blount (Chair)
Ali A. Zarrabi
Suhas Vyavhare
Brandon Smythe
Tom Royer
Jane Pierce
Bob Davis
Scott Bundy
Justin Talley
Holly Davis

YOUTH SCIENCE COMMITTEE
Wizzie Brown (Chair)
Molly Keck
Jane Pierce
Andrine Shufran

COMMITTEE ON DIVERSITY AND INCLUSION
Rupesh Kariyat (Chair)

EARLY CAREER PROFESSIONALS COMMITTEE
Brandon Smythe (Chair)
Dalton Ludwick

EDUCATION AND OUTREACH COMMITTEE
Wyatt Hoback (Chair)
Andrine Shufran
Molly Keck
Wizzie Brown

SCIENCE POLICY CAPABILITY COMMITTEE
Megha Parajulee (Chair)

STUDENT AFFAIRS COMMITTEE
Jordan Twombly Ellis (Chair)
Morgan Thompson
Myra Dickey
Alex Harman
Laura Marmolejo
Taylor Ussery
Emily Russavage

Past-Presidents and Chairmen of the Southwestern Branch

President	Year	Meeting Location
W. Wyatt Hoback	2020-21	Virtual
Molly Keck	2019-20	Virtual
Eric Rebek	2018-19	Tulsa, OK
Justin Talley	2017-18	Albuquerque, NM
Carlos Bográn	2016-17	Austin, TX
Jerry Michels	2015-16	Tyler, TX
Bob Davis	2014-15	Tulsa (Catoosa), OK
Jesus Esquivel	2013-14	San Antonio, TX
Scott Bundy	2012-13	Las Cruces, NM
Allen Knutson	2011-12	Little Rock, AR
Tom Royer	2010-11	Amarillo, TX
Carlos Blanco	2009-10	Cancun, Mexico
Bonnie Pendleton	2008-09	Stillwater, OK
Greg Cronholm	2007-08	Ft. Worth, TX
David Thompson	2006-07	Corpus Christi, TX
Bart Drees	2005-06	Austin, TX
Phil Mulder	2004-05	Albuquerque, NM
John D. Burd	2003-04	Lubbock, TX
Terry Mize	2002-03	Oklahoma City, OK
W. Pat Morrison	2001-02	Guanajuato, Mexico
Jim Reinert	2000-01	San Antonio, TX
James A. Webster	1999-00	Ft. Worth, TX
Carol Sutherland	1998-99	Las Cruces, NM
Ann Weise	1997-98	Corpus Christi, TX
Pete Lingren	1996-97	Oklahoma City, OK
Charles L. Cole	1995-96	Austin, TX
J. Terry Pitts	1994-95	Dallas, TX
Sidney E. Kunz	1993-94	Monterrey, Mexico
John G. Thomas	1992-93	Albuquerque, NM
Don Bull	1991-92	Tulsa, OK
Aithel McMahon	1990-91	College Station, TX
Russel E. Wright	1989-90	San Antonio, TX
Joyce Devaney	1988-89	El Paso, TX
Russ Andress	1987-88	Dallas, TX
Don Rummel	1986-87	Austin, TX
John E. George	1985-86	Monterrey, Mexico
Paul D. Sterling	1984-85	San Antonio, TX
H. Grant Kinzer	1983-84	Oklahoma City, OK
James R. Coppedge	1982-83	Corpus Christi, TX
Bill C. Clymer	1981-82	El Paso, TX
Horace W. VanCleave	1980-81	San Antonio, TX
Robert L. Harris	1979-80	Brownsville, TX
Jimmy K. Olson	1978-79	Houston, TX
J. Pat Boyd	1977-78	Lubbock, TX
Robert A. Hoffman	1976-77	Guadalajara, Mexico
Weldon H. Newton	1975-76	Oklahoma City, OK
Harry L. McMenemy	1974-75	El Paso, TX
Roger O. Drummond	1973-74	Dallas, TX
Dieter S. Enkerlin	1972-73	San Antonio, TX
Stanley Coppock	1971-72	Mexico City, Mexico

Chairman	Year	Meeting Location
C.A. King, Jr.	1970-71	El Paso, TX
Ted McGregor	1969-70	Brownsville, TX
Neal M. Randolph	1968-69	Dallas, TX
Walter McGregor	1967-68	Oklahoma City, OK
Harvey L. Chada	1966-67	San Antonio, TX
R.L. Hanna	1965-66	El Paso, TX
H.E. Meadows	1964-65	Austin, TX
Dial E. Martin	1963-64	Monterrey, Mexico
Manning A. Price	1962-63	Houston, TX
Sherman W. Clark	1961-62	Oklahoma City, OK
O.H. Graham	1960-61	San Antonio, TX
Clyde A. Bower	1959-60	El Paso, TX
Paul Gregg	1958-59	Dallas, TX
C.R. Parencia	1957-58	Houston, TX
J.C. Gaines	1956-57	San Antonio, TX
D.C. Earley	1955-56	Ft. Worth, TX
John M. Landrum	1954-55	Houston, TX
D.E. Howell	1953-54	Dallas, TX
P.J. Reno	1952-53	Galveston, TX
R.C. Bushland	1951-52	San Antonio, TX
H.G. Johnston*	1950-51	Dallas, TX

*** Southwestern Branch, American Association of Economic Entomologists**

Awards

Southwestern Branch Student Awards

Percival Scientific Undergraduate Entomology Student Activity Award
Joel DuBois
Oklahoma State University

Mr. DuBois is a senior at Oklahoma State majoring in Entomology with an emphasis in Insect biology, Classification and curation. He possesses a passion for collecting and curating specimens and his collection was truly amazing. Outside of class, he has spent about 30 hours per week curating specimens, typing in data, and identifying unlabeled specimens in the OSU Entomology Museum. As part of his undergraduate research, he collected new state records of metallic woodboring beetles, documenting 10 new records in Oklahoma and New Mexico. Outside of the classroom and museum work, Joel exhibits a true passion for sharing his love of entomology with others. He volunteers almost every Saturday at the Insect Adventure where he engages kids and their parents about arthropods and answers their questions. Joel will graduate in May and has been accepted to a MS program at LSU where he will continue his education about taxonomy and systematics.

SWB-ESA Master's Student Graduate Award
Hannah Walker
New Mexico State University

Ms. Walker is a second year Master's student at New Mexico State University with a research assistant at the Veterinary Entomology Research Laboratory (VERL). Ms. Walker is a true leader that exudes enthusiasm and willingness to learn and is repeatedly called on to participate and contribute to multiple scientific investigations. Hannah's research project is primarily concerned with the consequences associated with inconsistent consumption of feedthrough products on filth fly control created a template that high level graduate students in my laboratory will use in the future.
Hannah is a hard worker with a strong academic focus and is always willing and available to assist others when needed. She thrives on helping others without complainant and is a natural leader of others. Hannah has outstanding organizational skills and is an invaluable asset to any laboratory. She successfully completes every task that she is given, with favorable results despite deadline pressure. Aside from the broad, goal-oriented classification of Ms. Walker's character, her attention to the small details truly sets her aside from her peers. After graduating in May 2022, Ms. Walker will be taking a position with Y-Tex Corporation.

Southwestern Branch Student Awards con't

John Henry Comstock Graduate Student Award
Alexandria Payne
Texas A&M University

Alexandria (Alex) Payne is a sixth year Ph.D. student in the Department of Entomology at Texas A&M University expected to graduate in May 2022. Alex is studying the disease ecology of honey bees. Her research incorporates aspects of virology, ecology, nutrition, and honey bee biology to better understand the interaction between honey bees and their associated pathogens to help address the global issue of declining honey bee health. Alex's research can broadly be broken up into two parts: 1) exploring how interspecies transmission of viruses occurs between honey bees and ants, a common pest found within honey bee hives, and 2) better understanding how honey bee nutrition that varies in its macronutrient profile can impact the physiology and health of bees infected with pathogens. In addition to her dissertation research, she has also conducted several side projects. Alex has proven in her short but productive career that she has all the qualities and ingenuity to conduct high-impact honey bee research that can provide invaluable service to apiculture. Last year, Alex was recipient of the 2020 Vice Chancellor's Award for Excellence in Graduate Student Research from Texas AgriLife Research, received the highly competitive National Science Foundation Graduate Research Fellowship in 2016, and was also the recipient of TAMU's two-year Diversity Fellowship. She has received several fellowships, awards, and scholarships worth over $370,000. Alex has been an excellent ambassador for Texas A&M. She regularly gives presentations to public audiences at outreach events and to beekeepers and has been very active in Aggie Women in Entomology. Alex is an outstanding student performing research at a high level.

Early Career Professional Award

ESA Excellence in Early Career Award
Dalton Ludwick
Texas A&M AgriLife Extension

Dr. Dalton Ludwick is an Extension entomologist/Assistant Professor in the Department of Entomology with Texas A&M AgriLife Extension. Dr. Ludwick joined the Department of Entomology in July 2020 and, despite the ongoing pandemic, has excelled in his duties. Located at the Texas A&M AgriLife Research & Extension Center in Corpus Christi, TX, Dalton continues to improve his network to identify local issues and focus education and research efforts on pressing matters in the Coastal Bend region. As a faculty member, Dalton quickly recruited a Master's student to aid his research projects and joined committees of two doctoral students. His commitment to graduate education has been apparent as he now serves on the Department's Graduate Admissions Committee and co-organized the 24th annual Graduate Student Forum where graduate students present their research to the Department of Entomology. All of this is done as an off-campus faculty member. Dalton's primary role is as an Extension Entomologist. Dalton has been interviewed on a variety of topics, including insect migrations, cicada emergences, and the impact of severe weather on insect populations. He is regularly contacted by the public to identify insects and offer cultural or chemical management tactics where appropriate. To date, Dalton has been involved with nearly $500,000 in research projects, authored or co-authored more than 100 presentations, authored factsheets on commonly encountered insects and served as an identifier for more than 100 website inquiries.

Southwestern Branch Nominations for ESA Professional Awards

Distinguished Achievement Award in Teaching
Jennifer Gillett-Kaufman
Texas A&M University

Dr. Jennifer Gillett-Kaufman joined the Department of Entomology at Texas A&M University as an Instructional Associate Professor (90% Teaching, 10% Service) on July 1, 2020. Prior to joining the Department, she served as a faculty member of Entomology and Nematology Department at the University of Florida where she was promoted to Full Extension Scientist in 2019. Dr. Gillett-Kaufman has developed numerous new courses both at Texas A&M and at the University of Florida and has taught an impressive scope of topics from those encountered in "*Insect Vectored Plant Pathogens*" to "*Insects in Italy*", but her true devotion is to courses that assist students with their professional development. These courses range from "*Grant Writing*" and "*Scientific Writing*" at the graduate level to "*Occupational and Professional Development"* for undergraduates; and they all have one thing in common, that is heavy amounts of grading and detailed feedback for students. Dr. Gillett-Kaufman has received multiple grants, totaling $428,567, to support her teaching program including small grants that facilitated her travel to southern Italy to learn about the impact of an insect vectored pathogen on olives, but also larger grants that improved public outreach and diversity in Entomology (especially through the Higher Education Challenge Grant program). In addition to her publications, she actively works to ensure her graduate and undergraduate students develop solid writing and communication skills. Her mentoring style is focused on helping students build their CVs with meaningful experiences and develop projects that generate publications that will help them be successful in achieving their future goals. With her students, she has published 17 refereed journal articles and 28 peer-reviewed Extension articles.

Distinguished Achievement Award in Extension
Sonja L. Swiger
Texas A&M AgriLife Extension

Dr. Sonja Swiger, an Associate Professor / Extension Entomologist with Texas A&M AgriLife Extension, has brought the attention and support of two programs focusing on humans and livestock to stakeholders. When hired, her responsibility was to focus on livestock entomology, assisting farmers and ranchers with their concerns pertaining to ectoparasites of cattle. However, as mosquito borne diseases became headline news, Dr. Swiger became part of the collaborative team of the Western Gulf Center of Excellence for Vector-Borne Diseases. As the Extension medical entomologist her responsibilities quickly increased to working with local, county, state, and federal officials on vector management. Her knowledge of Diptera allows her to educate young and old about their lifecycles and why they need to be managed properly to protect public health. The general objectives of her livestock entomology program are to promote and demonstrate the importance of pest/disease detection and monitoring information into pest management decisions, and to promote and demonstrate the use of integrated pest management (IPM) tactics. Dr. Swiger utilizes field demonstrations as a major focus of her Extension program. This provides opportunities for County Extension Agents to interact with local producers and allow producers an opportunity to see Extension efforts at work and provide up-to-date relevant data. The goal of her public health entomology program is to teach and increase proper mosquito management and surveillance techniques among Texas city/county/state and federal public health and vector control personnel. Sonja's Extension program is both extensive and effective, serving both the livestock and human health groups. Her funding has been exceptional, and the return on investment is quite notable.

Southwestern Branch Nominations for ESA Professional Awards cont'd

Award for Excellence in Integrated Pest Management
David Kerns
Texas A&M AgriLife Extension

Dr. David Kerns is the Associate Department Head, in the Department of Entomology at Texas A&M University where he is responsible for supervising and managing departmental Extension personnel including Extension Specialist faculty, IPM agents, and works with Extension Administrators to fulfill the missions of the Texas A&M AgriLife Extension Service and Texas A&M University as a Land-Grant Institution. During his career Dr. Kerns has made tremendous strides in developing and helping growers implement highly impactful IPM programs that have not only benefited Texas, but also the region and nation. Dr. Kerns developed the first data driven and comprehensive economic threshold for cotton aphids, and that has been adopted throughout the western U.S. Dr. Kerns conducted IPM research to determine which cotton aphid insecticides were least likely to disrupt aphid natural enemies. In 2011, Dr. Kerns identified a new thrips and immediately went to work to determine treatment options and pest impact. He was instrumental in finding management solutions and dispersing information regarding this thrips via turn row and crop tour meetings, oral presentations at grower meetings, ag radio talk shows, and newsletters. Estimated losses due to this pest was 49,789 bales or $20 million. The value of this Extension and outreach IPM program to Texas Cotton Producers was around $40 million. Additionally, Dr. Kerns was among the first to identify a new and devastating invasive pest of sorghum, the sugarcane aphid. Since 2017, he has been involved in securing over $6.3 million, of which almost $4.8 million went directly to his programs. Approximately $420,082 from commodity groups including Cotton Incorporated, the Texas Corn Producers and the Texas Sorghum Producers, which demonstrates his efforts to directly benefit farmers as well as their appreciation of his work on their behalf.

Plenary Session Schedule

Tuesday, April 19, 2022, 8:00 AM – 10:00 AM
Meacham

8:00 am	**Welcome and Call to Order** Wizzie Brown, President – Southwestern Branch ESA
8:10 am	**Welcome from the Society of Southwestern Entomologists** Sonja Swiger, President – Society of Southwestern Entomologists
8:20 am	**Governing Board Update** Jesus Esquivel, Representative to the ESA Governing Board
8:30 am	**ESA Presidential Address** Jessica Ware, ESA President
9:00 am	**ESA Society Update** Chris Stelzig, Executive Director of ESA
9:10 am	**Nominating Committee Report** Wyatt Hoback, Member
9:20 am	**In Memoriam Committee Report** Edmond Bonjour, Chair
9:40 am	**Voting on updates to Branch Constitution and Bylaws** Wizzie Brown, President
9:50 am	**Local Arrangement Announcements** Laura Weiser Erlandson, Chair
	Program Announcements Milo Lewis/ Sonja Swiger, Program Co-Chairs
10:00 am	**Town Hall Meeting**

Program Summary

MONDAY, APRIL 18, 2022

Program	Time	Location
Registration	1:00 PM - 5:00 PM	Lower Terrace
Presentation Uploads	1:00 PM - 5:00 PM	Barons
Southwestern Branch Executive Committee Meeting	2:00 PM - 3:30 PM	Pickett
Society of Southwestern Entomologists General Membership Meeting	4:00 PM - 5:00 PM	Courtright/Parker
Student Competition Poster Setup	5:00 PM - 7:00 PM	Upper Terrace
Welcome Reception	5:00 PM - 7:00 PM	Meacham
Student Affairs Committee Meeting / Photo Salon Judging	8:00 PM - 10:00 PM	Pickett

TUESDAY, APRIL 19, 2022

Program	Time	Location
Registration	7:30 AM - 4:00 PM	Lower Terrace
Presentation Uploads	7:30 AM - 5:00 PM	Barons
Plenary Session	8:00 AM - 10:00 AM	Meacham
Student Poster Competition - Undergraduate	8:00 AM - 4:00 PM	Upper Terrace
Student Poster Competition - Masters	8:00 AM - 4:00 PM	Upper Terrace
Student Poster Competition - PhD	8:00 AM - 4:00 PM	Upper Terrace
ESA Town Hall	10:00 AM - 11:00 AM	Meacham
Break	11:00 AM - 11:20 AM	Upper Terrace
Emerging Problems in Entomology in the Southwest: Global Change, Biodiversity, Land Use Change, and Invasive Species	11:00 AM - 12:30 PM	Flatiron/Spring Palace
Regular Ten-Minute Paper Session I	11:15 AM - 12:40 PM	Westbrook
Regular Ten-Minute Paper Session II	11:15 AM - 12:30 PM	Chisolm
Student 10-minute Paper Competition - PhD	1:30 PM - 5:00 PM	Flatiron/Spring Palace
Student 10-minute Paper Competition - Undergraduate	2:00 PM - 4:00 PM	Chisolm
Student 10-minute Paper Competition - Masters	2:00 PM - 5:00 PM	Westbrook

Break	3:15 PM - 3:45 PM	Upper Terrace
Q&A with Student Poster Presenters	3:15 PM - 3:45 PM	Upper Terrace
Student Competition Poster Removal	4:00 PM - 5:00 PM	Upper Terrace
Entomology Games, Preliminary Round	5:00 PM - 7:00 PM	Meacham
Contributed Poster Setup	6:00 PM - 8:00 PM	Upper Terrace
Student Reception	7:00 PM - 9:00 PM	Cassidy's

WEDNESDAY, APRIL 20, 2022

Program	**Time**	**Location**
Registration	7:30 AM - 4:00 PM	Lower Terrace
Presentation Uploads	7:30 AM - 5:00 PM	Barons
Advances in Field Crop IPM	8:00 AM - 12:00 PM	Flatiron/Spring Palace
Arthropod Behavioral Changes in Response to a Rapidly Changing Climate	8:00 AM - 10:00 AM	Meacham
Genome Editing and Molecular Biology of Insects	8:00 AM - 12:00 PM	Westbrook
The Current State Of Insects As Feed: Impediments, Gaps, And Opportunities	8:00 AM - 12:00 PM	Chisolm
Regular Poster Session	8:00 AM - 4:00 PM	Upper Terrace
Break	10:00 AM - 10:20 AM	Upper Terrace
Current Trends in Social Insect Biology	1:00 PM - 5:00 PM	Meacham
Establishing Minimum Standards in Forensic Entomology	1:00 PM - 5:00 PM	Westbrook
IPM Implementation and Sustainability for Southwestern Cotton Systems	1:00 PM - 5:00 PM	Chisolm
Break	2:25 PM - 2:55 PM	Upper Terrace
Q&A with Regular Poster Presenters	2:25 PM - 2:55 PM	Upper Terrace
Contributed Poster Removal	4:00 PM - 5:00 PM	Upper Terrace
Entomology Games, Final Round	5:00 PM - 7:00 PM	Meacham
Awards Banquet and Final Business Meeting	7:30 PM - 10:00 PM	Flatiron/Spring Palace

THURSDAY, APRIL 21, 2022

Program	**Time**	**Location**
Final Southwestern Branch Executive Committee Meeting	8:00 AM - 9:45 AM	Barons

Oral & Poster Presentation Schedule

Tuesday, April 19, 2022, Posters

Student Poster Competition - Undergraduate / 8:00 AM-4:00 PM

Location: Upper Terrace

10-1 **Comparing Nosema levels in wild and managed honey bee (*Apis mellifera)* populations at Welder Wildlife Refuge.** ***Mckaela Whilden*** *(mckaela@tamu.edu)[1], Brittany Usoff[1], Myra Dickey[2] and Juliana Rangel[1], [1]Texas A&M Univ., College Station, TX, [2]Texas A&M, College Station, TX*

10-2 **Just add water: Invertebrate colonization of temporary ponds in central Oklahoma.** ***Gabrielle Jones*** *(gabriellejo14@gmail.com), Oklahoma State Univ., Stillwater, OK*

10-3 **Night and day: Determining niche partitioning through circadian rhythms of dung beetle genera.** ***Ethan Shaw*** *(etshaw@okstate.edu) and William Hoback, Oklahoma State Univ., Stillwater, OK*

10-4 **Using metabarcoding to determine the selectiveness of pollinators in a black land prairie.** ***Frank Goodavish*** *(fgoodavish20@austincollege.edu) and Loriann Garcia, Austin College, Sherman, TX*

Student Poster Competition - Masters / 8:00 AM-4:00 PM

Location: Upper Terrace

11-1 **The taxonomy of adult females in the genus *Xenos* (Strepsiptera: Xenidae) with a re-description of the females of three North American species.** ***Clea Garza*** *(cleagarza@shsu.edu) and Jerry Cook, Sam Houston State Univ., Huntsville, TX*

