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CONFERENCE ABSTRACTS

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Invited Speaker Abstracts

The Control of Invasive Alien Plants with Biocontrol in South Africa

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Invasive alien plants (IAPs) are a serious threat to indigenous biodiversity, water security and agricultural productivity in South Africa. The negative impacts from these plants has resulted in the South African government investing significant funds into their control, primarily through the Working for Water (WfW) programme. WfW was founded in 1995 with the dual mandate of protecting ecosystem services and providing employment through the control of IAPs. Since 1995, the annual budget of WfW has grown from 2.5 to 78 million USDA. Initial clearing has been conducted on over 3.5 million hectares of land, and 247 000 jobs have been created. Despite these efforts, IAPs are still an increasing problem in South Africa. The majority of control interventions rely on mechanical and herbicidal control, which are appealing because the results are immediately visually evident, but are often not sustainable in the long-term because continuous follow-up treatments are required. Biocontrol, the use of host specific natural enemies from the indigenous distribution of the target plant, takes longer before results are evident, but can provide permanent and sustainable control. Biological control is also ecologically and environmentally safe in comparison with other control methods. The WfW programme allocates a significant portion of its budget to biocontrol initiative and there have been a number of spectacular successes. In some cases, biocontrol is successful in combination with other control methods, while in others, biocontrol provides complete control alone. Some IAPs in South Africa originate in the USA, and there are serious IAPs in the USA that originated in South Africa, so both countries could benefit from collaborating to develop biocontrol agents that could reduce the negative impacts of IAPs in both countries.

Semiochemical management of fruit flies

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Semiochemicals are message bearing naturally produced chemicals that mediate the behaviour of living organisms. They can serve as eco-friendly alternatives to synthetic chemical pesticides for the management of pests. Inspired by this knowledge, research conducted at the International Centre of Insect Physiology and Ecology *(icipe*), Nairobi, Kenya has identified a plethora of semiochemicals for the management of pests of public health and agricultural importance. This presentation will highlight advances made by our team at *icipe* in chemo-ecological research which has led to the identification and exploitation of semiochemicals for the management of indigenous African fruit fly pests.

Tracking a decade of climate change in the last tropical forests of Mexico using epiphytes as bioindicators

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Climate change is the biggest challenge of our time, and efforts to understand its effect on natural environments are crucial. Epiphytes have been proposed as bioindicators for environmental change given their high coupling to the environment, lack of connection with soil and small size, yet few long-term databases exist. The family Bromeliaceae has high diversity of epiphytic species in southwestern Mexico, where the country´s most conserved tropical forests remain. We studied populations of epiphytic Bromeliaceae for ten years within a mangrove, sand dune scrub, and three seasonally dry forests of increasing stature and decreasing deciduousness, within the Yucatan Peninsula. Permanent plots measuring 10 x 10 m were established in 2009 and annual epiphyte census were performed. Results showed high coupling of epiphyte populations to the environment, but the relationship was different among the sites, the drier forests showed diminished populations following dry and hot years, but these conditions increased populations at the wettest site. Comparison between environmental variables collected from weather stations and climate change scenarios showed different trajectories to those predicted by the models, as the northern part of the Peninsula is so far getting wetter and not drier as predicted. These changes are being recorded in the local epiphytic species abundance, as well as in species anatomic traits. Unexpected interspecies interactions arose as being more important than environmental cues in some cases, though most likely these can also be traced back to environmental factors. Among these were widespread bromeliad floral herbivory by a wasp, and increased death rates of a tree host preferred by the epiphytes. Thus, the complexity of both the climate and ecological systems makes predictions on ecosystem outcomes complicated.

Do Arbuscular Mycorrhizae Fungi Enhance Plant Tolerance against Insects?

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Arbuscular mycorrhizal fungi (AMF) form mutualistic associations with the roots of many plants, including many crops. Associations with AMF have been shown to both increase or decrease resistance to herbivory in different crops. However, little research has been conducted to investigate whether colonization by AMF enhances the tolerance of crop plants to herbivores. Plant tolerance refers to the ability of some plants to sustain injury from herbivores with little or no loss in plant fitness or crop yield. We conducted a series of four small-plot experiments over three years to determine whether colonization of rice with AMF increased the tolerance of the crop to root herbivory by the rice water weevil, Lissorhoptrus oryzophilus. Treatments were factorial combinations of an insecticidal seed treatment and a mycorrhizal seed treatment containing a mixture of four species of AMF. Densities of insect pests were higher on rice treated with AMF, as reported earlier. Colonization with AMF stimulated both plant growth (biomass) and yields, but percent yield losses were no lower in AMF-treated rice than in rice not treated with AMF. In addition, we conducted subsequent greenhouse experiments with maize; plants that were treated as seeds with a mixture of four species of AMF (using a granular formulation) recovered more quickly (as measured by plant biomass) from both artificial defoliation and defoliation by the fall armyworm, Spodoptera frugiperda. The results of these experiments with two crop species suggest that AMF may increase crop plant tolerance to insect herbivory.

Potential concerns of glyphosate: Synergistic toxicity with environmental pollutants

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Glyphosate is the active ingredient of Roundup, the world's most widely used but most debated herbicide. According to the U.S. Environmental Protection Agency (EPA), about 280 million pounds of glyphosate are applied to an average of 298 million acres of crop land annually in this country. The intensive use of glyphosate has resulted in increasing environmental residues over time. Recently, our lab developed a new method for quantifying glyphosate in water samples with high performance liquid chromatography-triple quadrupole mass spectrometer (HPLC-MS/MS) technique. The developed method resulted in the detection of 56−132 μg/L glyphosate in lake and river waters in central Texas region, including Waco and Bryan-College Station. In January 2020, EPA released the interim decision mandating registration reviews of glyphosate and continues to state that *"there are no risks of concern to human health when glyphosate is used in accordance with its current label"*, and *"glyphosate is unlikely to be a human carcinogen"*. However, toxicological studies show that glyphosate causes adverse health effects at the cellular level of human liver, lungs, and nerves. In fact, the LC50 values of glyphosate against human neuronal cells are significantly lower than the values against liver or lung cells. Most recently, our lab assessed the combinatorial effects of glyphosate and contaminants in drinking water, including heavy metals and disinfection byproducts. The results show that glyphosate induces synergistic toxic effects with lead (Pb), copper (Cu), haloacetic acids (regulated disinfection byproducts by EPA), and other emerging water pollutants. The synergism of glyphosate with other contaminants may raise concerns in the continuous long-term application of glyphosate-based herbicides. Won Park

Long-term evaluation of citrus fibrous root tissue as a source for improved HLB diagnosis

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Huanglongbing (HLB; aka citrus greening), a destructive disease in citrus, is caused by three '*Candidatus* Liberibacter' species, '*Candidatus* Liberibacter asiaticus' (CLas), '*Ca*. L. americanus' (CLam) and '*Ca*. L. africanus' (CLaf). While CLas is the most widely spread, the incidence of HLB caused by CLam and CLaf is geographically limited to South America and Africa, respectively. These HLB causing bacteria are transmitted by citrus psyllids, *Diaphorina citri* in Asia and America and *Trioza erytreae* in Africa. Since there is no known treatment or resistant commercial cultivars available, the early HLB detection is crucial for a timely deployment of an efficient disease control strategy that is now heavily dependent on the chemical method to control the population of citrus psyllids. Currently, routine HLB diagnosis involves a visual inspection of tree canopy for HLB symptoms followed by diagnostic qPCR assay using DNA extracts prepared from symptomatic leaves. However, slow symptom development and uneven distribution of the bacteria within a tree canopy make the disease diagnosis extremely difficult at an early stage of HLB. Previously, our lab has shown that the root system has more even distribution of CLas compared to the tree canopy, which has led us to develop a root HLB assay. The current study monitored the efficacy of root vs leaf HLB assay for two years in the field to investigate the potential of root HLB assay for earlier HLB diagnosis. The data indicated that the root HLB assay greatly improves the CLas detection rate for earlier HLB diagnosis compared to the leaf assay.

Pesticide resistance in ticks

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Since the late 19th century chemical acaricide treatment of cattle remains the main method of controlling the cattle tick, *Rhipicephalus microplus*, worldwide. Populations of *R. microplus* have developed resistance to every acaricide chemical class since the first report of resistance to arsenicals in the 1940s. Synthetic pyrethroids, organophosphates, amitraz, fipronil, macrocyclic lactones, and fluazuron are generally marketed in Brazil and resistance to all these chemical classes have already been reported in the states of Rio Grande do Sul, São Paulo, Minas Gerais, Goiás and Mato Grosso do Sul. In a scenario of absence of novel molecules with different modes of action, multiple resistance to acaricides is the major obstacle for sustainable *R. microplus* control. Good practices of acaricide treatments and resistance detection are the core of sustainable control ticks. Resistance can be diagnosed with toxicological bioassays that are simple, low-cost laboratory procedures aimed at the detection of resistance individuals (adults or larvae) in a given tick population. Bioassays have the disadvantage of taking four to six weeks to completion, and time can be critic for decision making in terms of acaricide choice and treatment of animals. Molecular detection in the other hand can be performed quickly with any development stage of the tick. However, it depends on high-cost equipment and there are no molecular markers for all the acaricides available in the market. In the past ten to twenty years there was a remarkable increase in the number of studies describing the mechanisms of resistance to acaricides in *R. microplus* and other tick species. PCR-based techniques are already available to detect mutations associated to resistance to synthetic pyrethroids, amitraz and fipronil. The mechanism of resistance to macrocyclic lactones seems to be related to overexpression of ATP-biding cassette transporters, however, a molecular marker of macrocyclic lactone resistance detection is yet to be developed. Further studies are needed to comprehend and develop markers associated with metabolic resistance. This information can be used to develop a high-throughput method to genotype and detect allele-specific mutations in cattle tick populations to inform acaricide resistance management strategies. Financial support: CNPq, FAPERGS, CAPES, FAPESP, INCT-EM, USDA-ARS, ORISE.

Insect Ecology in the Rio Grande Valley: Current Research and Future Directions

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The Lower Rio Grande Valley is blessed with tremendous plant and insect diversity, and consequently the valley is home to a suite of interesting species interactions mediated by plants and insects. In this talk, I will summarize the work carried out in the insect-ecology lab at University of Texas Rio Grande Valley. This includes plant-herbivore interactions in natural and agricultural ecosystems, plant-pollinator interactions focused on specialized buzz pollination, biocontrol, and integrated pest management. The talk will also explain the tools used in our work from traditional trapping to recent developments in olfactory cues, plant volatiles and insect behavior. Our primary focus is on using the native but worldwide invasive species silver leaf nightshade (*Solanum eleaegnifolium*; Solanaceae) and tobacco hornworm (*Manduca sexta*; Sphingidae) as models in our studies. The talk will summarize major research activities carried out by MS, BS and high school students, and collaborative and participatory research with local, regional, and international agencies related to pest management and invasion biology.

Physiology of Adapted Livestock in a Tropical Environment

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Heat stress is a common problem in ruminant production throughout the tropics and southern U.S. Methods used to alleviate heat stress have ranged from low-cost changes in management practices to expensive infrastructure (sprinklers, shade and fans). Senepol cattle and St. Croix White hair sheep are adapted to the tropical climate and are common throughout the region. Hair coat can play a role in this adaptation and Senepol have the Slick Hair gene which expresses as a phenotype of very short hair and a lower body temperature. Monitoring heat stress has usually been done by measuring respiration rate and body temperature. We have used rectal temperature (RT), vaginal temperature (VT) and thermal imaging of the eye and found them to be highly correlated within cattle and sheep and are useful indicators of body temperature. Our studies have reported that Senepol cattle have a lower body temperature and higher sweating rate than cattle with only 50% Senepol breeding. Both genotypes exhibited diurnal patterns of body temperature change but the temperature of the Senepol was always 0.2 to 0.5 °C lower. We also have reported that body temperature is lower in St. Croix White compared to Dorper x St. Croix White ewes. Pregnant ewes had a 0.5 °C lower body temperature than non-pregnant ewes and is likely due to the higher respiration rate measured in pregnant ewes. Pregnant ewes also had a narrower range of body temperature change throughout the day compared to non-pregnant ewes which may be a protective mechanism for the developing fetus. The use of adapted breeds can be used to select for heat tolerance of livestock production systems in the tropics.

Golden Kiwifruit (*Actinidia chinensis* Planch) in Texas: Conclusions and Outlook for the Future

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The genus *Actinidia* comprises a total of 66 species. Of these, *A. chinensis* (golden kiwifruit) and *A. deliciosa* (green or fuzzy kiwifruit) are the two most economically important. Golden kiwifruit has grown in popularity as a new fruit crop over the past two decades, largely a result of its novel yellow flesh color, reduced pubescence, and greater perceived sweetness, as compared to its green-fleshed relative. Both species are large deciduous vines with dioecious flowering habit. A preliminary trial planting consisting of two *A. chinensis* cultivars and one *A. deliciosa* cultivar, along with their respective pollinizers, (total of 30 plants) was installed on the Stephen F. Austin State University campus at Nacogdoches, TX in 2011. 397 kg of fruit were harvested in 2015, with an average yield of 170 kg recorded for the following five years (2016-2020). Initial success has led to the establishment of six replicated variety trials and the acquisition of roughly 60 cultivars for expanded trailing. Applied research has been conducted to study limitations to crop adaptation and feasibility of commercial production in Texas. Completed and ongoing areas of study include: winter chilling requirement and potential for negation by warm temperature; frost tolerance; tolerance to soil alkalinity; boron toxicity; alternative propagation techniques; use of trunk-wrap materials for cold protection; effectiveness of artificial pollination methods; trialing of kiwi berry (*A. arguta*) under partial shade; protected culture trials. Research and outreach efforts have been supported by funding from the Texas Department of Agriculture Specialty Crop Block Grant (SCBG) program. Conclusions from research and assessment of commercial production feasibility in Texas will be discussed.

On becoming a Hispanic Serving Agricultural University: Research, Education, and Community at the University of Texas Rio Grande Valley

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UTRGV is a regional minority serving institution located in the southern tip of Texas along the US-Mexico border. This region has long been considered an agricultural hotspot in Texas, and in recent years has become a statewide mecca for sustainable and organic agriculture. The region is also home to the largest concentration of Hispanic farmers and ranchers in the country, and to a small but burgeoning population of beginning and minority farmers—all of whom are growing or ranching in a region of tremendous biological and ecological diversity. In this context, The University of Texas Rio Grande Valley has developed new emphases and fields of study at the intersection of agriculture, conservation, sustainability, and environment, with a new Bachelor's degree in Sustainable Agriculture and Food Systems, as well as a Master's degree in Agriculture, Environmental, and Sustainability Sciences (AESS). This program provides students with a unique, integrative education and training that prepares them to meet the challenges and opportunities in the multiple dimensions of agricultural and sustainability sciences, designed to supplement theoretical understanding with action-oriented, applied research and experiential learning. In this brief presentation, I describe the advances in these programs and current opportunities for involvement and collaboration, with an emphasis on research and community engagement in UTRGV's foundational program in Agroecology and Resilient Food Systems.

Technical Talks Abstracts

Morphological characterization and functional identification of Solanaceae trichomes and their defensive roles against chewing and sucking herbivores

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Solanaceae, one of the largest families in flowering plants include various model plants such as tomato and tobacco for plant-herbivore interactions. Trichomes, one of the major physical defenses have been well studied, but we still lack an understanding of various trichome types and their functional defensive roles against herbivores. In this study, we used 17 wild and domesticated Solanaceae species to study detailed morphology of trichomes and their effects on herbivore growth. We found that there is significant variation for trichome type, density and size among examined species. Damage assessment of tobacco hornworm (*Manduca sexta*), Solanaceae specialist chewing type herbivore and mealy bug (*Pseudococcus sp.*), a generalist sucking type herbivore was carried out. Our preliminary results show strong negative correlation between trichome density and time taken by chewing herbivore to initiate feeding. Moreover, in preferential feeding experiments, caterpillars chose to feed on abaxial leaf surface in spite of the fact that it had higher trichome density, with consequences for herbivore growth and development. Altogether, our results show that trichome variation in Solanaceae differentially impacts feeding and can have consequences for growth of specialist and generalist herbivores.