11-2 **Evaluating the reproductive potential of *Rhopalosiphum padi* on resistant sources of barley.** ***Malea Parsons*** *(maleagonzalez18@gmail.com)[1], Dolores Mornhinweg[2], J. Scott Armstrong[3] and Wyatt Hoback[1], [1]Oklahoma State Univ., Stillwater, OK, [2]USDA-ARS, Stillwater, OK, [3]USDA - ARS, Stillwater, OK*

11-3 **Sampling dung beetles between rocks and other hard places testing above ground trap design.** ***Greg Middleton*** *(greg.middleton@okstate.edu) and William Hoback, Oklahoma State Univ., Stillwater, OK*

Student Poster Competition - PhD / 8:00 AM-4:00 PM

Location: Upper Terrace

12-1 **A novel tick carousel assay for testing efficacy of repellents on *Amblyomma americanum* L..** ***Hailey Luker*** *(hailey13@nmsu.edu), New Mexico State Univ., Las Cruces, NM*

12-2 **Massive changes in the phosphoproteome in *Aedes aegypti* Malpighian Tubules after a blood meal and during vitellogenesis.** ***Yashoda Kandel*** *(yashoda@nmsu.edu), New Mexico State Univ., Las Cruces, NM*

12-3 **Heroic beetles and butterflies: The moral alignment of insect-themed characters in American superhero comic books.** ***Emily Geest*** *(egeest@okstate.edu)[1], Ashley Knoch[2] and Andrine A. Shufran[2], [1]Oklahoma State Univ., STILLWATER, OK, [2]Oklahoma State Univ., Stillwater, OK*

12-4 **Linking maize enzymes to herbivore defense.** ***John Grunseich*** *(johngrunseich@tamu.edu), Julio S. Bernal and Michael Kolomiets, Texas A&M Univ., College Station, TX*

12-5 **Grasshoppers and fire: Prescribed burning and patch recovery affects short-horned grasshopper diversity in northern Oklahoma.** ***Alexander Harman*** *(aleharm@okstate.edu), William Hoback and Sam Fuhlendorf, Oklahoma State Univ., Stillwater, OK*

12-6 **Using nutrition to mitigate the effects of pathogen infection in honey bees.** ***Alexandria Payne*** *(alexnpayne@gmail.com)[1], Pierre Lau[2], Cora Garcia[1], Jordan Gomez[1] and Juliana Rangel[1], [1]Texas A&M Univ., College Station, TX, [2]United States Dept. of Agriculture, Stoneville, MS*

Tuesday, April 19, 2022, Morning

Symposium: Emerging Problems in Entomology in the Southwest: Global Change, Biodiversity, Land Use Change, and Invasive Species

Location: Flatiron/Spring Palace
Organizer: Sarah Elzay, Oklahoma State Univ., Stillwater, OK

11:00 AM **15-1** **Increasing entomological diversity: Experiences training Native American entomologists.** ***Melissa Reed*** *(mleath@okstate.edu), Oklahoma State Univ., Stillwater, OK*

11:20 AM **15-2** **Honey bee (*Apis mellifera)* disease ecology: Invasive ants and bee nutrition impact host-pathogen interactions.** ***Alexandria Payne*** *(alexnpayne@gmail.com), Texas A&M Univ., College Station, TX*

11:40 AM **15-3** **Know your audience: How to plan science outreach and science communication projects.** ***Joanie King*** *(joanie_king@tamu.edu), Univ. of Georgia, Athens, GA*

Regular Ten-Minute Paper Session I

Location: Westbrook
Moderator: Edmond Bonjour, Oklahoma State Univ., Stillwater, OK

11:15 AM **16-1** **Horde of the flies: Pollinator composition and trends in Plymouth County, MA.** ***Wes Walsh*** *(kwalsh59@massasoit.edu), Adam Germaine, Prisca Sanon, Christina Orazine, Andrew Oguma and Michael Bankson, Massasoit Community College, Brockton, MA*

11:27 AM **16-2** **Knowing when to fumigate a grain storage facility.** ***Edmond Bonjour*** *(edmond.bonjour@okstate.edu), Oklahoma State Univ., Stillwater, OK*

11:39 AM **16-3** **Meet them where they think: Engaging business majors in an undergraduate entomology course.** ***Bruce Noden*** *(bruce.noden@okstate.edu), Oklahoma State Univ., Stillwater, OK*

11:51 AM **16-4** **Observations of pecan bud moth, *Gretchena bolliana* (Lepidoptera: Tortricidae), in commercial pecan orchards of southern New Mexico.** ***Tiffany Johnson*** *(tjohnson@nmda.nmsu.edu), New Mexico Dept. of Agriculture AES, Las Cruces, NM*

12:03 PM **16-5** **A native range survey of the southwest United States for potential biological control agents of *Prosopis* species (Fabaceae).** ***Kristen Bowers*** *(kebowers@nmsu.edu)[1], Joel DuBois[2] and David Thompson[1], [1]New Mexico State Univ., Las Cruces, NM, [2]Oklahoma State Univ., Stillwater, OK*

12:15 PM **16-6** **Spreading insect science: A virtual insect pinning interactive targeting 7th grade science.** ***C. Scott Bundy*** *(cbundy@nmsu.edu), Barbara Chamberlin, Barbara Chamberlin, Matheus Chamberlin, Barbara Chamberlin, Don Edgar and Shannon Norris, New Mexico State Univ., Las Cruces, NM*

12:27 PM **16-7** **The effects of crop cover on wild bee-plant mutualisms across multiple spatial scales.** ***Sarah Elzay*** *(selzay@okstate.edu) and Kristen Baum, Oklahoma State Univ., Stillwater, OK*

Regular Ten-Minute Paper Session II

Location: Chisolm
Moderator: Robert Davis, BASF Corporation, Pflugerville, TX

11:15 AM **17-1** **Creating a pest house for hands-on applicator training.** ***Janet Hurley*** *(ja-hurley@tamu.edu), Texas A&M AgriLife Extension, Dallas, TX*

11:27 AM **17-2** **Efficacy of PT® Alpine® Pressurized Fly Bait, PT® Vedira™ Pressurized Fly Bait, Vedira™ Granular Ant Bait & InTice™ Rover Ant Bait on dark rover ants (*Brachymyrmex patagonicus* Mayr).** ***Robert Davis*** *(robert.davis@basf.com)[1], Edward Vargo[2] and Kyle Gilder[2], [1]BASF Corporation, Pflugerville, TX, [2]Texas A&M Univ., College Station, TX*

11:39 AM **17-3** **Repellent efficacy of essential oils from the EPA 25B list in two contact-repellency assays with *Aedes aegypti* (L.) (*Diptera: Culicidae*).** ***Soumi Mitra*** *(smitra69@nmsu.edu), New Mexico State Univ., Las Cruces, NM*

11:51 AM **17-4** **Nutritional composition of larval diet impacts life-history traits of a generalist and specialist in the carrion system: Applications in insects as food & feed industry.** ***Erin Harris*** *(erin.harris49@icloud.com) and Jeffery K. Tomberlin, Texas A&M Univ., College Station, TX*

12:03 PM **17-5** **Efficacy of various insecticides against house fly eggs, larvae, and pupae in poultry and dairy manure.** ***Sonja Swiger*** *(slswiger@ag.tamu.edu)[1], Robert Davis[2] and Micki Harris[3], [1]Texas A&M Univ., Stephenville, TX, [2]BASF, Blanco, TX, [3]Texas A&M AgriLife Extension, Stephenville, TX*

12:15 PM **17-6** **A review and new records of the nasute termite *Tenuirostritermes cinereus* (Blattodea: Termitidae) in Texas, U.S.A..** ***José Portugal III*** *(sportugal@goanteater.com)[1], Kim Engler[2] and Alan Brown[1], [1]ABC Home & Commercial Services, Austin, TX, [2]ABC Home & Commercial Services, San Antonio, TX*

Tuesday, April 19, 2022, Afternoon

Student 10-minute Paper Competition – PhD

Location: Flatiron/Spring Palace
Moderators: Wizzie Brown, Texas A&M AgriLife Extension Service, Austin, TX and Laura Weiser Erlandson, Texas A&M Univ., Killeen, TX

1:30 PM **18-1** **How the chemical ecology of host-associated differentiation improves natural enemy selection for biological control.** ***Morgan Thompson*** *(mthompson@tamu.edu), Raul F. Medina, Anjel Helms and Julio Bernal, Texas A&M Univ., College Station, TX*

1:42 PM **18-2 Smelling, searching, and sabotage: How two carrion insects compete for decomposing remains.** ***Jennifer Rhinesmith-Carranza*** *(Jennifer.Carranza@ag.tamu.edu) and Jeffery K. Tomberlin, Texas A&M Univ., College Station, TX*

1:54 PM **18-3 Stomata: A missing link to understanding plant volatile communication.** ***Natalie Aguirre*** *(n.aguirre@tamu.edu), John Grunseich and Anjel Helms, Texas A&M Univ., College Station, TX*

2:06 PM **18-4 Transcriptome profiling to identify detoxification genes involved in metabolic resistance in *Culex quinquefasciatus* and *Aedes albopictus* in Harris County, Texas.** ***Xinyue Huang*** *(lessice2019@gmail.com)[1], Chris Fredregill[2], Kendra Dagg[2], Christina Alvarez[2], Phillip Kaufman[3] and Michel A. Slotman[3], [1]TAMU, College Station, TX, [2]Harris County Public Health, Houston, TX, [3]Texas A&M Univ., College Station, TX*

2:18 PM **18-5 The correlation between direct and indirect defenses in sorghum: The potential for enhanced protection against an invasive aphid pest.** ***Emily Russavage*** *(emily.russavage@tamu.edu)[1], Jeremy Hewlett[1], Adrianna Szczepaniec[2], Anjel Helms[1], William Rooney[1] and Micky Eubanks[1], [1]Texas A&M Univ., College Station, TX, [2]Colorado State Univ., Fort Collins, CO*

2:30 PM **18-6 Novel method for *Varroa destructor* management: Utilizing worker brood to control mite populations in honey bee colonies.** ***Taylor Reams*** *(tdreams@tamu.edu) and Juliana Rangel, Texas A&M Univ., College Station, TX*

2:42 PM **18-7 Black soldier fly (Diptera: Stratiomyidae) larval and prepupal age and size impact thermal tolerance and preference.** ***Chujun Li*** *(lichujun@tamu.edu), Texas A&M Univ., College station, TX*

2:54 PM **18-8 Microbes regulating VOC production, insect attraction, and oviposition on decomposing remains.** ***Casey Flint*** *(caseyflint@tamu.edu) and Jeffery K. Tomberlin, Texas A&M Univ., College Station, TX*

3:06 PM **18-9 Determining the mechanism of honey bee (*Apis mellifera*) premature self-removal behavior.** ***Jordan Twombly Ellis*** *(jt574@tamu.edu) and Juliana Rangel, Texas A&M Univ., College Station, TX*

3:18 PM **Break**

3:48 PM **18-10 Comparative quantification of honey bee (*Apis mellifera*) associated viruses in wild and managed colonies.** ***Myra Dickey*** *(mdickey2@tamu.edu)[1] and Juliana Rangel[2], [1]Texas A&M, College Station, TX, [2]Texas A&M Univ., College Station, TX*

4:00 PM **Withdrawn**

4:12 PM **18-12 Lifespan shortening effects of a GRAS compound on three mosquito disease vectors in the United States.** ***Heidi Lindsley*** *(heidi_lindsley1@baylor.edu) and Jason Pitts, Baylor Univ., Waco, TX*

4:24 PM **18-13 Fieldable rapid pathogen detection in vector arthropods.** ***James Mann*** *(James_Mann1@Baylor.edu) and Jason Pitts, Baylor Univ., Waco, TX*

4:36 PM **18-14 Evaluation of Thryvon cotton as a control method of cotton fleahoppers (*Pseudatomocelis seriatus* Reuter).** ***Brady Arthur*** *(bparthur@tamu.edu) and David Kerns, Texas A&M Univ., College Station, TX*

4:48 PM **18-15 Implications of phloem-feeding pest *Dalbulus maidis* on morphological expressions of drought-tolerance in maize.** ***Tara-Kay L. Jones*** *(jonestarakay1@tamu.edu), Raul F. Medina and Julio S. Bernal, Texas A&M Univ., College Station, TX*

Student 10-minute Paper Competition - Undergraduate

Location: Chisolm
Moderators: Justin Talley, Oklahoma State Univ., Stillwater, OK and Milo Lewis, Nichino America, Whiteface, TX

2:00 PM **19-1 Overturning prohibition: Disparlure bait does not attract the threatened American burying beetle.** ***Robert Pille*** *(robert.pille@connorsstate.edu) and William Hoback, Oklahoma State Univ., Stillwater, OK*

2:12 PM **19-2 Effects of constant and variable temperature conditions on the development of *Lucilia eximia* (Weidemann) (Diptera: Calliphoridae).** ***Steven Graham*** *(sg2900@outlook.com)[1], Samantha Sawyer[2] and Jeffery K. Tomberlin[1], [1]Texas A&M Univ., College Station, TX, [2]Univ. of Florida, Gainesville, FL*

2:24 PM **19-3 Discovering jewels in new places: Increased distributional records of Buprestidae from Oklahoma and New Mexico.** ***Joel DuBois*** *(joedubo@okstate.edu) and William Hoback, Oklahoma State Univ., Stillwater, OK*

2:36 PM **19-4 Different interpretations: Herbivore-induced plant volatiles elicit different defense responses in inter-plant communication between heterospecific and conspecifics.** ***Laura Marmolejo*** *(lauramarmolejo18@gmail.com), Morgan Thompson and Anjel Helms, Texas A&M Univ., College Station, TX*

2:48 PM **19-5 *Varroa destructor* and its effects on the fat body development of *Apis mellifera* drones.** ***Jarod Perez*** *(perejar0894@tamu.edu), Juliana Rangel and Taylor Reams, Texas A&M Univ., College Station, TX*

3:00 PM **19-6 Effect of sublethal doses of pesticide on *Osmia* bees' olfactory learning retention.** ***Keegan Nichols*** *(Knicho5@gmail.com) and Loriann Garcia, Austin College, Sherman, TX*

Student 10-minute Paper Competition – Masters

Location: Westbrook
Moderators: Dalton Ludwick, Texas A&M Univ., Corpus Christi, TX and Suhas Vyavhare, Texas A&M AgriLife Research and Extension Center, Lubbock, TX

2:00 PM **20-1 A flying start for insects: Incorporating drones in the monitoring and distribution of insects used as biological control agents.** ***Haley Vincze*** *(haley.vincze@gmail.com)[1] and David Thompson[2], [1]New Mexico State Univ., Stephenville, TX, [2]New Mexico State Univ., Las Cruces, NM*

2:12 PM **20-2 Dietary protein and carbohydrate effects on tarnished plant bugs: Implications for omnivory.** ***Pio Bradicich*** *(piobradicich@gmail.com) and Spencer Behmer, Texas A&M Univ., College Station, TX*

2:24 PM **20-3 Age is more than just a number: Age impacts reproductive output for the black soldier fly, *Hermetia illucens* (Diptera: Stratiomyidae).** ***Amy Dickerson*** *(dickersonamyj@tamu.edu)[1], Noah Lemke[2], Chujun Li[3] and Jeffery K. Tomberlin[2], [1]Texas A&M Univ., BRYAN, TX, [2]Texas A&M Univ., College Station, TX, [3]Texas A&M Univ., College station, TX*

2:36 PM **20-4 Effects of temperature and photoperiod changes on development of *Aphelinus nigritus* (Howard).** ***Nina Rudin*** *(nrudin@okstate.edu)[1], Kristopher Giles[1], J.P. Michaud[2] and Bruce Noden[1], [1]Oklahoma State Univ., Stillwater, OK, [2]Kansas State Univ., Hays, KS*

2:48 PM **20-5** **The effects of inconsistent consumption of feedthrough-based insect growth regulators by cattle on house and horn fly (Diptera: Muscidae) development in a simulated field environment.** *Brandon Smythe[1] and* ***Hannah Walker*** *(hannahag16@gmail.com)[2], [1]New Mexico State Univ., Las Cruces, NM, [2]New Mexico State Univ., las cruces, NM*

3:00 PM **20-6** **Detection of Undocumented *Rickettsia* species using novel *Rickettsia amblyomattis* Exclusion Assay.** ***Brandon Henriquez*** *(brandon.henriquez@okstate.edu) and Bruce Noden, Oklahoma State Univ., Stillwater, OK*

3:12 PM **Break**

3:42 PM **20-7** **Crispy critters: Reproductive success of round-necked burying beetles (Coleoptera: Silphidae) on burnt rodent carcasses.** ***Sandra Rigsby*** *(Nicole.rigsby@okstate.edu), William Hoback, Sam Fuhlendorf and Justin Talley, Oklahoma State Univ., Stillwater, OK*

3:54 PM **20-8** **Investigating pyrethroid resistance in the rice stink bug *Oebalus pugnax* (F.) and insecticide options for sorghum management in Texas.** ***Danielle Gray*** *(ddg035@tamu.edu)[1], Stephen Biles[2], Kate Crumley[3], Tyler Mays[4], Sebe Brown[5,6], David Kerns[1] and Dalton Ludwick[7], [1]Texas A&M Univ., College Station, TX, [2]Texas A&M Univ., Port Lavaca, TX, [3]Texas A&M AgriLife Extension Service, Wharton, TX, [4]Texas A&M AgriLife, Hillsboro, TX, [5]Louisiana State Univ. AgCenter, Baton Rouge, LA, [6]Univ. of Tennessee, Jackson, TN, [7]Texas A&M Univ., Corpus Christi, TX*

4:06 PM **20-9** **Evaluating the impacts of starvation on permethrin resistant and susceptible horn flies (Diptera: Muscidae).** ***Jovy Ramirez*** *(zerimarj@nmsu.edu)[1], Brandon Smythe[1], Ulises Sanchez[1], Hannah Walker[2] and Jesus Zamudio[1], [1]New Mexico State Univ., Las Cruces, NM, [2]New Mexico State Univ., las cruces, NM*

4:18 PM **20-10** **The start of something new: Reproduction and host plant susceptibility of small grains with the hedgehog grain aphid, *Sipha maydis* (Heteroptera: Aphididae).** ***Mason Taylor*** *(masonta@okstate.edu)[1], J. Scott Armstrong[2], Dolores Mornhinweg[3] and William Hoback[4], [1]Oklahoma State Univ., Perry, OK, [2]USDA - ARS, Stillwater, OK, [3]USDA-ARS, Stillwater, OK, [4]Oklahoma State Univ., Stillwater, OK*

4:30 PM **20-11** **Applications of gibberellic acid for control and management of *Melanocallis caryaefoliae* (black pecan aphid).** ***Alexander Armijo*** *(alexmijo@nmsu.edu), David Thompson and Larry Blackwell, New Mexico State Univ., Las Cruces, NM*

4:42 PM **20-12** **Trends in functional trait diversity of an arid-land bee assemblage over time.** ***Benjamin Turnley*** *(bturnley@unm.edu), Univ. of New Mexico, Albuquerque, NM*

Wednesday, April 20, 2022, Morning

Symposium: Advances in Field Crop IPM

Location: Flatiron/Spring Palace
Organizer: Blayne Reed, Texas A&M AgriLife Extension, Kress, TX

8:00 AM **Introductory remarks**

8:05 AM **26-1** **Wheat curl mite, *Aceria tosichella*: A new source of the eriophyid mite in wheat field identified.** *Ken Obasa[1] and* ***Blayne Reed*** *(blayne.reed@ag.tamu.edu)[2], [1]Texas A&M AgriLife Extension, Amarillo, TX, [2]Texas A&M AgriLife Extension, Kress, TX*

8:25 AM **26-2** **Bt resistance and management in bollworm, *Helicoverpa zea*.** *David Kerns[1] and* ***Kate Crumley*** *(kate.crumley@ag.tamu.edu)[2], [1]Texas A&M Univ., College Station, TX, [2]Texas A&M AgriLife Extension Service, Wharton, TX*

8:45 AM **26-3** **Performance of Vip3a Seed Blend Refuge vs. Block Refuge in Producing *H. zea* Adults.** ***Suhas Vyavhare*** *(suhas.7@tamu.edu)[1], Patrick Porter[2], G. David Buntin[3] and Joni Blount[4], [1]Texas A&M AgriLife Research and Extension Center, Lubbock, TX, [2]Texas A&M AgriLife Extension, Lubbock, TX, [3]Univ. of Georgia, Griffin, GA, [4]Bayer, Welch, TX*

9:05 AM **26-4** **New and emerging pests in the Lower Rio Grande Valley.** ***Danielle Sekula*** *(danielle.sekula@ag.tamu.edu), Texas A&M AgriLife Extension, Weslaco, TX*

9:25 AM **26-5** **Control of fall armyworms, *Spodoptera frugiperda*, in Bermuda pastures.** ***Stephen Biles*** *(biles-sp@tamu.edu), Texas A&M Univ., Port Lavaca, TX*

9:45 AM **26-6** **A modern evaluation of labeled chemical control product efficacy for banks grass mite, *Oligonychus pratensis*, in West Texas corn.** ***John Thobe*** *(john.thobe@ag.tamu.edu)[1] and Blayne Reed[2], [1]Texas A&M AgriLife Extension, Muleshoe, TX, [2]Texas A&M AgriLife Extension, Kress, TX*