Phytoremediation potential of Hyperaccumulating Plant - An emerging green technology

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Environmental pollution has been drawing attention nowadays, which is therefore being extensively explored. Heavy metals persist as major pollutant in water bodies and soil. The principle cause of the prolonged presence of heavy metals in the environment is their non- biodegradable nature. Phytoremediation, the green technology is a cost effective and an in-situ method for remediation of pollutants. Our study shows efficient removal of chromium and copper from polluted soils using hyperaccumulator plants. Present study provides information regarding metal accumulation in plants, change in level of photosynthetic pigments, toxicity in plant growth, and remediation potential. The knowledge may help to adopt different strategies to combat stress in plants which tolerate and accumulate high levels of pollutants. Phytoextraction potential of all the plant species was assessed in hydroponic media as well as soil planted with *Brassica juncea*, *Cicer arietinum*, *Vigna mungo* and *Vigna radiata*. Quantification of phytoextraction potential of plant was based on Bioconcentration Factor (BCF)and Translocation Factor (TF). The accumulation of copper was found more in shoot compared to root (TF>1) in *Vigna mungo* and *Vigna radiata* plants hence, they are potential hyperaccumulator and suitable for phytoextraction for copper. In *Cicer arietinum* the accumulation of copper was more in root as compared to shoot. Its TF value is also less than 1, so it cannot be considered good candidate for phytoextraction. Results revealed that the percentage remediation of *Vigna mungo* for chromium (51.58%) and copper (60.14%) is the highest making it potential candidate for phytoremediation.

Unravelling the Role of PGPR "*Pseudomonas fluorescens*" in Semi-Arid Soils of the Rio Grande Valley

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Plant Growth Promoting Rhizobacteria (PGPR) are plant beneficial free-living bacteria which are found in rhizosphere and rhizoplane of various plants. *Pseudomonas fluorescens*, a PGPR, helps in plant growth and promotion either through direct or indirect mechanisms. In this study, 35 isolates of *P. fluorescens* isolated from the rhizosphere of sunn hemp (*Crotalaria juncea*), a warm season annual legume, from a certified organic farm in sub-tropical south Texas were screened in King's B (KB) media and comprehensively profiled for plant growth promoting traits such as production of indole acetic acid (IAA), hydrogen cyanide, siderophore, ammonia, ACC (1-Aminocyclopropane-1-Carboxylate) deaminase, phosphate, zinc and protease solubilization. Our result showed out of 35 isolates, all 35 isolates were able to produce siderophore, IAA, and ammonia, 22 isolates were able to solubilize phosphatase, 20 isolates were positive for protease production, 13 isolates were able to produce ACC deaminase, 25 isolates tested positive for HCN production, while none of the isolates were able to solubilize zinc. The study of secondary metabolite profiling of *P. fluorescens* in connection to plant development will reveal an effective biofertilizing and biocontrol agent in Rio Grande Valley.

Tobacco Hornworm (*Manduca sexta*) Blood regulates Plant Defense Signaling

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Plants have been at war with herbivorous insects for millions of years and have developed a set of highly regulated defense strategies to sense herbivore attack using chemical cues known as herbivore-associated elicitors (HAEs), including oral secretions, ovipositional fluids, and frass. These HAEs induce a series of signaling cascades, which ultimately provide induced defenses against them. Despite the existing HAEs and their role in plant defense induction, our knowledge of other herbivore generated HAEs in plant-herbivore interactions are limited. In this study, we demonstrate that "hemolymph" from *Manduca sexta,* caterpillars also induce plant defense signaling cascade and thereby act as a HAE. Using a dye-based imaging technique, our study showed that the application of crude *M. sexta* hemolymph potently increased reactive oxygen species (ROS) production in isolated tomato protoplasts. The addition of antioxidant NAC (N-acetyl-L-cysteine) antagonized hemolymph-induced ROS generation, indicating that *M. sexta* hemolymph is a ROS inducer in isolated protoplasts. Furthermore, incubating the protoplasts with Calcium (Ca^{2+}) chelator, BAPTA-AM efficiently abolished the hemolymph-induced ROS production, suggesting possible crosstalk between Ca^{2+} and ROS signaling. Interestingly, the application of crude *M. sexta* hemolymph dramatically increased Ca^{2+} in tomato protoplasts. Also, hemolymph-mediated ROS and Ca^{2+} increase was inhibited in the absence of extracellular Ca^{2+}. Taken together, our study demonstrates that "hemolymph" from *Manduca sexta* can directly modulate intracellular ROS and Ca^{2+} production and possibly regulate defenses against insect herbivores by acting as a HAE.

Rhizosphere microbiome and potential of range expansion of exotic invasive guinea grass, *Panicum maximum* in the Lower Rio Grande Valley

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Rhizosphere microorganisms are a key component of healthy soils. They play a key role in plant growth through nutrient cycling and directly influence the functioning of plant communities in both agricultural and natural ecosystems. Rhizobacteria and mycorrhizae are known as plant growth promoting organisms which have been widely used as bio stimulants in agriculture. The goal of this study is to explore the plant soil feedback in an exotic invasive grass, guinea grass (*Pancium maximum*) across different habitat types in the Lower Rio Grande Valley (LRGV). Guinea grass is an invasive bunch grass species native to Africa, introduced to South Texas as a forage grass. In south Texas, guinea grass has escaped from planted areas and has rapidly invaded native prairies, roadsides, old fields, and urban landscapes. To determine the habitat preference and the plant soil feedback we collected soil samples from 5 different locations representing different environmental conditions in the LRGV and analyzed for soil chemistry and physics. We are currently extracting DNA samples from the rhizosphere, rhizoplane, and endosphere of guinea grass and coexisting native plants to determine the differences in the soil microbial communities. Our preliminary results indicate that the plant has some drought tolerance but prefers wetter soils, moderate salt tolerance, prefers alkaline soils, and is shade tolerant which gives it a competitive advantage over native plant species. Results from these analyses will be presented at the conference.

Potential of polyphenol rich purple corn pericarp extract to be used as biopesticide

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Bioactive compounds present in plants have been well studied for their insecticidal properties. They can be potentially used as safe alternative to chemical pesticides due to their non-toxic nature and lower persistence in environment. However, their presence in very low amount in plant makes the extraction process very complex and expensive. This is major drawback to use them on commercial level to control insect pests. We used recently developed simple and cheap method of extraction from purple corn pericarp (byproduct of corn processing industry) and found that purple corn pericarp extract rich in polyphenols has antifeedant properties against tobacco hornworm (*Manduca sexta*), specialist insect pest. Following this study, we also examined whether the extract has similar effects on fall armyworm (*Spodoptera frugiperda*), generalist insect pest feeding on 76 plant families, causing huge economic losses every year. Our results indicate that polyphenol rich purple corn pericarp extracts negatively affected the growth and development of larval and pupal stages of *S. frugiperda*. Taken together, our our findings suggest that purple corn pericarp rich in polyphenols have potential to be used as biopesticide and to be incorporated in Integrated Pest Management strategies.

Role of Trichomes in mediating plant-herbivore interactions in two Cucurbitaceae species

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Plants are constantly under pressure from herbivores that damage them and reduce their fitness. To counter this, they have evolved a set of traits that are broadly classified and structural and chemical defenses. One such defense is trichome. To investigate the role of trichomes (hair like appendages on leaves) as structural and chemical defense in two plant species of Cucurbitaceae family. We identified different morphotypes and density difference for trichomes present on the leaves of bottle gourd (*Lageneria siceraria)* and cucumber (*Cucumis sativa*), also affecting different herbivore incidence and feeding in common garden experiments. We found out that *C. sativa* has significantly lower number of trichomes as compared to *L. siceraria*. We also found that these species also vary in the density of their trichome type- with *L. siceraria* having significantly more glandular trichomes when compared to *C. sativa*. Volatiles produced by these glandular trichomes mediate plant-herbivore interactions by emitting foul-smelling compounds that cause repulsion of herbivores through smell. To further examine whether the differences in volatile production is the reason behind reduced herbivory on *L. siceraria*, we collected volatile organic compounds in glandular trichomes, identified and quantified through GAS-Chromatography and Mass -Spectral libraries. We found the presence of several terpenes such as -ocimene, caryophyllene and humulene in the trichomes of *L.siceraria*, which are common insect-deterrent compounds. Through our studies, we have shown that the trichomes mount an effective defense strategy against chewing herbivores

Evaluation of Palmer Amaranth (*Amaranthus palmeri*) biotype's response to water stressed growing environments

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Palmer amaranth (*Amaranthus palmeri*) is a vigorous competitor against crops due to its rapid growth rates and environment adaptations. In South Texas, producers experience periods ofthere is limited rainfall where in periods where most crops are grown under dryland growing conditions. Limited data is available on studying the effects of water stress on Palmer amaranth growth and development. Therefore, the scope of this study was to evaluate four soil moisture levels (25, 50, 75, and 100% moisture) and the response of three Palmer amaranth biotypes on (1) growth (height, leaf count, and weight), (2) chlorophyll content, and (3) stomatal conductance. The three biotypes used in the study were two from Leland, Mississippi (NEW and OLD) and one collected locally in Kingsville, Texas (KPW). Plants were grown in a sifted sandy loam soil and soil moisture was recorded and maintained daily. Data was collected at 1, 3, 7, 14, and 21 days after treatment (DAT) on plant growth and development. At 21 DAT after data was collected, plants were harvest, weighed, and dried for 8 days and biomass was calculated. Results showed that after 21 DAT, Palmer amaranth plants continued to grow considerably at the 50% soil moisture treatment. In addition, KPW biotype was recorded with the highest rate of stomatal conductance, likely due to it being adapted to south Texas growing conditions. Unfortunately, this study demonstrated that Palmer amaranth will continue to grow under water stressed environments. This information is vital to growers so that they may make cautious weed management decisions during times of drought-like conditions in order to reduce the loss of crop yields.

Poster Abstracts

Animal Science

AS1

Passive transfer of *Steinernema riobrave* entomopathogenic nematodes with potential implications for treatment of cattle fever tick-infested nilgai

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Cattle fever ticks (CFT) Rhipicephalus microplus and R. annulatus are invasive livestock pests that are endemic to Mexico and invasive along the Texas – Mexico border. Acaricide resistance, alternate wildlife hosts, and pathogenic landscape forming weeds present challenges for sustainable eradication of this pest in the U.S. CFT are the vector for bovine babesiosis, a lethal disease causing high mortality particularly in cattle. Efforts to eradicate CFT from the United States have been successful; however, in recent years, there has been an increase in CFT infestations outside of the Permanent Quarantine Zone in Texas. One of the alternate wildlife hosts for CFT in South Texas are nilgai (Boselaphus tragocamelus), an exotic Asian bovid. Nilgai are highly mobile with large home ranges and are implicated in the spread of CFT, through the landscape. Insect and tick killing parasitic round worms (entomopathogenic nematodes) are under evaluation for eradication of CFT on nilgai. Nematodes can be applied as a water-based spray to nilgai. A remotely activated field sprayer was developed for application of nematodes on CFT infested nilgai as they transit fence crossings. Nematodes have the potential to be transferred to tick-infested nilgai as they transit fence crossings and brush against vegetation and soil that has been wetted by the nematode suspension. Using wax moth larvae as a substitute for CFT we found that nematodes could be transferred via wet leaves of Guineagrass and from soil. The nematodes remained viable for up to 3 hours in water droplets of Guineagrass. This research shows the potential for passive transfer of the tick-killing nematodes from foliage and soil at nilgai fence crossings.

AS2

Occurrence of the Inornate Tick, *Amblyomma inornatum* (Ixodidae: Acari) in Texas.

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South Texas has a tick fauna distinct from that in other parts of the US. This includes the inornate tick, *Amblyomma inornatum*. As the name implies it lacks the ornate alabaster markings on the dorsum characteristic of most species of *Amblyomma*. It is also considerably smaller in the adult stage than other species of *Amblyomma*. It is basically a Mexican tick that ranges into the border areas of the US. It is not commonly encountered; less than a dozen specimens detected out of thousands of specimens identified in surveys of ticks on cattle and deer. The adults have also been reported on humans, dogs, and rabbits. We recently found a male adult on a Nilgai antelope. The rarity on these animals suggest these are adventitious hosts. In Mexico they have been reported on both collared and white-lipped peccaries, and these may be the natural hosts. In our screen for associated microbes we sequenced *Rickettsia amblyommatis*, likely an endosymbiont.

Environmental Science and Ecology

ENV1

Characterization of Soil Nematode Community as Influenced by Weedy Plants and Environmental Variables.

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Soil nematodes play a crucial role in ecosystem processes as they link the above and below ground processes such as nutrient cycling and plant growth. They are the most abundant and diverse fauna in the soil and have diverse feeding habits. Fungal feeders, bacteria feeders, and omnivores feed on soil microbes and help in the release of plant available nutrients, while the plant parasitic nematodes if high in number can cause significant damage to plant growth. However, most of the studies on nematodes focus on the agronomic significance of plant parasitic nematodes. Aim of this study is to characterize the soil nematode community Goal of this study was to analyze the influence of south Texas native (*Helianthus annuus, Solanum elaegnifolium)* and exotic invasive weeds (*Pennisetum ciliare, Megathyrsus maximus*) We recorded a total of 21 different genera of nematodes with plant feeders being the most abundant. We also found a temporal shift in the nematode community with higher populations in the fall compared to the summer. The nematode community was also influenced by different weed species with silver leaf nightshade having the highest number of plant parasitic nematodes. However, the soil chemical and physical properties did not have any significant impact on the nematode populations. Our results show that further analysis is necessary assess the threat posed by weeds as well as the plant parasitic nematodes.

ENV2

Exploring Future Potential Expansion of Arid Conditions in the Texas-Mexico Trans-boundary Region

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In this study, the current and future aridity index for the transboundary states of Texas, Tamaulipas, Nuevo Leon, and Coahuila was calculated to view how arid conditions could potentially expand in this already semiarid and subtropical region. Knowing the potential risks of arid land expansion and associated extreme weather events (e.g., extended drought) will help us to initiate informed strategies into coping with these climate changes at many levels. We hypothesize that arid conditions will expand in the transboundary states of Texas, Tamaulipas, and Coahuila in the future. Using the geographic information system (GIS) and bioclimatic variables from the Worldclim data base for three general circulation models (CM3, HadGEM, IPSL) at two emissions scenarios (RCP 4.5, RCP 8.5), we calculated the aridity index for our study area. Lang's aridity index also known as Lang's Rainfall factor is calculated through the formula P/T=AI where P is annual precipitation (bio_12) and T is annual mean temperature (bio_1). Similarly, De Martonne's aridity index formula uses the same variables and is AI=P/(T+10). Using the raster calculator tool, we calculated Lang's and DeMartonne's aridity index for the present and future years of 2050 and 2070 for the three different general circulation models and two different climatic

scenarios. Results show that arid conditions are predicted to expand in the future primarily in the western portion of our study area in the Texas and Coahuila states. Given the outsized role that water (e.g., soil moisture) has on agriculture and ecosystem management (e.g., biodiversity conservation) in the study area, these results can help guide adaptive decision-making within this regional context.

ENV3

Conducting a survey of the destructive invasive Cactus moth, *Cactoblastis cactorum*, in the Lower Rio Grande Valley counties of Hidalgo and Cameron

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Prickly pear cacti, *Opuntia spp*., are native to the Lower Rio Grande Valley of Texas (LRGV) and serve an important role in the local agriculture and economy. *Opuntia* cacti are highly efficient at using water and because of this adaptation, they thrive in the semi-arid climate of the LRGV. Ranchers depend significantly on the *Opuntia* cacti as a source of food for livestock during times of frequent droughts, and using the *Opuntia* cacti as cattle feed is the economically favorable choice in comparison to alternative stock feed. Additionally, the cacti's fruit, known as a tuna is a great nutritious food source for the people of the LRGV. A threat to *Opuntia* cacti is the invasive Cactus moth, *Cactoblastis cactorum*, that is native to South America and has been found in parts of the United States and Mexico and of greatest concern to *Opuntia* in the LRGV, in northeast Texas. Our objective in this project was to monitor if the Cactus moth has expanded into the LRGV, specifically in Hidalgo and Cameron counties. We placed and surveyed 100 moth sticky traps throughout the LRGV, these traps contain a pheromone lure that is meant to attract Cactus moths. Each trap was monitored and replaced during the span of 15 months as a preventive measure to detect the potential introduction of the cactus moth in the LRGV. Our results have demonstrated no indication of the presence of the cactus moth in the LRGV. Since this is a destructive invasive species, we recommend continuing to monitor the area and expanding the monitoring to new places of future risk such as nursery areas.