10:05 AM **Break**

10:25 AM **26-7** **Potential and challenges of integrating HearNPV into sorghum and cotton IPM systems for *Helicoverpa zea* management.** ***David Kerns*** *(dlkerns@tamu.edu) and Wilfrid Calvin, Texas A&M Univ., College Station, TX*

10:45 AM **26-8** **Managing aphids in alfalfa, pecans, and sorghum with Sefina insecticide.** ***Adam Hixson*** *(adam.hixson@basf.com), BASF, Lubbock, TX*

11:05 AM **26-9** **Smart device applications for field crop scouting and reporting.** ***Tyler Mays*** *(tyler.mays@ag.tamu.edu), Texas A&M AgriLife, Hillsboro, TX*

11:25 AM **26-10** **Precision field scouting, crop management, issue reporting, spray record management, and field imagery with Syngenta's Cropwise Protector Scouting Program.** ***Blayne Reed*** *(blayne.reed@ag.tamu.edu), Texas A&M AgriLife Extension, Kress, TX*

11:45 AM **Concluding remarks**

Symposium: Arthropod Behavioral Changes in Response to a Rapidly Changing Climate

Location: Meacham
Organizer: Jensen Hayter, Texas A&M Univ., College Station, TX

8:00 AM **27-1** **Climate change and the threat of cattle fever tick reinvasion of the Southern United States.** ***Donald B. Thomas*** *(donald.thomas@usda.gov)[1], Weste Osbrink[2], K. H. Lohmeyer[3] and Kevin B. Temeyer[2], [1]USDA - ARS, Edinburg, TX, [2]USDA - ARS, Kerrville, TX, [3]Knipling-Bushland US Livestock Insect Research Laboratory, Kerrville, TX*

8:20 AM **27-2** **Thermal response of *Cochliomyia macellaria* to constant and fluctuating temperatures.** ***Aaron Tarone*** *(tamlucilia@tamu.edu)[1], Jonathan Parrott[2] and Sing-Hoi Sze[1], [1]Texas A&M Univ., College Station, TX, [2]Arizona State Univ., Glendale, AZ*

8:40 AM **27-3** **Phenological consequences of thermal heterogeneity at the microscale.** ***Jensen Hayter*** *(jenshayter@tamu.edu)[1], Chujun Li[2], Jeffery Tomberlin[1] and Thomas Chappell[1], [1]Texas A&M Univ., College Station, TX, [2]Texas A&M Univ., College station, TX*

9:00 AM **27-4** **Snow melt and the seven drivers of aphid abundance.** ***Emily Mooney*** *(emooney@uccs.edu)[1], M. Shane Heschel[2], Maria Mullins[3] and James Den Uyl[1,4], [1]Univ. of Colorado, Colorado Springs, CO, [2]Colorado College, Colorado Springs, CO, [3]Institute for Applied Ecology, Santa Fe, NM, [4]Victoria Univ. of Wellington, Wellington, New Zealand*

9:20 AM **27-5** **Exploiting insects' processes of mitigating environmental variation, to predict phenology in variable environments.** ***Thomas Chappell*** *(tmchappe@ncsu.edu), Texas A&M Univ., College Station, TX*

9:40 AM **Panel discussion**

Symposium: Genome Editing and Molecular Biology of Insects

Location: Westbrook
Organizers: Bianca Kojin, Texas A&M Univ., College Station, TX and Vanessa Macias, Univ. of North Texas, Denton, TX

8:00 AM **Welcoming remarks**

8:20 AM **28-1** **Effects of heterogeneous microclimate temperatures on the vector competence of *Aedes aegypti*.** ***Tyler Pohlenz*** *(tpohlenz@tamu.edu)[1], Madhav Erranguntla[1], Mark Lawley[1], Buys Hur[2], Mustapha Debboun[3], Martin Reyna[3], Chris Fredregill[3], Jeremy Vela[3], Zach Adelman[1] and Kevin M. Myles[1], [1]Texas A&M Univ., College Station, TX, [2]Texas A&M, College Station, TX, [3]Harris County Public Health, Houston, TX*

8:40 AM **28-2** **On our search for *Aedes aegypti* iron transporters and beyond.** ***Hitoshi Tsujimoto*** *(htsujimo@tamu.edu)[1] and Zach Adelman[2], [1]Postdoctoral Research Associate, College Station, TX, [2]Texas A&M Univ., College Station, TX*

9:00 AM **28-3** **Exploring small RNA Biology in transgenic mosquitoes.** ***Vanessa Macias*** *(Vanessa.Macias@unt.edu)[1], Umberto Palatini[2], Vanessa Botinno-Rojas[3], Anthony James[4] and Mariangela Bonizzoni[2], [1]Univ. of North Texas, Denton, TX, [2]Univ. of Pavia, Pavia, Italy, [3]Univ. of California, Irvine, Irvine, CA, [4]Univ. of California, Irvine, CA*

9:20 AM **Break**

9:40 AM **28-4** **Investigating the function of an anopheline ammonium transporter using transgenic technologies.** ***Jason Pitts*** *(jason_pitts@baylor.edu)[1] and Laurence Zwiebel[2], [1]Baylor Univ., Waco, TX, [2]Vanderbilt Univ., Nashville, TN*

10:00 AM **28-5** **Cellular nutrient sensors in *Aedes aegypti*.** ***Immo Hansen*** *(immoh@nmsu.edu), New Mexico State Univ., Las Cruces, NM*

10:20 AM **28-6** **Reverse genetic analysis of *Aedes aegypti* SRPN25 gene using CRISPR/Cas9.** ***Bianca Kojin*** *(Bianca.Kojin@agnet.tamu.edu)[1], Ines Martin-Martin[2], Eric Calvo[2] and Zach Adelman[1], [1]Texas A&M Univ., College Station, TX, [2]National Institute of Allergy and Infectious Diseases, Rockville, MD*

10:40 AM **Concluding remarks**

Symposium: The Current State of Insects As Feed: Impediments, Gaps, And Opportunities

Location: Chisolm
Moderators and Organizers: Chujun Li, Texas A&M Univ., College station, TX; Amy Dickerson, Texas A&M Univ., College Station, TX and Noah Lemke, Texas A&M Univ., College Station, TX

8:00 AM **Introductory remarks**

8:05 AM **29-1** **The current state of insects as feed: Impediments, gaps, and opportunities.** ***Cheryl Preyer*** *(cheryl.preyer@gmail.com), The Center for Environmental Sustainability through Insect Farming (CEIF), College Station, TX*

8:25 AM **29-2** **From foundation to application: Unifying basic and applied behavior research and what it could mean for the black soldier fly industry.** ***Amy Dickerson*** *(dickersonamyj@tamu.edu) and Jeffery Tomberlin, Texas A&M Univ., College Station, TX*

8:45 AM **29-3** **Genetic diversity (or lack thereof) in the black soldier fly.** ***Christine Picard*** *(cpicard@iupui.edu), Indiana Univ.-Purdue Univ. Indianapolis, Indianapolis, IN*

9:05 AM **29-4** **Industrial scale experiments of black soldier fly larvae, microbial supplementation and spent brewers grain.** *Emilia Kooienga[1], Jonathan Cammack[2], Fenchun Yang[2], Jeffery K. Tomberlin[3] and* ***Heather Jordan*** *(jordan@biology.msstate.edu)[4], [1]St. Jude Children's Research Hospital, Starkville, MS, [2]EVO Conversion Systems, LLC, College Station, TX, [3]Texas A&M Univ., College Station, TX, [4]Mississippi State Univ., Mississippi State, MS*

9:25 AM **29-5** **Providing new opportunities for largescale phenotyping of insects using automated assessment methods.** ***Stine Laursen*** *(sfl@bio.aau.dk)[1], Laura Hansen[2], Simon Bahrndorff[1], Natasja Noer[1] and Torsten Kristensen[3], [1]Aalborg Univ., Aalborg, Denmark, [2]Aarhus Univ., Tjele, Denmark, [3]Aarhus Univ., Rønde, Denmark*

9:45 AM **29-6** **The puzzle of black soldier fly thermal biology.** ***Chujun Li*** *(lichujun@tamu.edu), Texas A&M Univ., College station, TX*

10:05 AM **Break**

10:25 AM **29-7** **Impacts of larval resource availability on mating and reproductive output of the black soldier fly in colony.** ***Noah Lemke*** *(noahlemke@tamu.edu) and Jeffery K. Tomberlin, Texas A&M Univ., College Station, TX*

10:45 AM **29-8** **Insects as alternative feed: Growing black soldier fly farms from partnerships in Malawi, Africa.** ***M. Eric Benbow*** *(benbow@msu.edu)[1], Arox Kamng'ona[2], Mphasto Jumbe[3], Andy Safalaoh[4], Jeremiah Kang'ombe[4], Kingsley Masamba[4], Mike Goliath[5] and Jennifer Pechal[1], [1]Michigan State Univ., East Lansing, MI, [2]Univ. of Malawi, Blantyre, Malawi, [3]Founder and Director of MoVE, Blantyre, Malawi, [4]Lilongwe Univ. of Agriculture and Natural Resources, Lilongwe, Malawi, [5]Lilongwe Univ. of Agriculture and Natural Resources (LUANAR), Lilongwe, Malawi*

11:05 AM **29-9** **Nutritional value of black soldier fly (*Hermetia illucens*) larvae meal to various warmwater fish species and potential health benefits.** ***Delbert Gatlin*** *(d-gatlin@tamu.edu), Texas A&M Univ., College Station, TX*

11:25 AM **29-10 Industrialization of black soldier fly production: Challenges and opportunities.** ***Jonathan Cammack*** *(jacammack@evoconsys.com)[1] and Fengchun Yang[2], [1]EVO Conversion Systems, LLC, College Station, TX, [2]Texas A&M Univ., College Station, TX*

11:45 AM **Concluding remarks**

Wednesday, April 20, 2022, Posters

Regular Poster Session / 8:00 AM-4:00 PM

Location: Upper Terrace

30-1 **Flow cytometric determination of DNA endoreplication, a potential diagnostic tool for electron beam-irradiated insect pests of fruits and vegetables.** ***Jiaxin Lei*** *(jiaxin.lei@ag.tamu.edu) and Keyan Zhu-Salzman, Texas A&M Univ., College Station, TX*

30-2 **Host discrimination behavior of *Aphelinus nigritus*: Acceptance of suitable hosts.** ***Haley Butler*** *(haley.butler@okstate.edu) and Kristopher Giles, Oklahoma State Univ., Stillwater, OK*

30-3 **A new section for teaching and outreach.** ***W. Wyatt Hoback*** *(whoback@okstate.edu), Oklahoma State Univ., Stillwater, OK*

30-4 **Co-occurrence of sugarcane aphid parasitoid competitors in time and space: Summary of multi-year regional populations dynamics data.** ***Kristopher Giles*** *(kris.giles@okstate.edu)[1], Norman Elliott[2], Michael Brewer[3], Haley Butler[1] and Nina Rudin[1], [1]Oklahoma State Univ., Stillwater, OK, [2]USDA-ARS, Stillwater, OK, [3]Texas A&M AgriLife Research, Corpus Christi, TX*

30-5 **Life cycle determination of *Dermestes maculatus* (Coleoptera: Dermestidae) in a controlled environment.** *Elyssa Cox[1], Darren Pollock[2] and* ***Kenwyn Cradock*** *(Kenwyn.Cradock@enmu.edu)[2], [1]Michigan State Univ., East Lansing, MI, [2]Eastern New Mexico Univ., Portales, NM*

30-6 **Impact of ground temperature and cover on the abundance and diversity of arthropods in oak-juniper habitats.** ***Abigail Berrios-Starbird*** *(aberrios@stedwards.edu) and Darren Proppe, St. Edward's Univ., Austin, TX*

Wednesday, April 20, 2022, Afternoon

Symposium: Current Trends in Social Insect Biology

Location: Meacham
Moderators and Organizers: Juliana Rangel, Texas A&M Univ., College Station, TX; Tonya Shepherd, Texas A&M Univ., College Station, TX and Molly Keck, Texas A&M Univ., San Antonio, TX

1:00 PM **Welcoming remarks**

1:05 PM **31-1 Distinct colony boundaries and larval discrimination in polygyne red imported fire ant (*Solenopsis invicta*).** ***Micky Eubanks*** *(Micky.Eubanks@ag.tamu.edu), MacKenzie Kjeldgaard, Pierre-Andre Eyer, Collin Cutrone McMichael, Juliana Bockoven, Joanie King, Thomas Boutton and Edward Vargo, Texas A&M Univ., College Station, TX*

1:25 PM **31-2 Molecular characterization of a dsRNA-degrading nuclease in the tawny crazy ant (*Nylanderia fulva*).** ***Jiaxin Lei*** *(jiaxin.lei@ag.tamu.edu) and Keyan Salzman, Texas A&M Univ., College Station, TX*

1:45 PM **31-3** **Urban adaptation in the odorous house ant *Tapinoma sessile*. *Alexander Blumenfeld*** *(alex93@tamu.edu), Pierre-Andre Eyer and Edward Vargo, Texas A&M Univ., College Station, TX*

2:05 PM **31-4** **Developing a quicker and more reliable method of counting *Nosema* spp. spores for honey bee (*Apis mellifera*) research. *Tonya Shepherd*** *(Tonya.Shepherd@ag.tamu.edu) and Juliana Rangel, Texas A&M Univ., College Station, TX*

2:25 PM **Break**

2:55 PM **31-5** **Using transcriptomics to address complex topics of social insects. *Joanie King*** *(joanie_king@tamu.edu) and Edward Vargo, Texas A&M Univ., College Station, TX*

3:15 PM **31-6** **Assessing nutritional variation in pollen: a unifying approach for the study of pollinator health.** *Pierre Lau[1], **Pierre Lesne** (Pierre.Lesne@ag.tamu.edu)[2], Robert J Grebenok[3], Juliana Rangel[2] and Spencer Behmer[2], [1]United States Dept. of Agriculture, Stoneville, MS, [2]Texas A&M Univ., College Station, TX, [3]Canisius College, Buffalo, NY*

3:35 PM **31-7** **RNAi in social insects, current advances and challenges with the tawny crazy ant (*Nylanderia fulva*). *Fabian List*** *(fabian.list@tamu.edu), Aaron Tarone and Edward Vargo, Texas A&M Univ., College Station, TX*

3:55 PM **Concluding remarks**

Symposium: Establishing Minimum Standards in Forensic Entomology

Location: Westbrook
Moderators and Organizers: Casey Flint, Texas A&M Univ., College Station, TX; Jennifer Rhinesmith-Carranza, Texas A&M Univ., College Station, TX and Jeff Tomberlin, Texas A&M Univ., College Station, TX

1:00 PM **Introductory remarks**

1:05 PM **32-1** **Is PMI the hypothesis or the null hypothesis? *Aaron Tarone*** *(tamlucilia@tamu.edu)[1] and Michelle Sanford[2], [1]Texas A&M Univ., College Station, TX, [2]Harris County Institute of Forensic Sciences, Houston, TX*

1:25 PM **32-2** **Who's on first? Why it is important that we are speaking the same language in development study literature *Casey Flint*** *(caseyflint@tamu.edu) and Jennifer Rhinesmith-Carranza, Texas A&M Univ., College Station, TX*

1:45 PM **32-3** **Validating standard methods and assumptions in forensic entomology– Lessons learned from the Anthropology Research Facility (aka the "Body Farm"). *Charity Owings*** *(cowings1@utk.edu)[1], Hayden McKee-Zech[1], Clea Garza[2], Megan McQueen[1], Mary Smith[1], Riley Wal[1], Erin Patrick[1], Sarah Schwing[1], Thomas Delgado[3], Mary Davis[1] and Dawnie Steadman[1], [1]Univ. of Tennessee, Knoxville, TN, [2]Sam Houston State Univ., Huntsville, TX, [3]California State Univ. Chico, Chico, CA*

2:05 PM **32-4** **Minimum standards in teaching forensic entomology. *Ashleigh Faris*** *(ashleigh.faris@tamu.edu), Texas A&M Univ., College Station, TX*

2:25 PM **Break**

2:55 PM **32-5** **OSAC standards for molecular forensic entomology.** ***Christine Picard*** *(cpicard@iupui.edu)[1], Aaron Tarone[2] and Jeffrey Wells[3], [1]Indiana Univ.-Purdue Univ. Indianapolis, Indianapolis, IN, [2]Texas A&M Univ., College Station, TX, [3]Florida International Univ., Miami, FL*

3:15 PM **32-6** **American Board of Forensic Entomology Technician Certification – Minimum standards for tech-qualifying workshops.** ***Jennifer Rhinesmith-Carranza*** *(Jennifer.Carranza@ag.tamu.edu), Texas A&M Univ., College Station, TX*

3:35 PM **32-7** **Current applications and limitations of aquatic entomology.** ***John Wallace*** *(john.wallace@millersville.edu), Millersville Univ., Millersville, PA*

3:55 PM **32-8** **Case experiences reveal research opportunities for forensic entomology.** ***Jeffery K. Tomberlin*** *(jktomberlin@tamu.edu), Texas A&M Univ., College Station, TX*

4:15 PM **32-9** **Sharing the yuck! increasing awareness and engagement in forensic entomology.** ***Heather Ketchum*** *(Heather.R.Ketchum-1@ou.edu), Eric Bright, Gracie Hedgpeth and Elena Wilson, Univ. of Oklahoma, Norman, OK*

4:35 PM **Concluding remarks**

Symposium: IPM Implementation and Sustainability for Southwestern Cotton Systems

Location: Chisolm
Moderators and Organizers: Lindsey Perkin, USDA-ARS, College Station, TX; Wilfrid Calvin, Texas A&M Univ., College Station, TX and Zachary Cohen, USDA Agricultural Research Service, College Station, TX

1:00 PM **Welcoming remarks**

1:05 PM **33-1** **Development of economic thresholds toward bollworm (Lepidoptera: Noctuidae), management in Bt cotton, and assessment of the benefits from treating Bt cotton with insecticide.** ***Wilfrid Calvin*** *(wilfrid.calvin@ufl.edu)[1], Fei Yang[1], Sebe Brown[2], Angus Catchot[3], Whitney Crow[4], Donald R. Cook[5], Jeff Gore[4], Ryan Kurtz[6], Gus Lorenz[7], Nicholas Seiter[8], Scott Stewart[9], Tyler Towles[10] and David Kerns[11], [1]Texas A&M Univ., College Station, TX, [2]Louisiana State Univ. AgCenter, Baton Rouge, LA, [3]Mississippi State Univ., Mississippi State, MS, [4]Mississippi State Univ., Stoneville, MS, [5]Louisiana State Univ. AgCenter, St. Joseph, LA, [6]Cotton Incorporated, Cary, NC, [7]Univ. of Arkansas, Lonoke, AR, [8]Univ. of Illinois, Champaign, IL, [9]Univ. of Tennessee, Jackson, TN, [10]Louisiana State Univ. Agricultural Center, Winnsboro, LA, [11]Texas A&M AgriLife Extension Service, College Station, TX*

1:35 PM **33-2** **Insect-pest management strategies in limited irrigation cotton: Input optimization for production sustainability.** ***Megha N. Parajulee*** *(m-parajulee@tamu.edu)[1], Dol P. Dhakal[1], Abdul Hakeem[2], Michael Toews[3], Donna McCallister[2] and Suhas Vyavhare[2], [1]Texas A&M Univ. AgriLife Research and Extension Center, Lubbock, TX, [2]Texas A&M AgriLife Research and Extension Center, Lubbock, TX, [3]Univ. of Georgia, Tifton, GA*

2:05 PM **33-3** **Influence of microclimate and landscapes on predation in a semi-arid environment.** ***Jane Breen Pierce*** *(japierce@nmsu.edu), New Mexico State Univ., Artesia, NM*

2:35 PM **Break**

3:05 PM **33-4** **Field occurrence of entomopathogens in North American cotton pests.** ***Sergio Sánchez-Peña*** *(sanchezcheco@gmail.com), Universidad Autónoma Agraria Antonio Narro, Saltillo, CU, Mexico*

3:35 PM **33-5 Comparative genomics suggest novel targets for boll weevil control.** ***Zachary Cohen*** *(zachary.cohen@usda.gov)[1] and Lindsey Perkin[2], [1]USDA Agricultural Research Service, College Station, TX, [2]USDA-ARS, College Station, TX*

4:05 PM **Discussion**

Abstracts by Presentation Number

Student Poster Competition - Undergraduate

10-1. **Comparing Nosema levels in wild and managed honey bee (*Apis mellifera)* populations at Welder Wildlife Refuge. Mckaela Whilden** (mckaela@tamu.edu)[1], Brittany Usoff[1], Myra Dickey[2] and Juliana Rangel[1], [1]Texas A&M Univ., College Station, TX, [2]Texas A&M, College Station, TX

Honey bee (*Apis mellifera*) populations around the world have been declining due to a variety of parasites and pathogens. One such pathogen that has been shown to cause population decline is *Nosema*. This is a microsporidian gut pathogen, caused by *Nosema apis* and *Nosema ceranae*. When a honey bee is infected with *Nosema*, spores rapidly grow in the individual's stomach which leads to developmental issues or death by dysentery. In south texas, we have honey bees of both Africanized (*Apis mellifera scutellata)* and European descent (*Apis mellifera ligustica)* and both of these lineages can become infected with *Nosema.* A unique study site to look at wild Africanized honey bees (AHB) is at the Welder Wildlife Refuge (WWR). This population has been extensively documented over the past twenty years. One such study examined the prevalence of *N. apis* and *N. ceranae* over a twenty year period at WWR and found that *N. ceranae* is present at extremely low levels and did not detect *N. apis*. This study did not compare the WWR population to a nearby managed apiary. We will travel to Welder Wildlife Refuge to collect honey bees and determine *Nosema* counts. We hypothesize that the honey bees in WWR will have a significantly lower level of *Nosema* than managed colonies. We still have much to learn about wild honey bees, such as how they are able to survive without human interaction.