ENV4

Effect of Cover Crops on Soil Respiration and Organic Matter in South Texas

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Cover crops have demonstrated abilities to increase organic matter levels, suppress weeds, and increase soil microbe activity. The Lower Rio Grande Valley is a major agricultural region in Texas that might benefit from this practice yet cover crop adoption rates remain low. To determine how long it takes to see organic matter and yield increases in a semi-arid region, a 4-year winter cover crop study was conducted on an organic grain sorghum dryland farm in Lyford, Texas. Different cover crop species and seeding rates were used to improve nodulation rates, ground cover, and weed suppression. Plots were double disked to control weed populations and terminate because equipment obstacles prevented us from experimenting with conservation tillage practices. Soil carbon efflux rates were monitored to learn how activity levels respond to soil moisture, soil temperature, organic matter levels, and above and below ground biomass. As expected, microbial activity increased while cover crop biomass and moisture

increased. After 3 years, there was a significant increase in the difference in total organic matter levels compared to fallow ground, but we also experienced two out of three cash crop failures due to low soil moisture levels. Given these results, more time is needed to determine when the ecological benefits will outweigh the economic costs.

ENV5

The Analysis of Herbicidal Management for King Ranch and Kleberg Bluestems on the South Texas Rangelands

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King Ranch (*Bothriochloa ischemum*) and Kleberg bluestem (*Dichanthium annulatum*) were established in rangelands for hay production and erosion control, but now are pressuring out native grasses leaving pastures unproductive. This study evaluated fifteen herbicide treatments, rates, and timings for the long-term management of the invasive grasses. The field trial was conducted in Banquete, TX in 2019. The treatments were arranged in a randomized complete block design with three replications of each treatment and one non treated control (NTC). Bluestem density counts were conducted using a 0.3x0.3 meter square 3 times in each plot bi-weekly. Herbicide applications were made at three timings (A-Spring, B-Summer, and C-Fall). When evaluated at 49 days after application A there was a decrease in bluestem density compared to the NTC of 80.42-41.20% with treatments of glyphosate (3.05 kg ae ha^{-1}), imazapyr (0.34 kg ae ha^{-1}) + glyphosate (1.26 kg ae ha^{-1}), pendimethalin (2.77 kg ai ha^{-1}) + glyphosate (1.26 kg ae ha^{-1}), glyphosate (1.26 kg ae ha^{-1}) followed by glufosinate-ammonium (0.66 kg ae ha^{-1}; 5-7 days later), and indaziflam (43.87 and 73.12 g ai ha^{-1}) + glyphosate (1.26 kg ae ha^{-1}). At the final evaluation, 25 days after application C, treatments of indaziflam (43.87 and 73.12 g ai ha^{-1};A) + glyphosate (1.26 kg ae ha^{-1};A, B, C), pendimethalin (2.77 kg ai ha^{-1};A) + glyphosate (1.26 kg ae ha^{-1};A, B, C), and glyphosate (1.26 kg ae ha^{-1};A, B, C) had 79.40-67.02% decrease in bluestem density. This field study revealed indaziflam and pendimethalin fb glyphosate (1.26 kg ae ha^{-1}) were effective for long-term management. Currently, further analysis will be conducted, and a second year of data is being analyzed to corroborate these results.

ENV6

Using desktop electron microscope to characterize plant trichomes

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Trichomes are the epidermal hairs present on various plant parts including stem and leaves. Trichomes function as one of the major physical defenses possessed by plants against insect herbivores and are primarily categorized as glandular and non-glandular trichomes. Besides deterring herbivory and increasing their time to commence feeding, trichomes can also lead to post-ingestive effects on caterpillar gut. Although functional characterization of trichomes is well advanced, we still lack detailed morphological characterization of trichomes across different plant families and species. Using the "plug and play" Desktop Scanning Electron Microscope (SNE- 4500 Plus Tabletop Scanning Electron Microscope) we show that finer details of trichome morphology including shape, size and precise dimensions can be accurately measured in a short time with minimum sample preparation. We used

species from Cucurbitaceae, Solanaceae and Asteraceae to demonstrate variation in trichome morphology using this device.

ENV7

Changes in dynamic soil properties across a conservation tillage chrono-sequence in the Lower Rio Grande Valley

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Dynamic soil properties (DSPs) are indicators of soil health and function that change over short time-scales due to changes in environmental conditions or management practices. Conservation tillage is a management practice that reduces soil disturbance and has been shown to improve soil health, as measured by DSPs. This study, part of a national NRCS project on DSPs and soil health, investigates the impact of tillage practices in Hidalgo sandy clay loam, a soil series that spans more than 250,000 acres in south Texas. We measure DSPs including organic carbon and nitrogen, aggregation, infiltration, bulk density, respiration, biological community structure and enzymes in unirrigated agricultural fields in Hidalgo and Willacy counties with a history of strip tillage, intermittent strip tillage, and conventional tillage. A minimally disturbed natural site is also included as a reference point. Local lab results will be compared to results from the NRCS Kellogg Soil Survey Laboratory to help standardize laboratory procedures and increase accuracy for future soil tests in our region. We expect fields with reduced soil disturbance to compare favorably to those with higher soil disturbance for all measured DSPs. Improved local DSP testing capacity and better data on conservation tillage's impacts on soil health will support efforts to expand conservation agriculture practices in the Lower Rio Grande Valley.

Entomology

ENT1

Evaluation of fir oil as a potential repellent to Asian citrus psyllid

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The Asian citrus psyllid (ACP, *Diaphorina citri*) is a vector to the phloem-limited *Candidatus* Liberibacter asiaticus (CLas) bacteria. This pathogen is the causal agent of Huanglongbing (HLB), an incurable disease that affects citrus trees leading to their decline and loss in productivity. ACP control is one the recommended methods to reduce the incidence and spread of HLB. ACP populations have remained high in all major citrus producing areas despite several years of using broad-spectrum insecticides. Although pesticides play an important role in ACP management, they are not sustainable and they can negatively affect the environment and the natural enemies. Development of effective integrative tactics to supplement or replace broad spectrum pesticides is needed. In this study the role of essential and essential oil in repelling ACP adults and prevention plant colonization is evaluated. Wax devices infused with 20% fir oil were tested as a potential ACP repellent in laboratory, greenhouse and field studies. Olfactometer studies clearly showed that fir oil was a potential repellent. In field cage studies, fewer ACP

selected potted citrus plants baited with fir containing waxes that non-baited plants. Field studies are ongoing to evaluate the effects on these wax devices in reducing ACP densities and plant colonization.

ENT2

Preliminary examination of the field host range of north American lacebug (*Gargaphia arizonica* Drake & Carvallo*)* and Texas false potato beetle (*Leptinotarsa texana* Schaeffer) as potential biocontrol agents for silverleaf nightshade (*Solanum eleagnifolium* Cav.)

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Silverleaf nightshade (*Solanum eleagnifolium* Cav.) is native to south Texas but it has become a serious agricultural weed in Australia. Silverleaf nightshade (SLN) has proven difficult to control with chemicals, and some significant attention and research is currently focused on biological control options. The main aim of this research is to investigate the suitability of the North American lacebug (*Gargaphia arizonica* Drake & Carvallo) and the Texas false potato beetle (*Leptinotarsa texana* Schaeffer) as a prospective biological control agent for SLN and to determine the susceptibility of Solanaceous crops (including the potato cultivar "Nadine" and the eggplant cultivar "Black Beauty") to herbivory from these insects under field conditions. A field trial was initiated at Edinburg TX using a reverse interspersion approach that included a central row of transplanted SLN surrounded on both sides by blocks of eggplant and potato. Periodic observations (every 2d) were made from March to July to determine feeding potential of these target insects on all plants in the experiment. Throughout the observation period, both nymphs and adults of *G. arizonica* were observed on SLN, whereas at least one individual of *L. texana* was observed across multiple observations both SLN and on the cultivated crops. Although feeding behavior of *L. Texana* was not observed in potato cultivar Nadine, these results may signal the potential of these insects as biological control agents. Additional field trials are planned for spring 2021 and will complement other no-choice caged experiments that examine host-specificity of the lacebug.