10-2. **Just add water: Invertebrate colonization of temporary ponds in central Oklahoma. Gabrielle Jones** (gabriellejo14@gmail.com), Oklahoma State Univ., Stillwater, OK

Fishless ponds are important to invertebrate production. As a result, unique ecosystems are formed that provide food and resources for other organisms such as amphibians, reptiles, and migratory birds. There is currently little research in Oklahoma about insect colonization after filling a previously empty pond. Experimental ponds near Stillwater, OK were filled using water from a nearby lake. Traps were constructed using plastic bottles, bedrocks, and zip ties and were set in the ponds for three weeks per trial. Across all three trials, artificial substrate traps collected 897 individual aquatic insects. The most commonly collected insects were Chironomidae (83.946%). Adult beetles (Hydrophilidae, Dytiscidae, and Notonectidae) were collected along with larval beetles (Hydrophilidae and Dytiscidae). Additionally, three larval mayflies (Baetidae), three larval dragonflies (Aeshnidae), and one larval damselfly (Coenagrionidae) were collected. During the third trial, small minnows were discovered in one pond.

10-3. **Night and day: Determining niche partitioning through circadian rhythms of dung beetle genera. Ethan Shaw** (etshaw@okstate.edu) and William Hoback, Oklahoma State Univ., Stillwater, OK

Producers of livestock benefit from the activities of dung beetles (Coleoptera: Scarabaeidae) in a variety of ways. Burial of dung can prevent pest fly species from reproducing, and adds nutrients and aeration to soils, encouraging future plant growth in pastures. The estimated ecosystem value of dung beetles exceeds $380 million with Oklahoma ranking second in U.S. cattle production. Despite their recognized importance and the characterization of behavioral groups and timing of reproduction, many dung beetles have limited natural history information about daily activity patterns. Because dung is an ephemeral resource, competition is predicted to lead to niche partitioning in activity patterns. We observed daily activity patterns of *Phanaeus vindex*, *Copris fricator*, *Canthon vigilians*, and *Onthophagus hecate* to determine if they are diurnal or nocturnal. We discovered that *P. vindex*, *C. vigilans*, and *O. hecate* were primarily diurnal while *C. fricator* appeared to be exclusively nocturnal. We also observed how some of these species interacted with the resource of dung. *C. vigilans* rolled dung balls along the surface before burying it, and *C. fricator* also buried their dung but showed no signs of any surface dung rolling. *O. hecate* appears to have taken pieces off of the dung they were provided, and buried said pieces. These results can potentially benefit producers by allowing treatments to occur when beneficial insects are inactive.

10-4. **Using metabarcoding to determine the selectiveness of pollinators in a black land prairie. Frank Goodavish** (fgoodavish20@austincollege.edu) and Loriann Garcia, Austin College, Sherman, TX

The codependence between plant and pollinator is a complex relationship. Many plants and pollinators have evolved together to become more specific towards each other, resulting in not every pollinator being able to pollinate every plant. This results in a higher pollination rate for the plants and allows for the pollinator to have a source of nectar/pollen that others cannot easily get to. Metabarcoding is a technique that is becoming more common to determine what plant species are in the pollen collected by the pollinators, allowing to determine the link between plant and pollinator. This data can be used to determine how selective plants are which can help determine which plants/pollinators need protecting. Metabarcoding requires DNA extraction from pollen, which then can be used with PCR to determine what species the pollen belongs to. After the bee has been identified, a "map" can be created to see which bees collect pollen from which plants in the ecosystem, allowing us to map how selective pollinators are. We have collected bees in a black land prairie habitat and will investigate the selectivity of milkweed, lady tresses, beard tongues, and coral roots. We expect the rarer plants, coral roots and lady tresses, to have fewer, more specialized pollinators, whereas beardtongues and milkweeds, or more common plants, to have a greater number of pollinators, and more generalist pollinators.

Student Poster Competition - Masters

11-1. **The taxonomy of adult females in the genus *Xenos* (Strepsiptera: Xenidae) with a re-description of the females of three North American species. Clea Garza** (cleagarza@shsu.edu) and Jerry Cook, Sam Houston State Univ., Huntsville, TX

The genus *Xenos* (Strepsiptera: Xenidae) includes 39 species, 14 of which are only known from the female, three only from the male, and 22 with both sexes described. Female strepsipterans are neotenic and do not emerge from their host. The taxonomy of neotenic female strepsipterans has previously relied upon color, measurements of the cephalothorax, and identification of the host, though these characters have proven mostly uninformative in defining species. All species of *Xenos* whose females are known should be re-described for clarity. Unfortunately, our understanding of *Xenos* taxonomy lags far behind the knowledge of their hosts and the biology of many of these strepsipteran species remain poorly understood. In this presentation, we will discuss how the use of indices helps define the general shape as well as the shapes of the morphological characters that remain on the cephalothorax, specifically in the genus *Xenos.* In this study, we re-described the females of three *Xenos* species (*Xenos kifunei*, *Xenos nigrescens*, and *Xenos peckii*) to demonstrate the utility of the taxonomic characters herein proposed.

11-2. **Evaluating the reproductive potential of *Rhopalosiphum padi* on resistant sources of barley. Malea Parsons** (maleagonzalez18@gmail.com)[1], Dolores Mornhinweg[2], J. Scott Armstrong[3] and Wyatt Hoback[1], [1]Oklahoma State Univ., Stillwater, OK, [2]USDA-ARS, Stillwater, OK, [3]USDA - ARS, Stillwater, OK

The *Bird cherry-oat aphid*, *Rhopalosiphum padi* (Linnaeus)(BCOA), infests wheat, barley, and oats within the United States and is a primary vector of barley yellow dwarf virus, the most devastating viral disease of cereal crops. The USDA-ARS, Stillwater, OK has identified barley lines with potential resistance to BCOA. Four lines selected from accessions in the National Small Grains Collection (CI 1969, CI 6493, CI 1128, CI 14305), Russian wheat aphid resistant germplasm STARS 9301B, and a susceptible cultivar, Morex, were evaluated for reproductive potential. Reproductive potential for the BCO was evaluated by counting all nymphs produced by a single female (net reproduction (*Ro)*), the age of the founding female known as longevity in days (d), and the average number of nymphs produced for each female measured in days (d). Morex, the susceptible entry in this evaluation was significantly higher in female longevity, although was not significantly different from CI 1969 in *Ro,* or nymphs produced per d. All other lines including CI 14305,, CI 6493, CI 1128, and STARS 9301B provided reduced reproductive potential, which is indicative of antibiosis and should be further developed to provide BCO resistant sources of barley.

11-3. **Sampling dung beetles between rocks and other hard places testing above ground trap design. Greg Middleton** (greg.middleton@okstate.edu) and William Hoback, Oklahoma State Univ., Stillwater, OK

Dung beetles (Coleoptera: Scarabaeidae) provide critical ecosystem services by helping to decompose dung in pastures, reduce manure breeding parasites, and by aerating soils. Many species of dung beetles have been suggested to be in decline, however, standard methods for dung beetle sampling have not been developed. Most dung beetle sampling uses pitfall traps dug into the ground and baited with pig or human dung. In areas with rocky or high clay soils, alternative trap designs are required. This work confirmed known species of Scarabaeinae in Oklahoma and tested capture rates of different trap designs. We hypothesized that below-ground and above-ground traps would be equally effective in capturing the dung beetle community. Dung beetles were sampled at two sheep pastures in Payne County Oklahoma. Below ground pitfall traps consisting of buckets dug in flush to the ground surface and above-ground pitfall traps, consisting of buckets with landing platforms and funnels to prevent escape were baited with pig dung and sampled between August and November of 2021. Over the course of samples, 181 individuals belonging to six species were captured. All individuals were captured in belowground traps and none were caught in above ground traps despite previous field observations of dung beetles caught in carrion beetle traps. Based on these results, below ground traps should be used for dung beetle sampling. We will continue to test alternative designs for trapping in areas where below ground traps cannot be placed and explore reasons for differences in capture.

Student Poster Competition - PhD

12-1. **A novel tick carousel assay for testing efficacy of repellents on *Amblyomma americanum* L. Hailey Luker** (hailey13@nmsu.edu), New Mexico State Univ., Las Cruces, NM

Ticks are important vectors of human and veterinary diseases. A way ticks gain access to human hosts is by engaging to clothing. Repellents or acaricides sprayed onto fabric are used to deter ticks' access to human hosts. However, there are a limited amount of standardized laboratory assays that can determine the efficacy of these repellents. We present a novel fabric-engagement assay referred to as the 'Tick Carousel Assay'. This assay utilizes fabric brushing past ticks located on an artificial grass patch and measures tick engagements to fabric over time. After screening a variety of tick species, we used the lone star tick *(Amblyomma americanum*) to test the efficacy of four commonly used active ingredients in repellents: DEET, Picaridin, IR3535, and Oil of Lemon Eucalyptus. Repellency was tested immediately, after three hours, and six hours post application to fabric. Our data show that each repellent we tested significantly reduced the number of tick engagements to fabric for at least 6 hours. We did not find significant differences in repellent efficacy between the four active ingredients tested directly and three hours after application. After six hours, Oil of Lemon Eucalyptus repelled ticks more than the other active ingredients. We show that our Tick Carousel Assay provides an affordable, repeatable, and standardized way to compare and test repellent efficacy on treated fabrics. Our results confirm that commonly used repellents applied to fabric are an effective way to reduce tick engagement.

12-2. **Massive changes in the phosphoproteome in *Aedes aegypti* Malpighian Tubules after a blood meal and during vitellogenesis. Yashoda Kandel** (yashoda@nmsu.edu), New Mexico State Univ., Las Cruces, NM

All hematophagous arthropods face one challenge - vertebrate blood contains more than 90% water. To concentrate blood meal-derived nutrients, an efficient diuretic system must be present and quickly activated. The Malpighian tubules are the renal organs of mosquitoes and facilitate the rapid dehydration of blood meals through aquaporin-mediated osmosis. Earlier studies have shown massive changes in the transcriptome of Malpighian tubules in mosquito females after a blood meal. The goal of our study was to gain insights into the activation of aquaporin-mediated water transport. We used immunofluorescence to document the translocation of aquaporin 1 from intracellular vesicles to the cell membrane of stellate cells and the brush border membrane of principal cells upon blood feeding. Phosphoproteomics analysis of protein libraries from unfed and blood-fed mosquitoes resulted in the identification of 1932 putative phosphorylation sites, suggesting a massive increase in V-ATPase activity, activation of the target of rapamycin signaling pathway, protein synthesis directly after a blood meal, and later the activation of monocarboxylate transport. Our phosphoproreomic analysis revealed that proteins involved in vertebrate AQPs shuttling are also conserved in mosquitoes AQP shuttling.

12-3. **Heroic beetles and butterflies: The moral alignment of insect-themed characters in American superhero comic books. Emily Geest** (egeest@okstate.edu)[1], Ashley Knoch[2] and Andrine A. Shufran[2], [1]Oklahoma State Univ., STILLWATER, OK, [2]Oklahoma State Univ., Stillwater, OK

People view animals through a framework of a negative to positive scale, with these views having wide-ranging implications including conservation program investment and success. Media can change public perception, and one media form that has largely been ignored in this regard is comic books. Within superhero comic books, characters are defined by animal aliases, resemblance, or traits. Superhero comic books are a unique medium due to characters existing on a hero to villain dichotomy. Examining insect representation on this hero/villain dichotomy can reveal public perceptions of various taxa. Out of 558 characters, only 118 characters were classified as invertebrates. Within class Insecta, 8 orders emerged with only three large enough for further analysis: Lepidoptera, Coleoptera, and Hymenoptera. Lepidoptera and Coleoptera were depicted as heroic more often than villainous, while Hymenoptera was portrayed equally as heroic and villainous. Similarly, Arachnid themed characters were depicted equally as heroic and villainous. Additionally, male comic book characters outnumbered female comic book characters, with the exception in Lepidoptera where female characters outnumbered male characters. Within Arachnida female characters with spider aliases were portrayed as heroes more often than villains while the opposite was true with male characters with spider aliases being depicted as villainous more often than heroic. Investigating animal depictions in media, such as superhero comic books, can help reveal where public perceptions originate and add further context to existing species bias research.

12-4. **Linking maize enzymes to herbivore defense. John Grunseich** (johngrunseich@tamu.edu), Julio S. Bernal and Michael Kolomiets, Texas A&M Univ., College Station, TX

The western corn rootworm (WCR), *Diabrotica virgifera virgifera* is a devastating pest of maize (*Zea mays)* in the United States and is responsible for over $1 billion in control costs and yield losses, annually. Chemical and cultural methods have been used to control WCR, but with limited success due to WCR developing resistance to insecticides. Furthermore, while traditional plant breeding programs have developed tolerant maize varieties, little is known about the specific mechanisms responsible for plant resistance and tolerance. This highlights a critical need to determine the genes and their upstream metabolites/enzymes that may facilitate insect resistant in order to advance modern breeding methods as well as our understanding of maize insect defense.

The goal of this study is to characterize and quantify insect-resistance mechanisms in maize roots associated with oxylipin biosynthesis because of their importance in herbivore defense. Green leaf volatiles (GLVs) and jasmonic acid are oxylipin signaling molecules that play important roles in facilitating insect resistance. Specifically, we investigated the roles of maize lipoxygenase (LOX) and oxo-phytodienoate reductase (OPR) genes in WCR resistance using non-transgenic knockout plants disrupted in LOX and OPR expression. Lox10 has an important role in GLV synthesis, while OPR2 is involved in the production of jasmonic acid. Our hypothesis was that both LOX10 and OPR2 are required for maize resistance against WCR, and that maize susceptibility to WCR increases in lines with single knockouts and then was amplified with the double knockout mutant.

12-5. **Grasshoppers and fire: Prescribed burning and patch recovery affects short-horned grasshopper diversity in northern Oklahoma. Alexander Harman** (aleharm@okstate.edu), William Hoback and Sam Fuhlendorf, Oklahoma State Univ., Stillwater, OK

Grasshoppers (Orthoptera: Acrididae) are an essential component of Great Plains ecosystems, where they are a primary food source for many species of vertebrates and play an important role in nutrient cycling. However, grasshopper declines have been documented in long-term monitoring sites in well-managed prairies, threatening the integrity of those ecosystems. Prescribed burning is a commonly used technique to manage grassland ecosystems, but has varying effects on different groups of insects. The response of grasshoppers to fire is unclear, as responses of different species depend on a variety of factors such as host preference, dispersal capability, and the stage at which the grasshopper overwinters. As a result, studies that try to group grasshoppers by taxon or food preference often produce inconsistent results when

examined for response to fire, as species that are similar in one variable may differ in another. We surveyed grasshoppers in different patches at the Oklahoma Tallgrass Prairie preserve that were burned in the spring or fall of 2018, 2019, or 2020. Grasshoppers were collected using sweep sampling, taking 100 sweeps per patch during each of the four sampling trips. In total, we collected approximately 70 grasshoppers representing 9 different species, with the most numerous being *Campylacantha olivacea* and *Melanoplus femurrubrum*. We found species diversity was highest two years after a burn, and that grass-feeding species varied in the amount of time it took to colonize a burned patch. These results emphasize that patch burning rather than large scale annual burning should be used to maintain grasshopper diversity.

12-6. **Using nutrition to mitigate the effects of pathogen infection in honey bees. Alexandria Payne** (alexnpayne@gmail.com)[1], Pierre Lau[2], Cora Garcia[1], Jordan Gomez[1] and Juliana Rangel[1], [1]Texas A&M Univ., College Station, TX, [2]United States Dept. of Agriculture, Stoneville, MS

The health of honey bees infected with pathogens can be improved by ensuring proper nutrition. However, pollen and protein supplements vary widely in their protein-to-fat/lipid (P:L) ratios, and it is unknown at what target ratio bees can better deal with pathogen infection. In this study, we wanted to determine which P:L ratios may have a positive impact on survivorship, physiology, and overall health of honey bees infected with either of two common honey bee pathogens: *Nosema sp*. and *Deformed wing virus* (DWV). If we can determine which macronutrient ratios are optimal in mitigating the effects of pathogen infection in honey bees, we can work towards creating more effective pollen supplements that can help colonies self-medicate, ultimately improving overall colony health.

Regular Ten-Minute Paper Session I

16-1. **Horde of the flies: Pollinator composition and trends in Plymouth County, MA. Wes Walsh** (kwalsh59@massasoit.edu), Adam Germaine, Prisca Sanon, Christina Orazine, Andrew Oguma and Michael Bankson, Massasoit Community College, Brockton, MA

Discussions over declining pollinators typically concern only bees. However, non-bee insect pollinators provide pollination services similar to bees and may respond differently to environmental changes. If their response does vary, non-bee insects could safeguard against potential bee declines caused by habitat changes or, conversely, require different conservation efforts. Alternatively, possible bee declines may only be part of a larger insect decline. This study compares the abundance of pollinator groups on an urban to rural gradient and their responses to natural and anthropogenic factors. The following orders were included: Hymenoptera, Diptera, Lepidoptera, and Coleoptera. Hymenoptera included only bees and wasps. Sampling was conducted in Plymouth County, Massachusetts from April to November, 2016-2021.
In Plymouth County, 68.4% of sampled pollinators were flies, 15.5% were bees. Given abundance and effectiveness, Dipterans likely provide important, previously unrecognized pollination services. No pollinator followed a consistent seasonal trend; the presence of multiple pollinators throughout the season may strengthen plant resiliency if bees alone decline. However, flies ($r = -0.31$, $p = 0.02$), wasps ($r = -0.57$, $p < 0.001$), beetles ($r = -0.44$, $p < 0.001$), and bees ($r = -0.46$, $p < 0.001$) were all negatively correlated with imperviousness, suggesting urbanization threatens most pollinators. Additionally, average yearly bee and non-bee sweep net abundances had a strong positive ($r = 0.83$, $p = 0.04$) correlation; pollinators appear to follow similar trends. Thus, reported bee declines may simply reflect overall insect declines. Non-bee pollinators warrant consideration given their prevalence, ecological contributions, and similarity to bees.

16-2. **Knowing when to fumigate a grain storage facility. Edmond Bonjour** (edmond.bonjour@okstate.edu), Oklahoma State Univ., Stillwater, OK

It is vitally important to only fumigate a grain storage facility when necessary to protect your commodity. Treating a grain mass based on a calendar date may waste insecticide and time. Using various monitoring systems to determine the presence and abundance of pest insects will be discussed and this information will be utilized to help make that best decision for when to apply a fumigant.

16-3. **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 to consider how entomology can apply practically to their own lives – and hopefully, engage their interests to learn more.

16-5. **A native range survey of the southwest United States for potential biological control agents of *Prosopis* species (Fabaceae). Kristen Bowers** (kebowers@nmsu.edu)[1], Joel DuBois[2] and David Thompson[1], [1]New Mexico State Univ., Las Cruces, NM, [2]Oklahoma State Univ., Stillwater, OK

Mesquite, *Prosopis* spp., are considered weedy in arid and semi-arid regions, and are among the 100 worst invaders world-wide, including in Australia and southern and eastern Africa. Despite current control efforts, *Prosopis* coverage in South Africa has expanded rapidly over the past 15 years. As a result, there is interest in increasing the supply of biological control agents against *Prosopis* species in South Africa. Successful biological control of weeds is based on the collection and identification of appropriate host specific agents during native range surveys. From May to October 2021, we used visual surveys and beating of foliage to collect arthropods on *Prosopis* and related trees, including *Vachellia*, *Mimosa* and *Senegalia* species. Surveys were conducted in Arizona, New Mexico, and Texas. We collected and identified over 900 individual insects. Coleoptera was the most well represented order among our specimens, with over 700 individuals in 17 families. We also collected Lepidoptera representing eight families, as well as nine families of Hemiptera. To prioritize host-range testing, we developed a matrix to rank potential biological control agents for *Prosopis*. Based on our field notes and published literature, we ranked prospective agents according to criteria including host specificity and potential ability to damage or kill *Prosopis* species.

16-7. **The effects of crop cover on wild bee-plant mutualisms across multiple spatial scales. Sarah Elzay** (selzay@okstate.edu) and Kristen Baum, Oklahoma State Univ., Stillwater, OK

Agricultural land use affects wild bee-plant mutualisms, increasing the incidence of pollen limitation among wild flowering plants. Over time, pollen limitation may negatively impact wild flowering plant populations. Mass flowering crops (MFCs) such as canola (*Brassica napus* L.) increase foraging resource availability to wild bees in historically forage-poor agroecosystems. Increased foraging resources by way of MFCs may enhance or dilute pollination of wild flowering plants growing nearby. We tested the effects of canola cover on wild bee-plant mutualisms by evaluating seed count and weight of three wild flowering plants, G*aillardia pulchella* (Foug.; Indian blanket)*, Verbesina encelioides* (Cav.; cowpen daisy), and *Salvia azurea* (Michx ex Lam.; azure blue sage), across a gradient of canola cover. We also tested pollen limitation of each of the selected wild flowering plants. Each species increased seed set as canola cover increased at one or more spatial scales, suggesting canola may enhance pollination services to wild flowering plants. However, each species also demonstrated pollen limitation. MFCs may play an important role in supporting wild bees and wild flowering plants in some agroecosystems by providing foraging resources for bees and by enhancing pollination services to wild flowering plants. Our results show that MFCs may facilitate wild bee pollination of some wild flowering plants. In the context of ongoing wild bee

declines, understanding the effects of MFCs on wild bee-plant mutualisms is important in the conservation of wild bees and wild flowering plants.

Regular Ten-Minute Paper Session II

17-1. **Creating a pest house for hands-on applicator training. Janet Hurley** (ja-hurley@tamu.edu), Texas A&M AgriLife Extension, Dallas, TX

Hands-on experience houses are training facilities that provide pest professionals with the opportunity to learn and practice skills and techniques. A handful of training facilities are distributed across the US, mostly associated with university extension programs. This presentation will discuss the steps needed to create a hands-on experience house for applicator training, and address questions about who funds the facility, who provides training, and how classes are structured and scheduled.

17-2. Efficacy of PT® Alpine® Pressurized Fly Bait, PT® Vedira™ Pressurized Fly Bait, Vedira™ Granular Ant Bait & InTice™ Rover Ant Bait on dark rover ants (Brachymyrmex patagonicus Mayr). Robert Davis (robert.davis@basf.com)[1], Edward Vargo[2] and Kyle Gilder[2], [1]BASF Corporation, Pflugerville, TX, [2]Texas A&M Univ., College Station, TX

The Efficacy of PT® Alpine® Pressurized Fly Bait, PT® Vedira™ Pressurized Fly Bait, Vedira™ Granular Ant Bait & InTice™ Rover Ant Bait on Dark Rover Ants (*Brachymyrmex patagonicus* Mayr) was evaluated. Five replications of 40 field collected dark rover ant nestmates and 5-10 nestmate brood were set in 150 X 20 mm arenas. Each arena was provisioned with water. Small weigh boats (cut in half) contained treatments and food. Sprayable baits were applied to the top of weigh boat surfaces at labeled rates. Two weigh boat halves, one with bait & one with honey water, were placed in each arena. Untreated controls received 2 honey water weigh boat halves. The number of dead ants was recorded at 0, 1, 3, 6, 9, 12 & 15 DAT. Data was analyzed with an ANOVA with Tukey's test. Mortality observed with Vedira Granular Ant Bait was significantly higher than all other treatments on day 1 (95.5%) and day 3 (95.5%). PT Alpine Pressurized Fly Bait & PT Vedira Pressurized Fly Bait mortality was significantly higher than Intice Rover Ant Bait and UTC at 3, 6, 9, 12 & 15 DAT. Intice Rover Ant Bait provided minimal mortality in this test.

17-3. **Repellent efficacy of essential oils from the EPA 25B list in two contact-repellency assays with *Aedes aegypti* (L.) (*Diptera: Culicidae*). Soumi Mitra** (smitra69@nmsu.edu), New Mexico State Univ., Las Cruces, NM

Background*:* Aedine mosquitoes are vectors for Dengue, Chikungunya, and Yellow Fever. Using repellents is a common strategy to prevent female mosquitoes from biting and spreading deadly diseases. In this study, we tested 21 active ingredients listed on the EPA 25 B list in two contact repellency assays.
Methods: We conducted feeding assays using sausage casings treated with emulsions made out of individual active ingredient and unscented lotion at 1:9 ration to determine the efficacy of each emulsion. We also performed arm-in-cage repellency bioassays with six emulsions that previously provided statistically significant protection in the feeding assay.
Results: In the feeding assay, 2Phenyl ethyl pyruvate provided protection from mosquito bites for an average of 31 minutes, Peppermint for 12 minutes, Geranium for 11 minutes, Citronella and Thyme for approximately 10 minutes and Cornmint for 5 minutes. We conducted arm-in-cage bioassay with these 6 active ingredients and found that Peppermint, Thyme and Cornmint provided protection for more than 90 minutes, Citronella for 88 minutes and 2-PEP for 43 minutes.
Conclusion: In general, the maximum protection times measured for various essential oil mixtures, were shorter in the feeding assay, compared to the arm-in-cage assay. Some active ingredients from the EPA 25 B list are strong mosquito repellents with average maximum protection times of 90 minutes or more.

17-4. **Nutritional composition of larval diet impacts life-history traits of a generalist and specialist in the carrion system: Applications in insects as food & feed industry. Erin Harris** (erin.harris49@icloud.com) and Jeffery K. Tomberlin, Texas A&M Univ., College Station, TX

Not all detritus material is created equally. Availability of carbohydrates, lipids, proteins and amino acids within an environment impacts the development and survival of all living organisms. Tryptophan, an essential amino acid (AA), is a highly limited resource in the environment, as it is the lowest stored AA among plant and animal tissues in comparison to all other AAs. Dietary tryptophan plays an important role in the regulation of physiological functions of invertebrates including modulating stress levels for adaptation in varying temperatures. Concentrations of tryptophan also vary within tissues of a single carrion or decaying plant material, which creates interspecific and intraspecific competition for this resource. Interspecific competition for resources also depends on if the organism is a generalist or a specialist, as detritus material creates small "islands" of available resources. *Hermetia illucens*, the black solider fly, is a generalist as it can feed and oviposit on a very wide range of detritus material, whereas *Cochliomyia macellaria*, the secondary screwworm, is a specialist and requires carrion for oviposition sites. Using an artificial holidic diet, concentrations of tryptophan were altered creating a total of five diets. Using both model species: *Hermetia illucens* and *Cochliomyia macellaria,* a diet choice assay and a development assay were conducted in a 22°C incubator until death or pupation.

17-5. **Efficacy of various insecticides against house fly eggs, larvae, and pupae in poultry and dairy manure. Sonja Swiger** (slswiger@ag.tamu.edu)[1], Robert Davis[2] and Micki Harris[3], [1]Texas A&M Univ., Stephenville, TX, [2]BASF, Blanco, TX, [3]Texas A&M AgriLife Extension, Stephenville, TX

House flies pose a serious pest for barn/stable operators and dairy operators throughout the United States. When the population rises well above a manageable rate they begin to travel to nearby houses and businesses. House flies do not bite but are extremely annoying and are not appreciated by the public. Although most livestock can tolerate several hundred house flies at one time, people become discouraged at the site of one house fly. In addition to their nuisance status, house flies have the ability to mechanically transmit over 200+ pathogens that cause disease to humans and animals. Therefore, it is important for barn/stable operators and dairy operators to keep their house fly numbers suppressed. This project evaluates the impact of various insecticides against the immature stages of the house flies.

17-6. **A review and new records of the nasute termite Tenuirostritermes cinereus (Blattodea: Termitidae) in Texas, U.S.A. José Santos Portugal III** (sportugal@goanteater.com)[1], Kim Engler[2] and Alan Brown[1], [1]ABC Home & Commercial Services, Austin, TX, [2]ABC Home & Commercial Services, San Antonio, TX

Tenuirostritermes cinereus (Buckley, 1862) is a Nearctic nasute termite that is limited to a range generally encompassing portions of northern Mexico and south-central Texas. Little is known about this termite, in-part, due to its habitat preference of less-inhabited, arid regions. In Texas, expansion of humans into previously more desolate areas has increased their visibility. Additionally, with the recent introduction of the destructive nasute conehead termite *Nasutitermes corniger* (Motschulsky) to Florida, pest management professionals (PMPs) across the country are likely to confuse them with any nasute termite encountered. *Tenuirostritermes cinereus* has not previously been implicated in structural damage, and as such should not necessitate treatment and reporting. This preliminary investigation utilizes historical records, citizen science (BugGuide, iNaturalist), and additional new submissions to further elucidate the current range of this species in Texas. Continued compilation and analysis of data will eventually result in a more thorough understanding of the ecology and distribution of this species.

Student 10-minute Paper Competition - PhD

18-1. **How the chemical ecology of host-associated differentiation improves natural enemy selection for biological control. Morgan Thompson** (mthompson@tamu.edu), Raul F. Medina, Anjel Helms and Julio Bernal, Texas A&M Univ., College Station, TX

Symbiotic associations influence speciation and ultimately generate biodiversity over evolutionary time. Associations can become highly specialized, such as between plants and herbivores or predators and prey. Ultimately, herbivores and predators develop heightened capacities to recognize specific, host-associated chemical cues, allowing them to distinguish host from non-host. However, host shifts can also occur and in the most extreme cases, genetically divergent populations within a species can evolve to preferentially occur on different host species, potentially representing an initial step towards

speciation. This phenomenon is referred to as host-associated differentiation (HAD). In agroecosystems, HAD often results in unique strains or biotypes of pest species that attack different species of crops, and can even cascade to affect populations of associated natural enemies. Natural enemy HAD may affect the outcomes of biological control efforts, whether classical, conservation, or augmentative. In this review, we explore the potential effects of pest and natural enemy HAD on biological control in agroecosystems, with emphases on current knowledge gaps and implications of HAD for selection of biological control agents. Additionally, given the importance of chemical cues in mediating trophic interactions, we emphasize the need to consider chemical ecology in interactions between pests and natural enemies and selecting organisms for biological control. Overall, we aim to jump-start a conversation concerning the relevance of HAD in biological control by reviewing currently available information on natural enemy HAD, identifying challenges to incorporating HAD considerations into biological control efforts, and proposing future research directions on natural enemy selection and HAD.

18-2. **Smelling, searching, and sabotage: How two carrion insects compete for decomposing remains. Jennifer Rhinesmith-Carranza** (Jennifer.Carranza@ag.tamu.edu) and Jeffery K. Tomberlin, Texas A&M Univ., College Station, TX

Resource location, evaluation, and acceptance by necrophagous insects are complex behaviors influenced by a myriad of biotic and abiotic factors. How these factors govern resource-related behaviors is important when we consider their ecological impacts on the necrobiome. Because carrion exists as a nutrient dense, ephemeral resource pulse in the larger ecosystem, there is intense competition amongst its users for detection, location, and colonization. Volatile organic compounds (VOCs) play an integral role in resource location and can also provide information about the quality and suitability of a resource conditional to insects' needs.

The common green bottle fly, *Lucilia sericata* (Diptera: Calliphoridae), is the most common *Lucilia* species in the United States and is important in medical, veterinary, and forensic entomology. The carrion burying beetle, *Nicrophorus vespilloides* (Coleoptera: Silphidae), has a palearctic distribution and is commonly found in cooler climates where they are considered a top competitor with blow flies for small carrion. *N. vespilloides* show extensive carcass preparation that includes covering the resource in secretions that contain antimicrobial and antifungal compounds which could alter the VOC profile and thus change the public information available for assessment. As primary colonizers with significantly different resource use strategies, *L. sericata* and *N. vespilloides* provide an interesting model system in which to explore carrion use and effects on intra- and interspecific competition for these resources.

This presentation will report results from a suite of experiments exploring the effects these insects have on the volatile profiles of small carrion and resulting changes in attraction and preference.

18-3. **Stomata: A missing link to understanding plant volatile communication. Natalie Aguirre** (n.aguirre@tamu.edu), John Grunseich and Anjel Helms, Texas A&M Univ., College Station, TX

Corn plants (*Zea mays*) face attack by insect pests which requires complex defense mechanisms to combat herbivory. Upon herbivory by fall armyworm (*Spodoptera frugiperda*), corn plants release complex mixtures of herbivore-induced plant volatiles (HIPVs) into the air. The HIPVs enhance or "prime" the defense response of non-attacked, neighboring plants upon subsequent herbivory. Recent research identified key compounds within the fall armyworm-induced corn volatile blend that trigger a primed state in neighboring plants, but relatively little is known about the perception mechanism of these compounds. The goal of this study was to determine the role of stomatal pores in the perception of key volatile compounds. We predicted that specific HIPVs (indole or (Z)-3-hexenyl acetate) will not be perceived by corn plants when stomata are closed, preventing defensive priming from occurring. To test this hypothesis, we quantified herbivore defense phytohormone levels in plants exposed to indole or (Z)-3-hexenyl acetate or unexposed plants during various treatments to manipulate stomatal aperture. We found significant increases in phytohormone levels (JA and ABA) from HIPV-exposed plants compared to control when exposure occurred while stomata were open. Closed-stomatal exposures, however, resulted in no differences in JA and ABA compared to control. The defensive plant priming response by indole or (Z)-3-hexenyl acetate exposure did not occur when stomata were closed by darkness or drought. These results suggest stomata could serve as a port of entry required for the perception of key volatile compounds.

18-4. **Transcriptome profiling to identify detoxification genes involved in metabolic resistance in *Culex quinquefasciatus* and *Aedes albopictus* in Harris County, Texas. Xinyue Huang** (lessice2019@gmail.com)[1], Chris Fredregill[2], Kendra Dagg[2], Christina Alvarez[2], Phillip Kaufman[3] and Michel A. Slotman[3], [1]TAMU, College Station, TX, [2]Harris County Public Health, Houston, TX, [3]Texas A&M Univ., College Station, TX

Whole transcriptome analysis of more than 480 field-collected *Culex quinquefasciatus* and *Aedes albopictus* from Harris County, Texas and a laboratory susceptible strain was conducted to investigate metabolic insecticide resistance. Mosquito samples were phenotypically classified into 'Malathion resistant' and 'Malathion susceptible' groups according to results from a CDC bottle assay, and live/dead specimens from the bottle assay were submitted for further analysis. Total RNA from these mosquitoes was extracted under four experimental groups (field/lab and susceptible/resistant) and subjected to whole-transcriptome sequencing. After differential gene expression analysis in R, differentially-expressed genes with false discovery rate value less than 0.05 were found in comparisons of insecticide resistant and susceptible groups, and between field-collected and laboratory-reared groups for both genera. Based on this result, gene candidates were filtered from three major gene families (P450, GST and esterase) associated with metabolic resistance mechanisms. Results from the evaluation of the 20 candidate genes for each genus will be presented. The detoxification function of candidate genes involved in metabolic resistance detected in *Culex* mosquitoes were validated using RNA interference technology. Our work developed a complete pipeline to identify detoxification genes responsible for metabolic resistance and validated candidate gene function, which may guide future insecticide research and development.

18-5. **The correlation between direct and indirect defenses in sorghum: The potential for enhanced protection against an invasive aphid pest. Emily Russavage** (emily.russavage@tamu.edu)[1], Jeremy Hewlett[1], Adrianna Szczepaniec[2], Anjel Helms[1], William Rooney[1] and Micky Eubanks[1], [1]Texas A&M Univ., College Station, TX, [2]Colorado State Univ., Fort Collins, CO

Plants respond to herbivory using a variety of traits. Direct defenses are plant traits that directly affect pest behavior or physiology, whereas indirect defenses are plant traits that attract natural enemies to reduce herbivory. To exploit the full suite of plant defenses for pest management, we must understand the relationship between them, as direct and indirect defenses could be negatively correlated, positively correlated, or not correlated. The sorghum aphid (*Melanaphis sorghi* Theobald), formerly known as the sugarcane aphid (*Melanaphis sacchari* Zehntner), is a pest that causes substantial damage to sorghum. We collected HIPVs from 6 sorghum varieties, studied natural enemy attraction to aphid-infested plants in an olfactometer, and measured aphid population growth to test the hypothesis that direct and indirect defenses are positively correlated or independent of one another. We found that direct and indirect defenses are positively correlated or independent of one another. For example, ATx3409/RTx436 produced high levels of volatiles (i.e., high indirect defenses) and had low aphid population growth (i.e., high direct defenses). This work indicates that indirect defenses should be incorporated into sugarcane aphid IPM programs to increase the effectiveness of crop resistance and pest management.

18-6. **Novel method for *Varroa destructor* management: Utilizing worker brood to control mite populations in honey bee colonies. Taylor Reams** (tdreams@tamu.edu) and Juliana Rangel, Texas A&M Univ., College Station, TX

Parasitization of *Apis mellifera* by the mite *Varroa destructor* is one of the main causes for the decline of honey bee health worldwide. To reproduce, a female mite enters the comb cell of a bee larva before it is capped, undergoes development and reproduction within the cell, and exits the cell as the bee emerges. *Varroa* mites have shown a preference for invading drone cells during the reproductive phase, but will invade worker cells throughout the year, as the population of mites within a hive escalates. A mechanical method for mite control is the removal of capped drone brood, but this can only be done when drone larvae are widely present in the hive. Our study involves the manipulation of nurse bee visitations of worker cells by starving worker brood for several hours. We then measured the mites' invasion rates of starved and non-starved (untreated) worker brood. Our results show that starved worker brood have increased mite invasion compared to non-starved worker brood. These results show that starved worker brood could be more attractive to *Varroa* mites, and could be used as a potential control method through out the summer, when drone larvae are not widely present in the colony.

18-7. **Black soldier fly (Diptera: Stratiomyidae) larval and prepupal age and size impact thermal tolerance and preference. Chujun Li** (lichujun@tamu.edu), Texas A&M Univ., College station, TX

Climate change is threatening food security globally. Thermal tolerance and preference are traits commonly used to predict animal distribution and behavior. Given climate change could impact such traits, understanding their relationship with animals in mass production is critical. In this study, impacts of temperature on black soldier fly, *Hermetia illucens* L. (Diptera: Stratiomyidae) tolerance and preference was examined due to its economic relevance. Age and size (due to feeding less daily) influenced thermal tolerance (i.e., LT_{50} for the temperature that half of the tested individuals knocked down) and thermal preference (i.e., temperature selected by each individuals on a thermal gradient) of larvae and prepupae. Results indicate the interaction between age and size was significant on both larval and prepupal thermal tolerance, but not on thermal preference. The heat tolerance LT_{50} ranged from 46.4°C (the large old prepupae) to 48.4°C (the large young larvae). The cold tolerance LT_{50} ranged from 21.6°C (the small young larvae) to 32.1°C (the small old larvae). Young larvae preferred ~3.0°C greater than old larvae. Large larvae preferred ~2.0°C lower than small larvae. Young prepupae preferred ~8.0°C lower than old prepupae. Large prepupae preferred ~3.0°C greater than small prepupae. Results indicate caution should be used when selecting temperatures for mass rearing the black soldier fly especially for old prepupae, which have relatively low mobility. This study indicates both ontogeny and feeding status have significant impacts on black soldier fly thermal tolerance and preference. Such high plasticity underlies potential mechanisms that black soldier flies evolve facing thermal heterogeneity.

18-8. **Microbes regulating VOC production, insect attraction, and oviposition on decomposing remains. Casey Flint** (caseyflint@tamu.edu) and Jeffery K. Tomberlin, Texas A&M Univ., College Station, TX

The time of colonization can be critical in determining circumstances surrounding death investigations (i.e., when did it occur as related to the time of death). This colonization event begins the post colonization interval (PostCI) which forensic entomologists attempt to estimate. However, forensic entomologists understand that there is a period in which the insect must detect and locate remains called the pre-colonization interval. The duration of the Pre-CI can be affected by a variety of factors, but effects of the host microbiome had not been previously explored. Microbes are known to produce volatile organic compounds (VOCs) for various purposes and as by-products of metabolism. Cell autolysis also produces VOCs, but it is unknown which VOCs primary colonizers are utilizing to detect and assess a resource. In the current study, we address this unknown. Axenic and xenic mouse carcasses were obtained and individually placed in sterile treatment containers and swabbed to identify microbes present prior to use in a preference assay. *Cochliomyia macellaria* adults were allowed to respond for 2-hour trials throughout decomposition. At the conclusion of the behavior experiments each day, VOC samples were taken from each treatment container followed by an oviposition assay on day 8. Adults significantly preferred the xenic mouse over the axenic mouse and oviposition data showed a ~90% reduction in oviposition without microbes. VOC profiles were significantly different between treatments and throughout decomposition, showing that microbes play a great role in attraction to and oviposition on a carrion resource through VOC production.

18-9. **Determining the mechanism of honey bee (*Apis mellifera*) premature self-removal behavior. 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. A sterile worker's own genetic fitness is best served by acting in the interest of her colony, even if that behavior curtails her own lifespan. Stressed bees typically leave the colony to forage early, which leads them to be underdeveloped and unproductive foragers. This precocious foraging behavior can even lead to colony collapse. In this study, we test the hypothesis that developmentally stressed young worker bees remove themselves from their colony and subsequently die due to extreme stress. To confirm that this behavior is a reaction to severe stress, and not a parasite or altruistic social immunity driven behavior, we stressed bees with either temperature stress or *Varroa* mite parasitization during pupation. Stressed bees, as well as control counterparts, were tagged upon emergence and introduced to a common observation hive. We then observed the colony for premature self-removal. We have found that the stressed bees self-remove at a significantly higher rate than their unstressed counterparts. Stressed bees also have smaller hypopharyngeal glands than their unstressed controls indicating that this is a stress driven behavior and potentially a form of extremely accelerated precocious foraging.