ENT3

Development of a Multiplex conventional PCR (McPCR) Test to Identify the European Cherry Fruit Fly (ECFF) *Rhagoletis cerasi* in North America

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The tephritid fruit fly known as the European Cherry fruit Fly (ECFF) *Rhagoletis cerasi* (L.) is a major pest species that attacks cherries and other plants including honey suckle. It is found throughout Europe and western Asia. However, it was first detected in the United States, Niagara County, New York in 2017. Accurate identification is very important to confirm its current distribution, movement, and host use. Morphological identification is difficult when adult specimens are damaged or flies are at immature life stages. In these cases, molecular diagnostic tools are useful for identification. In this study, a Multiplex conventional Polymerase Chain Reaction (McPCR) was developed for the identification of *R. cerasi*. The McPCR diagnostic incorporates primer sets for two DNA targets in a single reaction. One primer set targets nuclear ribosomal internal transcribed spacer 1 (ITS1) DNA sequence region that is specific for *R. cerasi*. The second primer set targets 18s ribosomal RNA (rRNA) gene and is used as an

indicator of sample quality. The assay produced an expected DNA product at 248bp and 180bp. This McPCR assay performed well for the testing of 361 flies. These flies include adults, immatures, and collections from around the world. This assay is straightforward, simple, user friendly and requires the use of simple and affordable equipment and is easy to interpret results.

ENT4

Entomopathogenic fungi as a form of integrated biological control of *Diaphorina citri* under field conditions

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Diaphorina citri is a vector for the causative agent of Huonglongbing (HLB), a devastating disease affecting a variety of citrus. To combat the spread of HLB, biological control methods such as the use of entomopathogenic fungi have been investigated to help reduce *D. citri* populations. *Isaria fumosorosea* strain Ifr 9901 (NoFly™) and *Beauveria bassiana* strain ANT03 (BioCeres®), two of the highest performing mycoinsecticide products under primary and secondary acquisitions studies, and the selected standard *Isaria fumosorosea* strain Apopka-97 (PFR-97™) were investigated for their efficacy against *D. citri* under Lower Rio Grande Valley (LRGV) field conditions. Experimental design for field trials were split into two components: a semi-field trial consisting of three *Murraya paniculata* plants in 40 gallon pots per treatment, and a field trial consisting of one mature tree per treatment. All treatments were enclosed in 12 ft. × 12 ft. × 10 ft. field cages and infested with *D. citri* adults. The plants were then sprayed with treatments and mean *D. citri* census counts of 1 ft.^{2} quadrats were assessed at 7 and 14-day intervals. Semi-field initial results indicated that NoFly™ outperformed other treatments at reducing *D. citri* populations in their respective cages. Field trials overall did not yield significant results due to poor psyllid population establishment on mature trees leading to higher variation. These two studies revealed that the use of three *M. paniculata* per treatment cage were a more efficient model for testing the entomopathogenic fungi under LRGV conditions.

ENT5

Molecular characterization of entomopathogenic fungal field isolates collected from Diaphorina citri in the Lower Rio Grande Valley

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Entomopathogenic fungi are ubiquitous microbes that can induce mortality in arthropods and can also be found as endophytes and in soils. These fungi have been used as a means of biological control for various insect pest species and are currently being examined as an additional facet in an existing integrated pest management strategy for the control of the citrus pest Diaphorina citri, a vector for the fastidious bacterium "*Candidatus* Liberibacter asiaticus", disease-causing agent of citrus greening. In order to examine for the prevalence of entomopathogenic fungi within *D. citri* populations, fungal samples were isolated and characterized. Preliminary morphological analyses identified the isolates as belonging to the

genera *Beauveria*, *Isaria*, and *Lecanicillium*. Molecular analyses were performed using known molecular markers for each of three morphological types. Phylogenetic analyses confirmed the identity of the *Beauveria* isolates as *B. bassiana*, whereas the two *Isaria sp*. isolates were identified as *Isaria javanica* and *Paecilomyces lilacinus.* Sequences from the *Lecanicillium* morphotype did not match *Lecanicillium* database in GenBank®. Rather, sequences for samples initially identified as *Lecanicillium* were more closely related to *Fusarium* species, sharing greater than 99% identity matches with the genus. Primary and secondary mortality bioassays revealed that two of the isolates, ACP18001 and 18002, were capable of inducing mortalities at rates comparable to or greater than Apopka97, indicating that these isolates could prove to be successful in controlling ACP populations in the field.

ENT6

Efficacy of selected entomopathogenic fungi strains and commercial formulations against ACP using spray exposure bioassays

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Protocols were developed to determine infectivity, virulence, and overall mortality of commercialized entomopathogenic strains of fungi against the Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama (Hemiptera: Liviidae). Fourteen strains sourced and isolated from commercial formulations of blastospore and conidiospore suspensions, and three unaltered commercial formulations selected through this screening process were tested against a standardized strain in a controlled laboratory setting. A statistical ranking system was established in which top performing pathogenic strains are selected for further screening and field trials. Potter spray towers were utilized to deliver a range of doses of viable spores per milliliter of isolated strains, and a rate equivalent to $1x10^{12}$ spores per acre of unaltered formulations on adult *D. citri* in spray exposure bioassays. After a 7 day incubation period, mortality rates of the *D. citri* were analyzed against a standard, PFR-97® (*Isaria fumosorosea;* Apopka97 strain). Results provided insight into mortality, rate of infectivity, and susceptibility to infection. Eight strains tested exhibited significantly greater efficacy when compared to the standard. The two unaltered formulations of top performing strains, NoFly WP, BioCeres WP, (PFR-97 WDG as standard) were selected for use in field trial applications against *D. citri*.

ENT7

Packaging and Shipment of Irradiated Mexican Fruit Fly Infested Grapefruits for Canine Training

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The main focus of the United States Department of Agriculture's National Detector Dog Training Center (NDDTC) is to train canines to find prohibited agricultural items entering the country. Detector dogs have the potential to prevent the spread of invasive insects, such as the Mexican Fruit fly,

Anastrepha ludens (Loew) (Diptera: Tephritidae), which are destructive to native ecosystems and local agricultural commerce. Training detector dogs to identify an insect species that is not endemic to a region where the canine training process occurs poses a problem. The USDA-APHIS located in Edinburg, Texas has begun preparing and packaging shipments of infested and irradiated fruit to provide training aids to the NDDTC in Newman, Georgia. Second instar *A. ludens* larvae are collected and inoculated into grapefruit with 20 second instar larvae injected per fruit. Weekly, a total of twelve fruit and 240 larvae are prepared. After 2-3 days, the infested fruit are irradiated at ~140 gray dose rate. The fruit are packaged in specially designed sealed PVC cannisters to contain any escaped larvae from the fruit during transportation. The cardboard shipping box measures 30 in x 22 in x 17 in with an inner styrofoam box and multiple icepacks. Shipments of infested fruit began in July 2020 and are currently ongoing. Overall, the goal of the project is to provide training aids to the detector dogs to ultimately utilize the canines as a tool to aid in survey work and border safeguarding by locating *A. ludens* larvae inside infested fruit.

ENT8

Validation of Rapid Diagnostic Tools Used in the Identification of *Anthonomus grandis grandis* Boheman

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The boll weevil, *Anthonomus grandis grandis*, is a serious pest of commercial cotton causing fruit loss and boll damage. Since first being discovered in South Texas in 1892, this pest has caused billions of dollars in losses to U.S. cotton. An eradication program established in 1978 eliminated the pest from many areas in the U.S. While the boll weevil has been eradicated from many areas in United States and portions of northern Mexico, many areas continue to be actively monitored for recent introductions. Occasional captures in weevil-free areas recovered from trapping programs include closely-related species such as *A. g. thurberieae*, the thurberia weevil. This subspecies feeds mainly on wild cotton, and has a geographic range that includes northwestern Mexico and the southwest U.S. These two weevil subspecies are behaviorally different and cannot be distinguished using morphology alone. The USDA currently uses molecular techniques that rely on sequencing the cytochrome oxidase I (COI) to distinguish boll weevil from those closely-related weevil species. However, while effective at identifying the boll weevil, conventional sequencing can be time consuming. Fast and accurate methods are needed in order to reduce the reaction time to infestations and provide accurate determinations. Single Nucleotide Polymorphism (SNP) assays were developed to provide rapid and accurate identifications for the boll weevil and the thurberia weevil. If found to be effective and robust, these fast assays may reduce costs by improving the efficiency of identifications, important to pest exclusion and eradication activities. The work presented here describes those tests conducted to validate the performance of these SNP assays. We provide the results of these tests across three laboratories and evaluate the performance of the assays.