18-10. **Comparative quantification of honey bee (*Apis mellifera*) associated viruses in wild and managed colonies. Myra Dickey** (mdickey2@tamu.edu)[1] and Juliana Rangel[2], [1]Texas A&M, College Station, TX, [2]Texas A&M Univ., College Station, TX

The most detrimental threat to honey bee (*Apis mellifera*) health is the ectoparasitic mite *Varroa destructor*, which is linked to sizeable colony losses worldwide. *Varroa* is also a prolific vector of several honey bee-associated viruses. Wild honey bee colonies live in feral conditions and are thus not treated for *Varroa* control, which has enabled the natural selection of mite tolerant bees. To date, there is limited information about virus prevalence in wild Africanized honey bee (AHB) populations. The Welder Wildlife Refuge (WWR) is a unique site to study the viral landscape of wild AHBs in the Southern U.S. The goal of this project is to quantify honey bee-associated viruses in a wild population of AHBs, compare the presence of these viruses to that in the nearest managed apiaries. In 2013 we detected the presence of Deformed wing virus (DWV), Black queen cell virus (BQCV), and Lake Sinai virus (LSV). In 2016 we detected the presence of DWV, BQCV, and Sacbrood virus (SBV). All samples that tested positive for viruses contained extremely low copy numbers in both years. This study provides us the first information on the presence and levels of honey bee-associated viruses in a wild population of AHBs.

18-11. **Withdrawn**

18-12. **Lifespan shortening effects of a GRAS compound on three mosquito disease vectors in the United States. Heidi Lindsley** (heidi_lindsley1@baylor.edu) and Jason Pitts, Baylor Univ., Waco, TX

Insecticide resistance is increasingly prevalent among disease vectors, including three major mosquito species in the United States: *Aedes aegypti, Aedes albopictus,* and *Culex pipiens.* To combat this concerning trend, we are investigating the effects of compounds that are Generally Recognized As Safe (GRAS) on lifespan in these species. GRAS compounds have been deemed safe for human use and consumption by the FDA and are often used in food and cosmetics. However, we have identified one compound, which we call PG, that is potentially toxic to arthropod pests. In a series of feeding assays, we determined that *A. aegypti* adults that were allowed to feed continuously on a 5% sucrose + 5% PG solution for seven days had significantly shorter lifespans than adults that only had access to 5% sucrose ($P<0.001$).This effect was also more acute at higher concentrations of PG, but was less pronounced when adults had access to PG for only 24 hours. Additionally, *A. albopictus* and *C. pipiens* were equally or more susceptible to this compound ($P<0.001$), respectively. These results demonstrate the feasibility of PG as an effective insecticide alternative for three major disease vectors in the United States.

18-13. **Fieldable rapid pathogen detection in vector arthropods. James Mann** (James_Mann1@Baylor.edu) and Jason Pitts, Baylor Univ., Waco, TX

Vectorborne pathogens contribute significantly to the global burden of infectious disease. They represent a continuing public health concern in the United States and contribute significantly to experienced economic burden. Rapid detection is critical to minimalize spread of vectorborne pathogens. CRISPR-Cas based assays provide a solution which is rapidly fieldable, specific and has prior been demonstrated with viruses and other vectorborne pathogens. The critical step of this platform requires the design of highly specific and efficient CRISPR RNA (crRNA) and isothermal primers. Currently, no one stop tool exists to rapidly design crRNA for use with the platform. PrimedSherlock is a new Python based design and analytics tool which leverages PrimedRPA and Cas-Offinder to automate crRNA design and analytical evaluation. It offers the user an ability to provide primer pairs, or to directly source designed RPA primers from primer design tools such as PrimedRPA. The tool then determines for each primer combo the four best crRNA pairs with two for maximized strain coverage and two for detection of highly divergent strains. Utilizing the tool specific crRNA targets were identified for several Flaviviruses DENV1-4, WNV, ZIKV and Cas12 assay-based detection was demonstrated with genomic stocks sourced from BEI. Furthermore fieldable detection in pooled samples was demonstrated with the detection of lab infected DAKAR and PRV59 ZIKV Strains using a Cas12 based lyophilized fieldable lateral flow assay. We expect this design tool and assay to directly translate to the fieldable detection of other pathogens of medical concern in the field of medical entomology.

18-14. **Evaluation of Thryvon cotton as a control method of cotton fleahoppers (*Pseudatomocelis seriatus* Reuter).**

Brady Arthur (bparthur@tamu.edu) and David Kerns, Texas A&M Univ., College Station, TX

In Texas the cotton fleahopper (*Pseudatomocelis seriatus* Reuter) is considered a highly economically damaging pests to cotton (*Gossypium hirsutum* L.). Current control methods rely heavily on the use of foliar applied chemical insecticides during the growing season. Considering the cost of insecticides and the critical timeliness of applications, chemical control methods are often not optimized to reduce the potential yield loss. The Cry51Aa2.834_16 gene in cotton (ThryvOn) has proven effective against thrips and other Miridid insect pests with piercing and sucking feeding behaviors, suggesting the trait may also prove effective at minimizing yield losses due to the cotton fleahopper. To evaluate the traits effectiveness a large plot field trial was conducted to compare a cotton cultivar containing the trait and a non-traited isoline cultivar. The field trial was arranged in a randomized complete block design with the two cultivars either untreated or sprayed with an insecticide when cotton fleahoppers reached the economic threshold. Weekly populations were noted by visually inspecting terminals and fruit retention was calculated weekly by a whole plant examination. While cotton fleahopper population differences were not consistently noted during the growing season the ThryvOn cotton offers boosted square retention in all levels of infestation. All three years of the study showed that the ThryvOn trait alone offers similar protection to fruit as using chemical insecticides to control cotton fleahoppers.

18-15. **Implications of phloem-feeding pest *Dalbulus maidis* on morphological expressions of drought-tolerance in maize. Tara-Kay L. Jones** (jonestarakay1@tamu.edu), Raul F. Medina and Julio S. Bernal, Texas A&M Univ., College Station, TX

Drought stress is amongst the most important factors affecting maize production globally. Existing strategies to offset drought impacts are centered around the rapid development of tolerant cultivars through plant breeding programs. However, under natural field conditions as well as projected climate changes, additional stress such as insect pests are likely to occur with drought simultaneously. To determine the impact of combined insect and drought stress on drought-tolerance in maize, the effects of *Dalbulus maidis*, drought, and both stresses combined were tested in drought-tolerant maize hybrids. Several maize morphological traits (*i.e.,* plant height, stem diameter, shoot weight, alive leaves, internode length, root weight, root length, presence of crown root hairs, and root-to-shoot ratio) were measured at the end of a 28-days period of stress and control exposure. Effect sizes were mostly insignificant when maize seedlings exposed to *D. maidis* only were compared to those exposed to drought only stress; as well as when drought only was compared to combined stress. Combined stress (insect + drought) had overall greater effects than *D. maidis* on maize drought-tolerant morphological traits, and these effects were either additive or synergistic, except for root length and shoot weight which were antagonistic. While there were indications that drought tolerance was maintained within the drought-tolerant bred hybrids, sustained effects of drought and insect damage acting together may detrimentally affect future maize productivity. Our study highlights the importance of testing the combined effect of multiple stressors to better predict insect-plant interactions in the context of plant breeding for drought-tolerant traits.

Student 10-minute Paper Competition - Undergraduate

19-1. **Overturning prohibition: Disparlure bait does not attract the threatened American burying beetle. Robert Pille** (robert.pille@connorsstate.edu) and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK

The American Burying Beetle (*Nicrophorus americanus* Olivier) is a threatened species of beetle that occurs in six states. *Lymantria dispar* (L.) is an invasive species that is a generalist herbivore that threatens hardwood forests. Sampling and management through mating disruption occur using a synthetic pheromone (disparlure). However, because no studies have examined attractiveness of disparlure on *Nicrophorus* beetles, it is prohibited in areas with potential or documented occurrence of American burying beetle. We conducted laboratory studies to test the attractiveness of disparlure to three species of *Nicrophorus*. We tested 16 *N. carolinus*, 91 *N. orbicollis*, and 8 *N. americanus* in a series of trials. Compared to unbaited pitfall traps, traps with disparlure caught similar numbers of all three species. Our results indicated that disparlure is not attractive to *Nicrophorus* and can be used in areas where the American burying beetle occurs.

19-2. **Effects of constant and variable temperature conditions on the development of *Lucilia eximia* (Weidemann) (Diptera: Calliphoridae). Steven Graham** (sg2900@outlook.com)[1], Samantha Sawyer[2] and Jeffery K. Tomberlin[1], [1]Texas A&M Univ., College Station, TX, [2]Univ. of Florida, Gainesville, FL

Lucilia eximia (Wiedemann) (Diptera: Calliphoridae) is a blow fly species native to the Neotropical region and southern North America. Like other Calliphoridae, *L. eximia* is a primary colonizer of carrion resources and will perform facultative myiasis. Development data for this species in the southern U.S. is not presently available. The development of *L. eximia* was observed at constant temperatures of 25°C, 32°C, and 37°C. The effects of variable temperature on were investigated by shifting temperature from 37°C to 25°C in the postfeeding 3rd instar. Larval eclosion occurred 3 h faster on average at 32°C and 37°C compared to 25°C. The 1st and 2nd instar were completed quicker at 32°C than 37°C. At 37°C, 3rd instars vacated the food source an average of 6.3 h faster than at 32°C. Pupation occurred 18.5 h slower and eclosion 2.4 d slower at 25°C than 32°C. When held at 37°C only one individual successfully pupated and no adults were observed. Decreasing temperature from 37°C to 25°C in the postfeeding 3rd instar improved pupation and adult eclosion. This could explain the tendency of Calliphoridae to vacate the host to pupate in cases of myiasis. These data provide the expected interaction period of immature *L. eximia* with carrion resources. Should *L. eximia* be used in maggot debridement therapy, this study provides the expected duration of medically useful life stages. This work also enables forensic entomologists in the Southern U.S. to use *L. eximia* for time of colonization estimates in legal investigations for the first time.

19-3. **Discovering jewels in new places: Increased distributional records of Buprestidae from Oklahoma and New Mexico. Joel DuBois** (joedubo@okstate.edu) and W. Wyatt Hoback, Oklahoma State Univ., Stillwater, OK

Buprestidae (Coleoptera) is among the largest families of beetles with more than 15,000 species described. Many species contribute important ecosystem services by decomposing wood, while some are invasive pests. We surveyed areas of Oklahoma and New Mexico using visual searches and beat sheets to sample Buprestidae. In Oklahoma, we added 7 new state records and one new adult plant host record, and in New Mexico, we produced 3 additional new state records. The new records included individuals from nine different genera: *Acmaeodera* Eschscholtz, *Acmaeoderopsis* Barr, *Agrilus* Curtis, *Brachys* Dejean, *Buprestis* Linnaeus, *Chrysobothris* Eschscholtz, *Melanophila* Eschscholtz, *Phaenops* Dejean, and *Polycesta* Dejean. Each new state record was compared to literature and museum records to determine the extent of range expansion. Providing new state records allows biodiversity to be measured and can detect expansions or human-facilitated introductions outside of a species' native range.

19-4. **Different interpretations: Herbivore-induced plant volatiles elicit different defense responses in inter-plant communication between heterospecific and conspecifics. Laura Marmolejo** (lauramarmolejo18@gmail.com), Morgan Thompson and Anjel Helms, Texas A&M Univ., College Station, TX

Herbivory induces plants to emit a blend of volatile organic compounds that are often used for defense. Neighboring plants can recognize these chemical blends and 'prime' their defenses. Primed plants typically mount a faster or stronger defense against herbivores. Recent evidence, however, revealed that herbivory by generalist salt marsh caterpillars (*Estigmene acrea)*, induces volatiles from zucchini plants (*Cucurbita pepo*) that increase vulnerability to herbivory in neighboring zucchini plants. Building on these findings, our goal was to determine if exposure to saltmarsh-induced volatiles of zucchini plants induces similar responses in neighboring heterospecific plants that are a wild relative of zucchini, buffalo gourds (*Cucurbita foetidissima*). We hypothesized that exposure to herbivore-induced volatiles from zucchini plants would suppress buffalo gourd defenses against herbivory. To test this hypothesis, 'emitter' zucchini plants were damaged by larvae or left undamaged as controls while neighboring 'receiver' buffalo gourd plants were exposed to the emitter-produced volatiles. After 24 hours of exposure, receivers were challenged with caterpillar herbivory. We then quantified herbivore damage and defense chemistry in receiver plants. Our results indicate a trend of decreased feeding on buffalo gourd receivers exposed to damaged-emitter volatiles. Our results suggest that the volatile blend released by caterpillar-damaged zucchini generates a different effect on buffalo gourds than was previously shown for neighboring conspecific zucchinis. Altogether, our data contributes to a better understanding of interspecific communication between plants and the role domestication may play in modifying plant-plant communication.

19-5. ***Varroa destructor* and its effects on the fat body development of *Apis mellifera* drones. Jarod Perez** (perejar0894@tamu.edu), Juliana Rangel and Taylor Reams, Texas A&M Univ., College Station, TX

Varroa destructor is an ectoparasite that feeds on developing honey bees, resulting in health problems during both worker and drone development. One of the organs that are impacted are called fat bodies. This organ is a critical part of an insect's storage of triglycerides, which are important compounds used in energy storage. Additionally, there is also evidence that *Varroa* mites cause drones to develop smaller bodies, as well as having reduced reproductive organs and sperm counts. This paper aims to investigate how honey bee (*Apis mellifera*) drone development is affected by high levels of infestation by the parasitic mite *Varroa destructor*. By measuring the differences between drone fat bodies from colonies with high levels of *Varroa* infestation and those with treated colonies, as well as the sizes of the bodies of these drones, the actual effects that *Varroa* mites have on colony development can be clearly compared.

19-6. **Effect of sublethal doses of pesticide on *Osmia* bees' olfactory learning retention. Keegan Nichols** (Knicho5@gmail.com) and Loriann Garcia, Austin College, Sherman, TX

Native bee populations are declining globally, which will have a drastic effect on the availability of certain agricultural crops. Part of this decline could be attributed to their exposure to pesticides in agriculture fields. They are constantly ingesting sublethal doses of pesticides while foraging amongst flowering crops. These doses of pesticide could be affecting the olfactory foraging and memory retention of the native bees. Most past research has been focused on Honeybees but not on how it affects the native bees. This hypothesis was tested on *Osmia ribifloris,* a managed species of mason bee. The bees were conditioned to have a PER (proboscis extension response) to a certain scent by a food reward. After consumption of pesticide laced food, they were presented with the conditioned scent to see if they remember the reward. Additionally, they were also subjected to a foraging array by different scented flowers having different rewards depending on the scent. These test how the pesticide affects olfactory retention. This is crucial to the survival of the bee as it needs to remember which flowers provide the highest reward per visit. Disruption of this pathway could lead the bee to not forage the necessary provisions for individual survival and ultimately, species survival.

Student 10-minute Paper Competition - Masters

20-1. **A flying start for insects: Incorporating drones in the monitoring and distribution of insects used as biological control agents. Haley Vincze** (haley.vincze@gmail.com)[1] and David Thompson[2], [1]New Mexico State Univ., Stephenville, TX, [2]New Mexico State Univ., Las Cruces, NM

New technology provides opportunities to aerially distribute biological control agents using more innovative methods. Unmanned Aerial Vehicles, or drones, are beginning to be used for aerial releases of several biological control agents in high value cropping systems, such as pecans. The feasibility of using drones to monitor pecan health and to disperse biological control agents to control black pecan aphids (*Melanocallis caryaefoliae* Davis) and blackmargined pecan aphids (*Monellia caryella* Fitch) was tested during the summers of 2020 and 2021 in Las Cruces, New Mexico. In 2020, 10 weekly releases of 5,000 convergent ladybird beetle adults (*Hippodamia convergens* Guérin-Méneville) per acre and in 2021, 9 weekly releases of 15,000 green lacewings eggs (*Chrysoperla rufilabris* Burmeister) per acre were delivered using a DJI Matrice 600 Pro drone. A prototype insect distribution system developed with an industry partner (WeRobotics) was used to deliver the insects. Appropriate release altitudes, insect densities, target accuracy, and insect fitness were determined for the prototype. This research showed that drones can efficiently release biological control agents in pecan agroecosystems, although in our small plots there were no corresponding decreases in targeted aphid populations.

20-2. **Dietary protein and carbohydrate effects on tarnished plant bugs: Implications for omnivory. Pio Bradicich** (piobradicich@gmail.com) and Spencer Behmer, Texas A&M Univ., College Station, TX

Lygus lineolaris (Hemiptera: Miridae), also known as tarnished plant bugs (TPB), are economically important pests of various crops throughout North America. They are highly polyphagous omnivores that have been reported to feed on over 330 different plant species. They are also prevalent and emerging pests in many agroecosystems. Despite this, we still know

little about their nutritional needs and related feeding behavior. The goal of this project was to investigate the effects of dietary protein and digestible carbohydrates (sugars and starch) on TPB survival, development, and feeding behavior. This was done in a series of no-choice and choice experiments using artificial diets that contained different amounts and ratios of protein and carbohydrates. The no-choice experiments demonstrated that TPB survival and development were positively associated with dietary protein and negatively associated with dietary carbohydrates. The choice experiments showed that TPBs preferred high protein-low carbohydrate diets, but that survival was enhanced when high protein-low carbohydrate diets were paired with high carbohydrate-low protein diets. They also demonstrated a preference for high protein-low carbohydrate diets during preliminary behavioral experiments. The results from this study provide novel insights into TPB nutritional requirements and foraging behavior. In the field, TPBs likely meet a significant portion of their protein requirements via predation of soft-bodied insects and/or cannibalism of conspecifics, while meeting their energy requirements by feeding on plant tissues.

20-3. **Age is more than just a number: Age impacts reproductive output for the black soldier fly, Hermetia illucens (Diptera: Stratiomyidae). Amy Dickerson** (dickersonamyj@tamu.edu)[1], Noah Lemke[2], Chujun Li[3] and Jeffery K. Tomberlin[2], [1]Texas A&M Univ., BRYAN, TX, [2]Texas A&M Univ., College Station, TX, [3]Texas A&M Univ., College station, TX

A reproductively successful colony is the heartbeat of any insect maintained in colony- especially for those used in the insects as food and feed industry. The primary strategy for colony maintenance of the black soldier fly (BSF), *Hermetia illucens*, tends to be a continual release program in which newly-emerged adult BSF are consistently introduced into a breeding cage with older individuals from previous emergence events still present. There are logistical perks to minimizing the frequency of cage resetting (i.e., the time investment not dedicated to cage resetting may be redistributed to other necessary tasks). However, the continual release strategy is blemished by unreliable hatch rates of eggs produced, sometimes with remarkable peaks and valleys in both egg production and hatch rate, with little insight as to the driving factor(s) for these disparities. This study is the first to provide evidence that the age of soldier flies within a breeding cage can significantly impact the reproductive output of the colony. Four treatments were applied within the present study, with breeding cages consisting of an equal sex ratio of the following combinations: 2-d-old males with 2-d-old females; 2-d-old males with 6-d-old females; 6-d-old males with 2-d-old females; 6-d-old males with 6-d-old females. We determined that egg quantity and hatch rate are significantly different and are subjective to the consequences of senescence of BSF within the breeding cages. These data serve to improve BSF breeding practices by offering a springboard for future work as well as to inform decision-makers within the industry.

20-4. **Effects of temperature and photoperiod changes on development of *Aphelinus nigritus* (Howard). Nina Rudin** (nrudin@okstate.edu)[1], Kristopher Giles[1], J.P. Michaud[2] and Bruce Noden[1], [1]Oklahoma State Univ., Stillwater, OK, [2]Kansas State Univ., Hays, KS

The Southern Plains of North America are a humid subtropical region that experiences extreme weather events. Drastic temperature changes are common, but multivoltine insects must adapt to allow their offspring to survive. In agricultural crops it is important to understand how climate and weather can influence pests and their natural enemies. *Aphelinus nigritus* (Howard), is a Nearctic solitary aphid parasitoid found in the Great Plains and has been observed to provide pest control in sorghum, yet very little is known about how this species transitions to and survives cold winter months. We sampled sorghum fields during July and collected *A. nigritus* mummies. Emerged adults were placed in microcosms (sorghum seedlings + greenbugs) then maintained at one of 6 temperature fluctuation x day length environmental conditions (14-10ºC and 28-24ºC daily fluctuations each at 15:9 L:D, 12:12 L:D, and 9:15 L:D) to assess how these conditions influenced growth and development of offspring. We assessed the effect of parental exposure to environmental change (adult pairs mating and ovipositing in experimental conditions) and immature exposure to environment change (parasitized aphids moved to experimental conditions). Results indicate that exposure to lower fluctuating temperatures and shorter days cause delays in development greater than those expected for *A. nigritus*. Delayed development associated with the onset of average winter conditions indicates that *A. nigritus* is entering oligopause, a form of dormancy which may allow it to survive harsh winters in the Southern Plains.

20-5. **The effects of inconsistent consumption of feedthrough-based insect growth regulators by cattle on house and horn fly (Diptera: Muscidae) development in a simulated field environment.** Brandon Smythe[1] and **Hannah Walker** (hannahag16@gmail.com)[2], [1]New Mexico State Univ., Las Cruces, NM, [2]New Mexico State Univ., las cruces, NM

Filth fly populations are synonymous with cattle production as manure is utilized for larval development and offer a target area for controlling fly pests through the use of insect growth regulators (IGR). The current study utilized twelve black Angus mixed-breed heifers (305 ± 62 kg of BW) in a completely randomized design with repeated measures. Animals were randomly allocated to one of 4 treatment groups: 1) an untreated control, 2) diflubenzuron (DFB) delivered every 24 h, 3) DFB delivered every 48 h, and 4) DFB delivered every 72 h. Animals receiving DFB were fed at label rates at designated times. Daily manure samples were collected from each animal and used to evaluate efficacy of DFB across treatment regimens via manure bioassays. A treatment by day interaction (P <0.0001) was observed for both species and multiple instances occurred in which treatment group emergences differed (P < 0.05) from that of the control. In general, when animals are forced to consume DFB inconsistently, both horn fly and house fly emergence increases (P £ 0.05) in a predictable pattern. Regardless of the reasons that may drive inconsistent product consumption in range land settings, our results aid in explaining potential undesirable control of pest populations when using feedthrough products in a field scenario. Subtle breaks in population growth and expansion as a result of inconsistent consumption of product requires further investigation on impacts of field populations.

20-6. **Detection of Undocumented *Rickettsia* species using novel *Rickettsia amblyomattis* Exclusion Assay. Brandon Henriquez** (brandon.henriquez@okstate.edu) and Bruce Noden, Oklahoma State Univ., Stillwater, OK

The southern Great Plains of the US has one of the highest incidence rates of tick-borne diseases (TbD), but there is a knowledge gap in the *Rickettsia* species found in the Lone Star tick, *Amblyomma americanum,* in this region. This tick species is continuing to spread west in the region and the need to characterize these *Rickettsia* species is becoming alarmingly important for the need of public health concerns. However, one of the reasons for the lack of knowledge of *Rickettsia* species in this organism is due to a common endosymbiont, *R. amblyommatis,* which obscures the detection of any other *Rickettsia* species. In order to bypass the endosymbiont, we used a recently developed *R. amblyommatis* exclusion assay to screen 1900 *Am. americanum* collected in Oklahoma City, Oklahoma, which resulted in 9 unique samples, which had originally been obscured by the endosymbiont. Through the process of characterizing primary and secondary Rickettsia species, we identified ticks primarily infected with *R. rhiphicephali* and a *Rickettsia* strain (2019-CO-FNY) previously linked with a canine rickettsia case in Tulsa, Oklahoma. We also identified another *Rickettsia* species that was 97% homologous with an endosymbiont of *Am. tonelliae* and aligned with archaic rickettsial species. This assay enabled us to exclude the endosymbiont, *R. amblyommatis,* as we screened *Am. americanum* for pathogens of medical and veterinary importance and described poorly characterized and previously undocumented *Rickettsia* species.

20-7. **Crispy critters: Reproductive success of round-necked burying beetles (Coleoptera: Silphidae) on burnt rodent carcasses. Sandra Rigsby** (Nicole.rigsby@okstate.edu), William Hoback, Sam Fuhlendorf and Justin Talley, Oklahoma State Univ., Stillwater, OK

Burying beetles are carrion feeders that use small vertebrate carcasses for reproduction, by first burying it and then treating it with antimicrobial secretions. The federally threatened American burying beetle, *Nicrophorus americanus,* has a self-sustaining population at Camp Gruber, located near Braggs, Oklahoma. Camp Gruber serves as both a wildlife management area and military training grounds, which causes accidental and prescribed burns to occur. Because of its close relation to the American burying beetle, we used the round-necked burying beetles, *Nicrophorus orbicollis* to test suitability of burned carcasses on burying beetle reproduction. Four different levels of fire exposure were tested: control/unburned, slightly burned, moderately burned, and charred (N = 7 per trial). Control and slightly burned carcasses resulted in similar numbers of offspring (mean $\pm$ 1 SE of 21.1 $\pm$ 3 and 19.6 $\pm$ 4.5 respectively). Moderately burned and charred carcasses supported significantly fewer offspring (2.9 $\pm$ 1.8 and 1.7 $\pm$ 1.7 respectively). While the overall reproductive success and brood sizes on the moderate and charred carcasses was much lower, *N. orbicollis* was able to use burned carcasses (1 of 7 charred carcasses produced offspring). Fires that result in the mortality of small vertebrates could benefit burying beetle reproduction by providing suitable resources.

20-8. **Investigating pyrethroid resistance in the rice stink bug *Oebalus pugnax* (F.) and insecticide options for sorghum management in Texas. Danielle Gray** (ddg035@tamu.edu)[1], Stephen Biles[2], Kate Crumley[3], Tyler Mays[4], Sebe Brown[5,6], David Kerns[1] and Dalton Ludwick[7], [1]Texas A&M Univ., College Station, TX, [2]Texas A&M Univ., Port Lavaca, TX, [3]Texas A&M AgriLife Extension Service, Wharton, TX, [4]Texas A&M AgriLife, Hillsboro, TX, [5]Louisiana State Univ. AgCenter, Baton Rouge, LA, [6]Univ. of Tennessee, Jackson, TN, [7]Texas A&M Univ., Corpus Christi, TX

Along the Coastal Bend of Texas, the rice stink bug *Oebalus pugnax* (F.) is a serious pest of grain sorghum and rice that is primarily managed by insecticide application. In 2015, a rice stink bug population from Wharton County, Texas, was found to be resistant to lambda-cyhalothrin, a pyrethroid. In more recent years, reports of control failures have spread well beyond Wharton County. However, no studies have thoroughly evaluated the extent or geographic range of resistance in the Coastal Bend. We evaluated rice stink bug populations along the Coastal Bend to determine the geographic range and extent of pyrethroid resistance in 2021. We calculated lethal concentrations to kill 50% (LC50) and 95% (LC95) of each sample population utilizing glass vials with different concentrations of lambda-cyhalothrin. We also evaluated the efficacy of alternative insecticides in field experiments conducted in Nueces County, Texas. In this field trial, we evaluated the efficacy of three insecticides (lambda-cyhalothrin, dimethoate, and dinotefuran) with regards to nymph and adult rice stink bug mortality. Our results indicated resistant populations of rice stink bug across the Coastal Bend, with LC50 values ranging from 11–1,742 times higher than a susceptible population. In the field efficacy trial, lambda-cyhalothrin did not provide adequate control for rice stink bugs. Dinotefuran provided excellent control of nymphs, but dimethoate provided better results for controlling adult rice stink bug. These results will impact rice stink bug management for sorghum growing regions of Texas.

20-9. **Evaluating the impacts of starvation on permethrin resistant and susceptible horn flies (Diptera: Muscidae). Jovy Ramirez** (zerimarj@nmsu.edu)[1], Brandon Smythe[1], Ulises Sanchez[1], Hannah Walker[2] and Jesus Zamudio[1], [1]New Mexico State Univ., Las Cruces, NM, [2]New Mexico State Univ., las cruces, NM

The use of push-pull strategies for horn fly (*Haematobia irritans*) control may provide alternative approaches to combat on-going issues with insecticidal control methods. However, the consequences of temporary starvation associated with the relocation of horn flies from one host to another have yet to be fully explored. The objective of the current study is to evaluate the impact of induced starvation on horn fly susceptibility to permethrin and general fecundity using filter paper and manure bioassays, respectively. Susceptible and permethrin resistant horn flies were both randomly allocated to one of four treatment groups; 1) blood fed, 2) partially starved, 3) moderately starved, and 4) severely starved groups. Permethrin susceptible 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. These preliminary results indicate that susceptibility to permethrin increases as time without a blood meal increases. In addition, evaluations of general fecundity as a result of starvation against both fly strains are currently underway and will be presented. Findings from this work will help expand current integrated pest management options for animal producers by expanding our understanding and implementation of push-pull strategies in animal production systems.

20-10. **The start of something new: Reproduction and host plant susceptibility of small grains with the hedgehog grain aphid, *Sipha maydis* (Heteroptera: Aphididae). Mason Taylor** (masonta@okstate.edu)[1], J. Scott Armstrong[2], Dolores Mornhinweg[3] and William Hoback[4], [1]Oklahoma State Univ., Perry, OK, [2]USDA - ARS, Stillwater, OK, [3]USDA-ARS, Stillwater, OK, [4]Oklahoma State Univ., Stillwater, OK

Sipha maydis, the hedgehog grain aphid (HGA*),* is a grass-feeding aphid that is a cereal/grain pest in Europe, Asia, Africa, and South America. This aphid was discovered in California in 2007, and they have been spreading eastward reaching the central U.S. in 2019. Although this species has a wide range of hosts, little information exists to assess its pest status. We conducted reproduction studies at the USDA ARS facilities in Stillwater OK and tested Custer wheat, Millex32 millet, and three varieties of Sorghum: TX 7000, TX 2783, and KS585 (N = 8 per trial). Reproduction by HGA was compared with that of the sugarcane aphid (SCA), *Melanaphis sacchrum*. After seedling growth, plants were infested with one nymph which was followed until its death. Fecundity was determined as the total number of nymphs produced. HGA reproduced on all tested plants with the highest reproduction (44.1 nymphs per female) on wheat; the lowest reproduction occurred on sorghum TX

2783. In contrast, SCA reproduced most on sorghum with the known susceptible TX 7000 producing 70.8 nymphs per female and the known resistant sorghum KS 585 producing the fewest (48.9). SCA reproduced at very low rates on wheat and millet (< 2 nymphs per female). In addition, the formation of wings was recorded and HGA produced wings on all host plants. These results show HGA can colonize crop fields but reproduction is modest and the formation of wings suggests optimal growth conditions are not present in our trials.

20-11. **Applications of gibberellic acid for control and management of *Melanocallis caryaefoliae* (black pecan aphid).** **Alexander Armijo** (alexmijo@nmsu.edu), David Thompson and Larry Blackwell, New Mexico State Univ., Las Cruces, NM

Pecans have the highest gross cash receipts of all crops in New Mexico. Most growers annually monitor and manage black pecan aphid (BPA, *Melanocallis caryaefoliae*). Feeding damage results in chlorotic/necrotic areas near feeding sites. In large numbers, BPA feeding will result in early leaf senesce resulting in poor nut fill, and lower yields. In pecans, exogenous applications of gibberellic acid (ProGibb) are used to promote leaf retention and help maintain green foliage. An untreated control and four rates of ProGibb were applied using a modified air blast sprayer to four blocks of five trees in 2021. Leaves were destructively sampled weekly to quantify all aphid life stages and were then scanned to determine total chlorosis. Clip cages were placed over a $3^{rd}/4^{th}$ instar BPA in the field and checked daily until molting into an adult. Clip cages were harvested two weeks after treatment to count aphids and estimate chlorotic area. Leaf nutrient concentrations, yield and nut quality were estimated for each tree. Preliminary results suggest applications of ProGibb did not result in lower aphid numbers between treatments. Chlorotic area was correlated with aphid numbers but not different among treatments. Developmental time of aphids in cages between treatments is still being analyzed. Stick tights and lower quality nuts are more prevalent at higher rates of ProGibb. We hope ProGibb could be an alternative for organic growers attempting to manage black pecan aphids.
Keywords: *Melanocallis caryaefoliae*, Plant growth regulator (PGR), Chlorosis/chlorotic, Clip cage, pecan

20-12. **Trends in functional trait diversity of an arid-land bee assemblage over time. Benjamin Turnley** (bturnley@unm.edu), Univ. of New Mexico, Albuquerque, NM

Understanding changes in bee diversity and abundance is critical because ecosystems rely on the pollination services that bees provide. One driver of the decline in bees is climate change. Certain physiological and morphological traits might help to mitigate the impacts of an increasingly hostile climate and drive shifts in the composition of the bee community. Here, we examine temporal trends in the trait values and functional diversity of a hyper-diverse bee assemblage at Sevilleta National Wildlife Refuge (NM, USA). We ask: (1) have community-weighted traits shifted over time towards arid-adapted values, consistent with the hypothesis that aridification is driving bee assemblage change? And, (2) has functional diversity of pollination-related traits declined over time, consistent with the hypothesis that pollination services could be declining. This study pairs new data collection on bee traits with an existing long-term bee abundance dataset spanning 2002-2019. We found no trend in community-weighted trait values or assemblage functional diversity over time. However, there is a significant relationship between these components and climate. Our work suggests that aridification is driving bee assemblage change.

Symposium: Arthropod Behavioral Changes in Response to a Rapidly Changing Climate

27-2. **Thermal response of *Cochliomyia macellaria* to constant and fluctuating temperatures. Aaron Tarone** (tamlucilia@tamu.edu)[1], Jonathan Parrott[2] and Sing-Hoi Sze[1], [1]Texas A&M Univ., College Station, TX, [2]Arizona State Univ., Glendale, AZ

Understanding thermal responses is critical to predicting effects of climate change. Thus, to understand the role of constant and fluctuating temperatures on physiology, 93 transcriptomes of C. macellaria (a common blow fly in Texas) were assessed across 7 developmental time points. Results from the experiment reveal expected and unexpected results with implications for behavior, immunity, and physiology.

Symposium: Genome Editing and Molecular Biology of Insects

28-4. **Investigating the function of an anopheline ammonium transporter using transgenic technologies. Jason Pitts** (jason_pitts@baylor.edu)[1] and Laurence Zwiebel[2], [1]Baylor Univ., Waco, TX, [2]Vanderbilt Univ., Nashville, TN

Ammonia is a ubiquitous compound that is generated naturally in the environment, often produced during the breakdown of nitrogen containing compounds by organisms. As a volatile kairomone, ammonia elicits behavioral responses in insects and serves as an attractant to host seeking female mosquitoes. Transmembrane transporters of ammonia or ammonium ions are encoded in the genomes of prokaryotes and eukaryotes, functioning either in cellular uptake or excretion. Interestingly, ammonium transporters are expressed at high levels in chemosensory tissues in flies. We have used transgenic tools to investigate the cellular localization and physiological function of an ammonium transporter, Amt, in the malaria mosquitoes, *Anopheles gambiae* and *Anopheles coluzzii*. Our studies have revealed Amt expression in neuronal and non-neuronal cells in olfactory sensilla. Curiously, knockout of Amt elicited no measurable effects on olfactory receptor neuron responses to ammonia or other odorants, yet produced pleiotropic deficits in reproduction and feeding behaviors. Future studies will employ similar transgenic strategies to elucidate the function of ammonium transporters in additional vector species.

Symposium: The Current State of Insects As Feed: Impediments, Gaps, And Opportunities

29-2. **From foundation to application: Unifying basic and applied behavior research and what it could mean for the black soldier fly industry. Amy Dickerson** (dickersonamyj@tamu.edu) and Jeffery Tomberlin, Texas A&M Univ., College Station, TX

When mass-rearing organisms as livestock, working with the innate behaviors of the organism can produce many benefits and streamline production. However, there is presently a major knowledge gap regarding the behaviors of wild populations of the black soldier fly, *Hermetia illucens* (Diptera: Stratiomyidae), with only one paper originating from twenty years ago. Seeking better understanding of species-specific behaviors may create the opportunity to redesign rearing protocols-potentially boosting annual profits within the industry.

29-3. **Genetic diversity (or lack thereof) in the black soldier fly. Christine Picard** (cpicard@iupui.edu), Indiana Univ.-Purdue Univ. Indianapolis, Indianapolis, IN

The black soldier fly, *Hermetia illucens*, is one of the most promising insect species for mass production as alternative protein sources. The rapid growth of industry in the United States and beyond are a testament to its ability to convert many 'waste' resources into something of value. As with all insects reared to mass scale, desirable characteristics for this production scale remain to be fully discovered, with an understanding that as insects are colonized, and selected for, trait tradeoffs will always happen. Most of the strains used across the globe originate, in some regards, to a single strain from North America – which has itself been in colony for a long time. The need to discover new genetic backgrounds that potentially minimize these tradeoffs is especially important in the early stages of colonization. The presentation will highlight the impacts of strain effects in different scale-produced insects and make a plea for a more thorough understanding of the genetic potential in this species.

29-4. **Industrial scale experiments of black soldier fly larvae, microbial supplementation and spent brewers grain.** Emilia Kooienga[1], Jonathan Cammack[2], Fenchun Yang[2], Jeffery K. Tomberlin[3] and **Heather Jordan** (jordan@biology.msstate.edu)[4], [1]St. Jude Children's Research Hospital, Starkville, MS, [2]EVO Conversion Systems, LLC, College Station, TX, [3]Texas A&M Univ., College Station, TX, [4]Mississippi State Univ., Mississippi State, MS

Black soldier fly larvae are poised for mass production; However, the system has not been optimized for maximum production or optimal waste degradation. In this experiment, we utilized probiotic supplementation, as well as spent barley grain as a food source, which is an abundant by-product from the beer-brewing process. We hypothesized that microbial supplementation would increase larval growth and waste conversion by providing more lipid source, and increased nutrient availability. We conducted industrial scale experiments with *Arthrobacter* and *R. rhodochrous* as food additives to

standardized diet or spent brewer's grain. Larvae fed constantly and at designated timepoints, a subset of larvae and digestate
was removed from pans, weighed, and frozen for analysis. Results showed black soldier fly larvae fed bacterial supplemented standardized Gainesville diet showed that *Arthrobacter* and *Rhodococcus* supplementation led to 21.6% and 22.2% respective increased weight on day 3 compared to controls. At day 6, *Arthrobacter* treated larvae weighed 29% more, and *Rhodococcus* treated larvae weighted 25% more than controls. Results using brewer's waste showed that larvae fed *Arthrobacter* supplement were 9.08%,and 11.6% larger than control larvae on days 3 and 6, respectively. Insect microbiomes shifted in composition and function and fatty acid profiles of larvae fed standard diet or spent brewer's grain revealed a richness of diversity in fatty acids with varying functional properties, depending upon substrate and whether bacterial supplementation was included. These results indicate *Arthrobacter* and *Rhodococcus* supplementation changes the initial environmental conditions, allowing other bacteria to proliferate and aids in larval growth and digestion.

29-5. **Providing new opportunities for largescale phenotyping of insects using automated assessment methods. Stine Laursen** (sfl@bio.aau.dk)[1], Laura Hansen[2], Simon Bahrndorff[1], Natasja Noer[1] and Torsten Kristensen[3], [1]Aalborg Univ., Aalborg, Denmark, [2]Aarhus Univ., Tjele, Denmark, [3]Aarhus Univ., Rønde, Denmark

Insect production for food and feed is a growing industry due to the potential of solving major issues related to sustainable protein production. To fulfill this potential, a deeper understanding of production-relevant species and traits is crucial. Phenotypic information on morphological and physiological traits are commonly obtained through manual assessment of numerous individuals. However, manual observations are time consuming and can introduce observer bias and human error. Therefore, we aimed at comparing larval body size and adult thermal tolerance assessed with novel, automated assessment methods to those obtained with manual assessment methods in the black soldier fly (*Hermetia illucens*) and the housefly (*Musca domestica*). Body size of larvae was obtained manually by weighing and automatically by using an image analysis software providing larval surface area. Results revealed that size estimates obtained by the two methods were highly correlated whilst the automated method was more time efficient. Estimates of thermal tolerance of flies exposed to different acclimation treatments were obtained from three widely applied thermal stress response assays. Assays were recorded with video cameras and start/cessation of fly movement was assessed both manually and with the software. Qualitatively similar results were obtained using the two methods and, in addition, the automated method revealed ecologically relevant information on fly behavior not obtainable through manual observation. In conclusion, the implementation of automated methods for assessment of morphological and/or physiological traits in insects will increase the experimental throughput and provide unbiased estimates of production-relevant traits, thus provide new opportunities within the insect production field.

29-6. **The puzzle of black soldier fly thermal biology. Chujun Li** (lichujun@tamu.edu), Texas A&M Univ., College station, TX

Both research and industry on the black soldier fly, *Hermetia illucens* L. (Diptera: Stratiomyidae) have increased dramatically in the past decade due to its important economic value. Thermal biology is fundamental to understand any species in order to optimize production. Compared to what has been accomplished for the traditional livestock (e.g., chicken, pig, and cow) as related to managing the impacts of temperature on optimal production, research on black soldier fly thermal biology is just beginning. This study aims to review scientific literature on black soldier fly thermal biology, summarize thermal issues industries are facing, and puzzle out the knowledge gaps that research can focus on in the coming years.