ENT9

Effect of *Serratia* isolates on *Anastrepha ludens* production.

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Insect mass rearing programs continually face issues with microbial contamination introduced through pests, humans, and diet ingredients. Conditions in the facilities are highly conducive to microbial growth due to the enriched insect diet, high density of insects in rearing cages and the humidity and temperatures required for efficient insect production. Literature indicates that some isolates of the bacteria genus *Serratia* are detrimental to rearing of fruit flies and produce yield losses from 1-20%. This study tested *Serratia* isolates obtained from Mexican Fruit Fly (Loew), *Anastrepha ludens*, (Mexfly) Mass Rearing Facility (PPQ Field Ops, Edinburg, Texas) and S&T Mission Lab Mexfly Containment back-up strains. Trials were conducted from 30 August 2020 to 12 November 2020 on three *Serratia* isolates identified through Acugenix® (Charles River, Newark, DE) using 16s RNA gene sequencing. Isolates include *Serratia* sp., *S. marcescens nematophilia* (red strain), and *S. marcescens*. Total larval weight (g), pupal weight (g), and total pupal production compared to control (water inoculate) were similar for *Serratia* sp. and *S. marcescens.* The *S. marcescens nematophilia* isolate produced a significant reduction in total larval weight (g), pupal weight (g), and total pupal production. Additionally, *Serratia marcescens nematophilia* produced a 15% and 17% reduction in percent adult emergence and percent adult flight ability, respectively.

ENT10

Red Harvester Ant Cover Crop Seed Preferences in South Texas

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Harvester ants (Genus *Pogonomyrmex*) are known to forage seeds up to 25m away from the colony to store in their underground granaries. Though quick, harvester ants can be fastidious in their seed selection for consumption – and will collect as many favored seeds possible. This study aims to determine if local red harvester ants prefer specific varieties of cover crop seeds commonly used in the Lower Rio Grande Valley and if they are deterred by inoculated seeds. If there is a strong preference by the Harvester Ants for a commonly used cover crop seed, it could prove detrimental to farmers that are trying to prevent topsoil erosion. To determine this, red harvester ant colonies around UTRGV with no prior exposure to cover crop seeds were chosen as test subjects. Trials were run with groups of 9 colonies (minimum of 10m apart) for a cafeteria study where several seed varieties were tested, wheatgrass and radish being preferred among the rest. To collect data on which seeds they were taking, we categorized 10 seeds of each variety into Petri dishes placed 2m from the entrance of the colony along a foraging trail. Upon completion of preliminary data, the preferred seeds were tested against inoculated counterparts. I-shaped Petri dishes were split equal parts between inoculated seeds and untreated seeds to see their preference between the two. All Petri dishes were placed within a wire cage to protect the seeds from vertebrates that could interfere with data collection. If deterred by inoculated seeds, they wouldn't touch their most preferred seeds and leave them to grow uninterrupted. Seeds left to grow will protect the ground's topsoil for the next growing season.

ENT11

The Effect of releasing *Tamarixia radiata* on trapping of adult Asian Citrus Psyllids *Diaphorina cit*ri , in the Texas Commercial Citrus Industry

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In the Rio Grande Valley, there is a disease that has been affecting the citrus industry for years, it is called Huanglongbing (HLB), or Citrus greening disease. The problem being addressed in this project is how to prevent the spread of the bacteria that causes HLB, *Candidatus* Liberibacter *asiaticus*. A way to mitigate the spread of HLB is by using the biological control agent *Tamarixia radiata,* a wasp that parasitizes the Asian citrus psyllid (ACP), *Diaphorina citri,* the vector of this bacteria. This method is being used by the Texas Citrus Pest and Disease Management Corporation to reduce ACP populations in commercial citrus groves. This study started by placing sticky traps in citrus groves like commercial, abandoned, or low maintained groves. *T. radiata* were released in select groves called "biocontrol groves", while the remaining groves are referred to as "non-biocontrol groves." Sticky traps were used to capture adult ACP, while eggs and nymphs were counted by hand at the groves. With the data collected we performed a t-test to examine if releasing *T. radiata* are reducing the number of ACP adults trapped. The results showed that there was not a significant difference in the number of adults and egg/ nymphs trapped between the biocontrol and the non-biocontrol groves. This research needs to be further studied to obtain more significant results and to observe why these results are different from those seen in California citrus groves, we hypothesize that this discrepancy is a result of the different temperatures in the Rio Grande Valley when compared to California.

ENT12

Effect of Tree Phenology on ACP Color Morphology and *Candidatus* Liberibacter Acquisition Potential

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The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama (Hemiptera: Liviidae) is an economically significant pest that vectors the bacterial pathogen *Candidatus* Liberibacter asiaticus (CLas), causing Huagnlongbing or citrus greening disease. ACP adults exhibit three abdominal color variants, blue/green, grey/brown, and yellow/orange. These colors are linked to traits in ACP such as flight ability, insecticide resistance, and CLas acquisition. Color morph composition of field collected ACP was evaluated in commercial citrus groves and residential trees in the Lower Rio Grande Valley of Texas to study the seasonality of the three variants, and assess their CLas status. ACP adults were collected from August 2019 to November 2020 and tree phenology that was recorded as presence or absence of young flush shoots. The abdomen color, morphometric data, sex ratio, and CLas status were determined from these adults. Multivariate analysis indicated that ACP color morph was associated with the tree phenology, with yellow/orange color morph the most abundant during flush cycles, while the blue/green color was most prevalent when no new flush shoots are present. Blue/green ACP were significantly larger that the two other color morphs. ACP color morph was not related to their CLas status, as all the percentage of CLas-positive adults were similar for three-color morphs. This study further sheds light on the need of chemical control during flush cycles as the less insecticide resistant yellow/orange ACP are more abundant during these periods.

ENT13

Improving the Diagnostic Capacity for the Members from the Genus *Anastrepha*

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Anastrepha is the largest genus of fruit flies within Latin America and the Caribbean, containing more than 300 species, many of which are undescribed. They include some of the most economically important pest species affecting agricultural regions like the Lower Rio Grande Valley, Tx. While some molecular methods have been developed, only a few DNA regions have been investigated, and these require DNA sequencing to complete an identification. For some pests the effectiveness of current molecular methods are limited by inadequate sampling or poor resolution among closely-related species. A collaborative project was initiated to increase the capabilities for identification of *Anastrepha* fruit flies by 1) the development of fast and accurate molecular tools for the identification of morphologically difficult fruit flies of regulatory concern; and 2) enhancement of morphological diagnostic tools for the adults and larvae of pest species. To date, existing collections as well as collections from areas of high diversity have provided the study with specimens representing over 250 species. Work has resulted in COI barcode sequences from 275 (approx.) species - many of these species diagnosable using this marker (Moore et al., *In*-preparation). Of these, 70 represent undescribed species to *Anastrepha* to date. This information is being used to update interactive identification keys and confirm morphological characters for pests. The team has also sequenced ~550 individuals/~170 spp using Next Generation Sequencing methods (Table 1). These methods have revealed loci that show promise for discriminating species that include those of economic concern (Fig. 1). Other loci, such as those within the ITS1 (Sutton et al., 2015), are being used to develop RT-PCR assays. We provide an update to this project.

Pathology

PATH1

Investigation of a Severe Virus-like Disease Outbreak in a Texas Lower Rio Grande Valley Okra (*Abelmoschus esculentus* (L.) Moench) Field

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A severe virus-like disease outbreak in a 37.1-ac. okra field in San Juan, Hidalgo Co. was investigated during spring/summer 2020. The observed symptoms of bright yellow mosaic and bleaching of interveinal areas were reminiscent of begomoviral symptoms. From ~28% recorded late-July 2020, disease incidence progressed to 100% by mid-August 2020 and high whitefly infestations were observed during the period. To identify the viruses involved and investigate possible role of cotton in the disease epidemiology, the field was divided into five quadrants and 20 plants were sampled systematically per quadrant. Total DNA was isolated from each sample and subjected to rolling cycle amplification, which

served as template for PCR with universal primers targeting begomoviruses. The obtained ~550 bp DNA band will be cloned and sequenced. Forty virus-free cotton seedlings (3-4 leaf stage) were randomly placed within the symptomatic okra field and allowed whitefly inoculation access for 2 weeks, following which the plants were maintained in insect-proof cages, monitored weekly for virus-like symptoms, and sampled/tested monthly for begomoviruses as described. The preliminary results confirmed the presence of begomovirus DNA fragments in symptomatic okra plants and their specific identities will be confirmed by sequencing. None of the field-exposed cotton seedlings have developed symptoms and they all tested negative for begomoviruses by PCR one month after field exposure. Studies are ongoing to complete PCR tests for the remaining 95 okra samples and to continue monitoring/periodic testing of the cotton seedlings to assess the potential role of this breeding host of whiteflies as an alternative host to begomoviruses. The results will inform recommendations to growers on best practices for managing virus-like diseases in okra and other vegetable fields.