29-7. **Impacts of larval resource availability on mating and reproductive output of the black soldier fly in colony. Noah Lemke** (noahlemke@tamu.edu) and Jeffery K. Tomberlin, Texas A&M Univ., College Station, TX

In industrial settings, black soldier flies are reared to adulthood and housed in insect cages where they are presumed to mate; however, males are known to be aggressive and fertile egg production is highly variable, suggesting sexual conflict is negatively affecting the system. Oviposition (egg laying) is induced by placing within the same cage an "oviposition box" that houses a substrate and conspecific larvae to attract females. As conspecific larvae digest the substrate, the associated microbe community changes, and with it, the chemical signals that induce oviposition. Despite this method being widely accepted, we hypothesize this is a critical failure in design, because it leads to wasted reproductive effort (e.g., males will

waste time chasing already-mated females), whereas in the wild, females are able to disperse from males in both time and space. Specifically, males swarm away from where they emerge, and females visit this aggregation strictly to mate, and leave to lay eggs in fresh substrate, meaning females within the swarm are most likely unmated. Therefore, one such way to potentially reduce sexual conflict within cages (in this case, male aggression against females yet to lay eggs), might be to encourage flightiness in females by introducing an oviposition box after peak mating, rather than at the time of adult emergence. This way, the availability of fresh substrate cooccurs with peak oviposition, and females can move away from the mating aggregation.

29-8. **Insects as alternative feed: Growing black soldier fly farms from partnerships in Malawi, Africa. M. Eric Benbow** (benbow@msu.edu)[1], Arox Kamng'ona[2], Mphasto Jumbe[3], Andy Safalaoh[4], Jeremiah Kang'ombe[4], Kingsley Masamba[4], Mike Goliath[5] and Jennifer Pechal[1], [1]Michigan State Univ., East Lansing, MI, [2]Univ. of Malawi, Blantyre, Malawi, [3]Founder and Director of MoVE, Blantyre, Malawi, [4]Lilongwe Univ. of Agriculture and Natural Resources, Lilongwe, Malawi, [5]Lilongwe Univ. of Agriculture and Natural Resources (LUANAR), Lilongwe, Malawi

Black Soldier Fly (BSF) farming has tremendous potential to offer an alternative form of protein in agriculture. There also is a need for alternative approaches to agriculture in developing parts of the world, like Malawi. Over several years we have built a collaborative Malawi-Michigan State University team focused on research, education, mentoring, and outreach to develop small-scale or "backyard" BSF farms in Malawi. We have developed two small-scale pilot BSF farms and have undertaken some of the first research in that country on the effects of different organic matter waste on BSF growth and production. In this study, we found significant differences in organic matter substrate utilization, larval growth, and nutritional composition, with all lower outcomes from larvae raised on animal tissue-based substrate compared to broiler feed. These data indicated that BSF farming has excellent potential to serve as an inexpensive and sustainable substitute protein source at household and local levels in Malawi. The long-term vision is to develop a pipeline for BSF farmers to grow at a pace and with flexibility appropriate to their infrastructure and locally available resources. Once there is reliable BSF larvae production, the larvae will be dried or pelletized to be used in chicken broiler research to determine the economic feasibility of replacing protein meal (e.g., soy) in chicken feed with a low-cost and locally sourced BSF feed. Our team will continue to identify factors that will be impactful on the outcomes and feasibility of widespread BSF farming and the local economic effects in Malawi.

29-10. **Industrialization of black soldier fly production: Challenges and opportunities. Jonathan Cammack** (jacammack@evoconsys.com)[1] and Fengchun Yang[2], [1]EVO Conversion Systems, LLC, College Station, TX, [2]Texas A&M Univ., College Station, TX

The black soldier fly industry has seen intensive growth worldwide over the past decade; driven by the need for better waste management practices, and more sustainable production of protein resources for traditional animal agriculture. Although insects in general have been mass produced at industrial scales for decades, numerous challenges, face the implementation and success of the black soldier fly industry at such a scale. These challenges include feedstock acquisition, material processing and handling, and streamlining of workflows. However, by casting a broad net, our industry has plenty to learn from industries such as traditional animal agriculture, indoor/vertical farming of plants, and food and beverage manufacturing and processing. This presentation will focus on some of the key obstacles currently impacting the growth and expansion of the black soldier fly industry, and knowledge that can be gained from other industries to help realize the full potential of the black soldier fly in tackling two global issues.

Regular Poster Session

30-1. **Flow cytometric determination of DNA endoreplication, a potential diagnostic tool for electron beam-irradiated insect pests of fruits and vegetables. Jiaxin Lei** (jiaxin.lei@ag.tamu.edu) and Keyan Zhu-Salzman, Texas A&M Univ., College Station, TX

Ionizing radiation including electron beam (eBeam) technology has been used as a quarantine measure around the world for transboundary shipment of agricultural products. Since the treatment goal of this technology is not to instantly kill insects but to cause them to be sterile, an apparent challenge is how to ensure that the agricultural commodities have been exposed to ionizing radiation if live insects are found. Because irradiation affects DNA synthesis and cell division, we investigated the feasibility of using flow cytometry detection of eBeam irradiation-induced ploidy change as a diagnostic tool. All eBeam-treated holometabolous insects tested including cowpea bruchid (*Callosobruchus maculatus*), corn earworm (*Helicoverpa zea*) and fruit fly (*Drosophila melanogaster*) displayed significantly higher proportions of polyploid cells than their respective unirradiated controls. However such increased DNA ploidy was mostly absent in irradiated hemimetabolous sand field cricket (*Gryllus firmus*), green peach aphid (*Myzus persicae*) and potato/tomato psyllid (*Bactericera cockerelli*). Further studies with representative holometabolous insects revealed that the eBeam-triggered DNA endoreplicative response was strong in larvae, but became weaker as insects continued to develop into pupae and was even diminished in adults. Therefore, the flow cytometry-based method has the potential to be developed into a diagnostic tool to determine whether juvenile insects found on agricultural shipments, particularly those that undergo complete metamorphosis have received irradiation as a quarantine treatment. This simple and rapid detection method could potentially resolve the dilemma that occurs in border control and domestic movement of plant material and products from areas under quarantine.

30-3. **A new section for teaching and outreach. W. Wyatt Hoback** (whoback@okstate.edu), Oklahoma State Univ., Stillwater, OK

Entomology is the study of insects and related arthropods, but also includes educating others formally or informally about the roles that these organisms play. The Entomological Society of America has four current sections that emphasize research, but many who earn degrees in entomology do not continue conducting research. At Research institutions, faculty can have primary appointments in teaching or extension, while instructors at teaching colleges, museum curators, extension agents, primary and secondary teachers, and many others may have no resources to conduct research. Participation in the Entomological Society of America could be expanded by including a new section to promote the importance of teaching and outreach. Current society changes, including the ability to be a member of more than one section, and proposed modification of branch meeting formats could lend themselves to the new section. Highlights of the proposal and advantages to a new section are discussed.

30-4. **Co-occurrence of sugarcane aphid parasitoid competitors in time and space: Summary of multi-year regional populations dynamics data. Kristopher Giles** (kris.giles@okstate.edu)[1], Norman Elliott[2], Michael Brewer[3], Haley Butler[1] and Nina Rudin[1], [1]Oklahoma State Univ., Stillwater, OK, [2]USDA-ARS, Stillwater, OK, [3]Texas A&M AgriLife Research, Corpus Christi, TX

Following the 2013 invasion of *Melanaphis sacchari* (SCA), this aphid spread to nearly all sorghum producing regions of the US. This pest caused significant losses in Texas, Oklahoma, and Kansas, but following development of regionwide IPM programs, SCA numbers have been steadily decreasing. Multiple published empirical and experimental studies have demonstrated that parasitoids and predators can prevent SCA from reaching economic injury level on susceptible and resistant sorghum, but no studies have quantified intraguild interactions. The most common solitary parasitoids attacking SCA are *Aphelinus nigritus* and *Lysiphlebus testaceipes*. These wasps likely compete for limited hosts on sorghum plants, but published studies have not evaluated their co-occurrence in time and space. We analyze multi-year population dynamics data from fields in Texas, Oklahoma, and Kansas to describe the co-occurrence of *A. nigritus* and *L. testaceipes* at increasing spatial scales throughout the Southern Plains. These data provide empirical evidence about the likelihood of competitive interactions between these parasitoids.

30-5. **Life cycle determination of *Dermestes maculatus* (Coleoptera: Dermestidae) in a controlled environment.** Elyssa Cox[1], Darren Pollock[2] and **Kenwyn Cradock** (Kenwyn.Cradock@enmu.edu)[2], [1]Michigan State Univ., East Lansing, MI, [2]Eastern New Mexico Univ., Portales, NM

Members of the coleopteran family Dermestidae have potential use in forensic entomology in the estimation of the post-mortem interval (PMI). In the published literature there is variation in the reported developmental times from egg through to adult. The variation can be due to differences in factors such as temperature, humidity, and nourishment and can complicate accurate estimation of the PMI. We aimed to add additional information and clarity to the understanding of *Dermestes* developmental times. *Dermestes maculatus* were reared from egg to adult in controlled laboratory conditions (Temperature: 22-25^{o}C; Humidity: 35-50% RH) on a diet of *Dipodomys ordii* (kangaroo rat). The total developmental time from egg to adult was 42.9 ± 6.7 days. Inter-stadial developmental times were as follows: egg to 1st larval instar 2.5 ± 0.7 days; 1st to 2nd instar 3.4 ± 1.7 days; 2nd to 3rd instar 3.2 ± 0.4 days; 3rd to 4th instar 5.9 ± 1.8 days; 4th to 5th instar 4.3 ± 0.5 days; 5th to 6th instar 4.3 ± 0.6 days; 6th larval instar to pupa 15.8 ± 2.8 days; pupa to adult 8.9 ± 0.3 days. These findings add to our understanding of the development of *D. maculatus*, and have applications in both pest management and forensic entomology.

30-6. **Impact of ground temperature and cover on the abundance and diversity of arthropods in oak-juniper habitats.** **Abigail Berrios-Starbird** (aberrios@stedwards.edu) and Darren Proppe, St. Edward's Univ., Austin, TX

Plant canopies play an important role in the reduction of surface and air temperatures. Ectotherms, insects and other arthropods have reduced capacity to regulate their own body temperature and are thus highly temperature responsive. In order to investigate the relationship between variations in temperature due to canopy cover and arthropod populations, the abundance and diversity of arthropods were assessed along a distributed temperature sensing (DTS) cable in Austin, Texas. This cable records temperature every thirty seconds at half meter intervals. Arthropods were collected over a 6-week period via pitfall trapping at 10 canopy covered and 10 open air sites. The abundance and diversity of captured arthropods were compared to temperature values at each site. We will present the impact of temperature and cover in the arthropod community. This relationship is important to consider given predicted changes in temperatures and cover as a result of increasing urbanization.

Symposium: Current Trends in Social Insect Biology

31-2. **Molecular characterization of a dsRNA-degrading nuclease in the tawny crazy ant (*Nylanderia fulva*). Jiaxin Lei** (jiaxin.lei@ag.tamu.edu) and Keyan Salzman, Texas A&M Univ., College Station, TX

RNA interference is a powerful tool that post-transcriptionally silences target genes. However, silencing efficacy varies greatly among different insect species. Recently, we attempted to knock down some housekeeping genes in the tawny crazy ant (*Nylanderia fulva*), a relatively new invasive species in the southern United States, but only achieved relatively low silencing efficiency when dsRNA was orally administered. Here, we detected divalent cation-dependent, dsRNA-degrading activity in the midgut fluid of worker ants in *ex vivo* assays.To determine whether dsRNA degradation could contribute to low effectiveness of oral RNAi in *N. fulva*, we cloned its sole *dsRNase* gene (*NfdsRNase*). The deduced amino acid sequence contained a signal peptide and an endonuclease domain. Sequence alignment indicated a high degree of similarity with well-characterized dsRNases, particularly the six key residues at active sites. We also identified dsRNase homologs from five other ant species and found a tight phylogenetic relationship among ant dsRNases. *NfdsRNase* is expressed predominantly in the abdomen of worker ants. Oral delivery of dsRNA of *NfdsRNase* significantly reduced the expression of *NfdsRNase* transcripts, and substantially suppressed dsRNA-degrading activity of worker ants' midgut fluids as well. Our data suggest that dsRNA stability in the alimentary tract is an important factor for gene silencing efficiency in *N. fulva*, and that blocking NfdsRNase in gut lumen could potentially improve RNAi, a novel pest management tactic in control of *N. fulva* and other ant species.

31-6. **Assessing nutritional variation in pollen: a unifying approach for the study of pollinator health.** Pierre Lau[1], **Pierre Lesne** (Pierre.Lesne@ag.tamu.edu)[2], Robert J Grebenok[3], Juliana Rangel[2] and Spencer Behmer[2], [1]United States Dept. of Agriculture, Stoneville, MS, [2]Texas A&M Univ., College Station, TX, [3]Canisius College, Buffalo, NY

Poor nutrition and landscape changes are two top factors regularly cited for causing the decline of pollinator populations. However, what constitutes "poor nutrition" currently remains inadequately defined. Several key pollinators including most bees are true palynivores: the broad suite of macro- and micronutrients they require comes only from pollen. However, the nutritional content of different pollen types varies, which in turn impacts pollinator foraging behavior and nutrient regulation. Thus, the characterization of the multidimensional nutrient content of pollen is a critical first step to better understand pollinator health. However, the use of a wide range of analytical approaches to assess pollen nutritional content has complicated between-studies comparisons and currently blurs our understanding of pollinator nutrition. In this study, we first reviewed different methods used to estimate pollen protein and lipid content – two important macronutrients for pollinator health. We uncovered significant inconsistencies between methods and experimentally revealed these biases using monofloral *Brassica* and *Rosa* pollen. Second, we performed a carbohydrate assay and an elemental analysis on these pollen types to broadly characterize pollen nutrient content. We use our collective data to propose a unifying protocol for the analysis of pollen nutritional content for the study of pollinator health.

Symposium: Establishing Minimum Standards in Forensic Entomology

32-2. **Who's on first? Why it is important that we are speaking the same language in development study literature.** **Casey Flint** (caseyflint@tamu.edu) and Jennifer Rhinesmith-Carranza, Texas A&M Univ., College Station, TX

Development studies that reflect larval growth rates for forensically relevant insects under varying temperatures and other conditions are at the core of a main applications of forensic entomology: time of colonization estimations. While there are general procedures accepted by the community, no minimum standards are available that allow for consistency across studies. Such criteria are needed to allow for more global assessments of variation within and across populations or species of forensic relevance. This talk will highlight some of this variation in existing development study literature as well as discuss the potential benefits that standardized methods produce with regards to data collection and reporting, as well as precision and accuracy with case interpretations.

32-6. **American Board of Forensic Entomology Technician Certification – Minimum standards for tech-qualifying workshops. Jennifer Rhinesmith-Carranza** (Jennifer.Carranza@ag.tamu.edu), Texas A&M Univ., College Station, TX

The American Board of Forensic Entomology Executive Committee recently approved a third qualifying pathway for those interested in sitting for the Technician certification exam: workshops. Previously, students or practitioners interested in Technician certification could qualify to sit for the exam via specific coursework or through years of experience in death investigations. This new pathway to qualifying for the exam helps increase the accessibility of Technician certification both to students at institutions which may not offer the qualifying coursework as well as to practitioners whose job duties may not routinely engage them in death investigations but for whom education and certification in collecting insect evidence may be beneficial. This talk will provide a brief overview of the minimum standards that workshops must include in order to qualify participants to sit for the ABFE-T exam.

IPM Implementation and Sustainability for Southwestern Cotton Systems

33-1. **Development of economic thresholds toward bollworm (Lepidoptera: Noctuidae), management in Bt cotton, and assessment of the benefits from treating Bt cotton with insecticide. Wilfrid Calvin** (wilfrid.calvin@ufl.edu)[1], Fei Yang[1], Sebe Brown[2], Angus Catchot[3], Whitney Crow[4], Donald R. Cook[5], Jeff Gore[4], Ryan Kurtz[6], Gus Lorenz[7], Nicholas Seiter[8], Scott Stewart[9], Tyler Towles[10] and David Kerns[11], [1]Texas A&M Univ., College Station, TX, [2]Louisiana State Univ. AgCenter, Baton Rouge, LA, [3]Mississippi State Univ., Mississippi State, MS, [4]Mississippi State Univ., Stoneville, MS, [5]Louisiana State Univ. AgCenter, St. Joseph, LA, [6]Cotton Incorporated, Cary, NC, [7]Univ. of Arkansas, Lonoke, AR, [8]Univ. of Illinois, Champaign, IL,

[9]Univ. of Tennessee, Jackson, TN, [10]Louisiana State Univ. Agricultural Center, Winnsboro, LA, [11]Texas A&M AgriLife Extension Service, College Station, TX

Widespread field-evolved resistance of bollworm [Helicoverpa zea (Boddie)] to Cry1 and Cry2 Bt proteins has threatened the utility of Bt cotton for managing bollworm. Consequently, foliar insecticide applications have been widely adopted to provide necessary additional control. Field experiments were conducted across the Mid-South and in Texas to devise economic thresholds for foliar insecticide applications targeting bollworm in cotton. Bt cotton technologies including TwinLink (TL; Cry1Ab+Cry2Ae), TwinLink Plus (TLP; Cry1Ab+Cry2Ae+Vip3Aa), Bollgard II (BG2; Cry1Ac+Cry2Ab), Bollgard 3 (BG3; Cry1Ac+Cry2Ab+Vip3Aa), WideStrike (WS; Cry1Ac+Cry1F), WideStrike 3 (WS3; Cry1Ac+Cry1F+Vip3Aa), and a non-Bt (NBT) variety were evaluated. Gain threshold, economic injury level, and economic thresholds were determined. A 6% fruiting form injury threshold was selected and compared with preventive treatments utilizing chlorantraniliprole. Additionally, the differences in yield from spraying bollworms was compared among Bt cotton technologies. The 6% fruiting form injury threshold resulted in a 25 and 75% reduction in insecticide applications relative to preventive sprays for WS and BG2, respectively. All Bt technologies tested in the current study exhibited a positive increase in yield from insecticide application. The frequency of yield increase from spraying WS was comparable to that of NBT. Significant yield increases due to insecticide application occurred less frequently in triple-gene Bt cotton. However, their frequencies were close to the dual-gene Bt cotton, except for WS. The results of our study suggest that 6% fruiting form injury is a viable threshold, and incorporating a vetted economic threshold into an Integrated Pest Management program targeting bollworm should improve the sustainability of cotton production.

Indices

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* denotes presenting author

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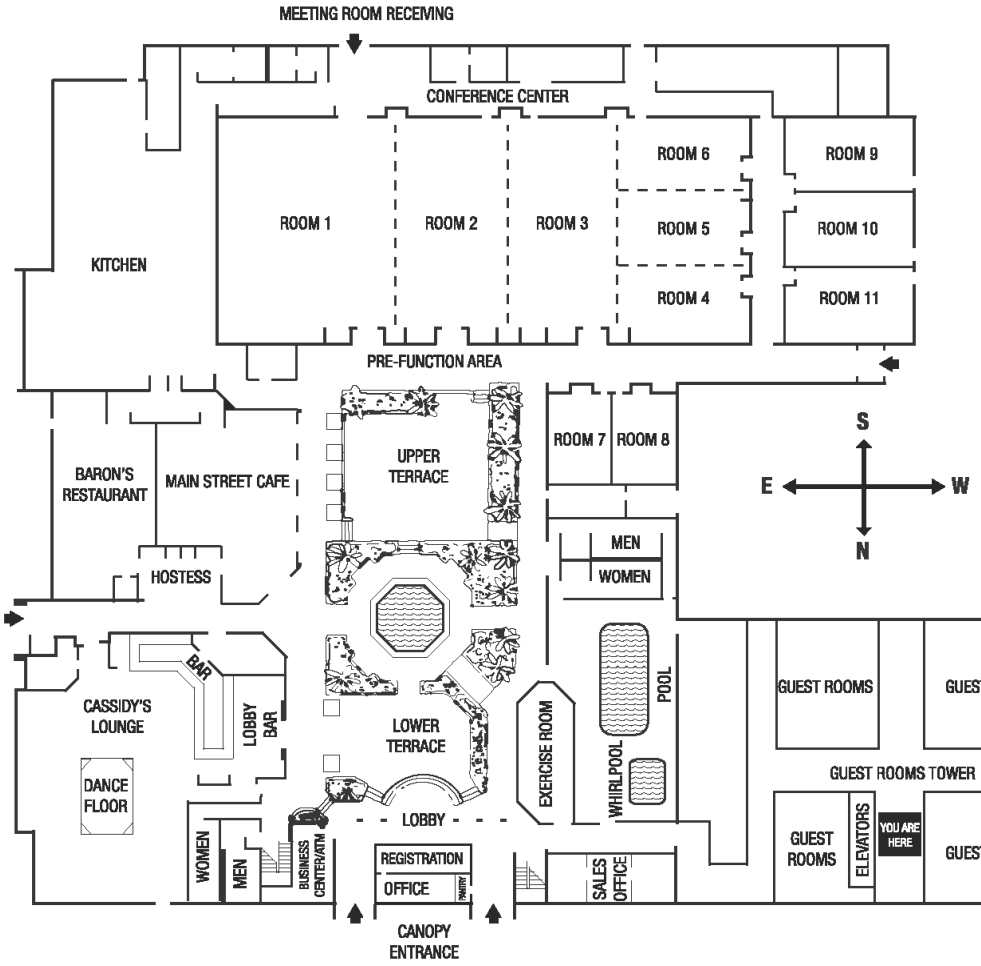

Meeting Rooms

1) Meacham
2) Flatiron
3) Spring Palace
4) Westbrook A
5) Westbrook B
6) Westbrook C
7) Goodnight
8) Burnett
9) Courtright
10) Parker
11) Pickett

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