PATH2

Bdellovibrio bacteriovorus, a Potential Biocontrol Agent

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Bdellovibrio bacteriovorus is an obligate predatory proteobacterium. They feed on their prey for nutrition, growth and reproduction leading to prey death. *Bdellovibrio bacteriovorous* are predators of pathogenic Gram-negative bacteria and can prey on multi-drug resistance Enterobacteriaceae such as *Salmonella* and *Klebsiella* which have been associated with agricultural pre- and post-harvest contamination. *Salmonella,* a foodborne pathogen which could pass through the food processing chain is estimated to cause illness in 1 in 10 persons and about 33 million lives are lost to its foodborne diseases annually. *Bdellovibrio* is a potential safe biocontrol agent and can be well exploited for agricultural purpose. Whole-genome comparative analysis of five *Bdellovibrio bacteriovorus* strains revealed a total of 131 associated predatory genes. Of this, about 49 genes code for enzymes which could be involved in prey death. The predatory potential of *Bdellovibrio bacteriovorus* and its rich lytic enzymes contributes to its potential use as a biocontrol agent for agricultural purpose.

PATH3

Methods for small greenhouse management of *Citrus* to propagate Candidatus *Liberibacter asiaticus* via a *Diaphorina citri* rearing cycle

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With decades of devastation to commercial Citrus worldwide, the Citrus Greening disease (HLB) has prompted substantial effort towards culturing the fastidious bacteria, Candidatus *Liberibacter asiaticus* (CLas). So parasitic is CLas, it dies too quickly without hosts or biofilm, hindering Koch's postulates and even definitive taxonomy as Liberibacter. Without the *in vitro* arsenal, studying and

countering requires controlled microenvironments, particularly rearing infected Citrus and the insect vector, *Diaphorina citri* Kumayama [Hemiptera: Psyllidae] (ACP). Leveraging research under Daniel Flores (for ACP and *Tamarixia radiata*, USDA APHIS), Greg McCollum (for ACP and CLas, USDA ARS), and Kinnie Laughlin (for ACP and CLas, TAMU AgriLife), NCSU with USDA APHIS maintains CLas in ACP and Citrus in quarantine (BSL2) greenhouses in a quarantined region of South Texas to produce age-discriminated cohorts of ACP in separate +CLas and –CLas enclosures. Our 9+ week cycle focuses on Transmission, Preparation, Infestation, and Recuperation, with Assays for CLas monitoring and experimentation. Transmission transfers +CLas ACP to flushing –CLas plants with increased opportunities for uptake by removing offspring and mature leaves while including +CLas grafts or nearby +CLas plants for free-range feeding. Preparation readies host plants for the requisite flushing through pruning and micronutrients. Infestation synchronizes and maximizes ACP reproduction through simultaneous introduction, environment, and nutrient management. Recuperation promotes host plant vegetative growth free of pests, including ACP. Assay checks CLas titers in plants and insects through controlled sampling, extraction, and detection. Our benchmark is 400 CLas-carrying ACP in the collection month per cohort. We recently achieved an 83% +CLas population, sufficient for experiments exposing targeted antimicrobial proteins and phagemids for testing conjugation, localization, and efficacy.

PATH4

Field Deployable Loop-Mediated Isothermal Amplification (LAMP) Assay for the Detection of '*Candidatus* Liberibacter asiaticus' in Citrus

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Huanglongbing (HLB, citrus greening disease) is a destructive disease that undermines the production of citrus around the world. The presumed causal organism, '*Candidatus* Liberibacter asiaticus' (*C*Las) is a non-culturable, fastidious and phloem limited α-proteobacterium. Pre-symptomatic field-based *C*Las detection techniques would empower the growers to implement better HLB management strategies for mitigating the spread of the disease. The current study focused on the development of a field deployable Loop Mediated Isothermal Amplification (LAMP) method for *C*Las detection. We designed primers for the LAMP assay based on the *C*Las five copy gene, *nrdB*, encoding the β-subunit of ribonucleotide reductase (RNR), an enzyme critical for multiplication of bacteria. The LAMP assay was optimized for *C*Las detection from leaf, bark and root samples. The estimated detection limit of the LAMP assay was 2.2×10^3 copies of target molecule. The observed sensitivity of the LAMP assay using field samples was slightly lower than qPCR-based assay as the LAMP assay produced inconsistent results for the samples with cycle threshold (Ct) greater than 30 (i.e. > ~10^3 copies of target molecule). However, the LAMP assay has 98.1% accuracy for samples with qPCR Ct values below 30. Suitability of plant DNA extracts prepared by various DNA extraction methods for LAMP assay is being evaluated.

PATH5

Sunn hemp (*Crotalaria juncea*) as a reservoir of fungal pathogens affecting economically important crop *Sorghum bicolor*

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Cover crops are a boon to sustainable farming for their numerous benefits to soil health. However, there are instances where cover crops pose as a "green bridge" or living host offering pathogens an escape from the highly competitive environment of decomposing plant residue to infect subsequent cash crop. Sunn hemp (*Crotolaria junceae*), an emerging cover crop has relatively little research covering pathogens population within the lower Rio Grande Valley of Texas, an important agricultural region. The objective of this study was to survey fungal associations of sunn hemp along with characterizing the role of sunn hemp as a potential 'green bridge' for pathogens that affect *Sorghum bicolor.* A total of 46 fungal isolates were collected from diseased sunn hemp leaves from Lyford Texas and Agro-ecology garden UTRGV. 18 promising isolates were experimented for cross inoculation studies at UTRGV research facility on healthy sunn hemp and sorghum to determine if these pathogens could host on both sunn hemp and sorghum. Pathogenicity assays showed 10 isolates could produce infection in both sunn hemp and sorghum within 9 days, morphologically identified as, *Fusarium (3), Cylindrocarpon (1),Bipolaris (1), Alternaria (1), and Stemphylium (1).* 7 isolates produced mild lesions only in sunn hemp. Further, use of molecular markers to identify the isolates to species is underway. Field surveys also revealed sunn hemp plants with distinct white mycelia on leaves and green stems, consistent with powdery mildew disease. Microscopic examination of conidia identified the pathogen as a *Golovinomyces* species, and pathogenicity assays confirmed pathogenicity on sunn hemp. These results suggest that sunn hemp may serve as a green bridge capable of hosting and spreading pathogens to agronomically important crops.

PATH6

Evaluation of field deployable leaf sensor for HLB screening in Citrus

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Huanglongbing (HLB) is the most devastating disease that compromises the tree health leading to yield reduction that subsequently results in significant loss to the citrus industry around the world. Currently, quantitative polymerase chain reaction (qPCR) is the most widely used technique for HLB diagnosis in citrus. This method includes visual inspection of tree canopy for HLB symptoms followed by qPCR using DNA fraction extracted from symptomatic leaves in the laboratory. Since HLB symptom development is a slow process to appear in the infected trees, this approach lacks the capability of HLB diagnosis at pre-symptomatic stage of the disease. Recent scientific reports showed that asymptomatic trees significantly contribute to the spread of the disease. The current study evaluated the efficacy of a portable spectrometer equipped with G-Fresnel lens for HLB screening in the asymptomatic mature (12 years old) and young (1 year old) Valencia Sweet Orange trees under field conditions. HLB induces anatomical, physiological, and ultrastructural changes in the internal components of the leaf including vascular system even at pre-symptomatic stage of infection. This device utilizes the principle of diffuse reflectance spectroscopy that can monitor the internal structural changes in the leaf and is equipped with cloud-based data analysis capability. We will present the device optimization and comparative HLB diagnostic data between the sensor and qPCR.