Professional Leave Report Cover Sheet

Name: Jacob Wenger

Department: Plant Science

College: Jordan College of Ag Sciences & Technology

Leave taken: ◉ Sabbatical ○ Difference in Pay ○ Professional Leave without Pay

Time Period: ○ Fall

◉ Spring 2024

○ Academic Year

○ Other

Your report will be sent to your Dean for your PAF and to the Library Archives.

Sabbatical Leave Final Report

Sabbatical Recipient: Dr. Jacob Wenger, Associate Professor, Department of Plant Science, Jordan College of Agricultural Sciences and Technology

Period of Sabbatical: Spring Semester 2024

Background Information:

The Fresno State Plant Science Department maintains an academic insect collection composed primarily of arthropods collected over the past 60 years by undergraduate and graduate students in the Plant Science Department. Collection specimens have been primarily drawn from student collections produced in PLANT 162 (formerly PLTH 103) Economic Entomology, but also contain insects from graduate student and faculty projects. The Fresno State insect collection serves as a primary teaching resource to demonstrate the diversity and morphology of agricultural insects in California and is utilized in both PLANT 162 and PLANT 163 (Integrated Pest Management).

Despite the insect collection's importance as an educational tool, it was not been well maintained by the entomology faculty over the course of its existence. Prior to my sabbatical work, the collection was not taxonomically organized, had not been cataloged, and had never been checked for substandard specimens. This resulted in a collection that was disorganized and contained many broken and substandard specimens which were not useful for teaching. Indeed, prior to my sabbatical I had no clear idea how many orders, families, or specimens were held in the collection, or the whereabouts of specific insects within the cabinets. This level of disorganization made the collection extremely difficult to use, requiring significant searching of drawers to find even the most basic specimens. Similarly, the collection was uncatalogued, making it difficult to assess the collection's relative completeness or make directed efforts toward improving the sample diversity.

Summary of Sabbatical Work:

I received sabbatical leave during the spring 2024 semester to remediate the insect collection and bring it in line with standard curatorial norms. Below I have provided a report describing my sabbatical work and current status of the Fresno State agricultural arthropod collection. I have divided the report into three sections based on the sabbatical objectives I listed in my original sabbatical application (Appx. 1):

Objective 1: Meet with museum curators at the Bohart Insect Museum at UC, Davis and/or the UC, Riverside Entomological Museum to exchange discipline specific knowledge to improve my knowledge of insect collection curation.

In February 2024 I reached out to the Dr. Douglas Yanega, Senior Museum Scientist at the UC Riverside Entomology Research Museum, and Dr. Jason Bond, Professor of Insect Systematics at UC Davis. A museum tour was scheduled for UC, Riverside for early March. No tour was set for UC, Davis due to previous travel engagements and schedule conflicts.

On March 11th, I met with a team of museum specialists at the UC Riverside Entomology Research Museum which included: Dr. Yanega, Dr. Serguei V. Tiapitsyn (Museum Director), and Dr. Adriean Mayor (Museum Curator ret., Great Smoky Mountains National Park). During

the visit I received a private tour of the facility, as well as an overview of the museum's protocols for adding specimens to their collection including: sampling, storage, identification and cataloging of specimens. This was highly instructive, as it included a description of an alcohol hydration approach that I had not heard of before, which I included in my PLANT 162 course during the Fall 2024 semester. Perhaps the most instructive information I gained was an understanding of the different categories of insect collection held by the museum including: research collections, teaching collections, and certification collections. These types of collections serve distinct scientific roles within the entomological community, and consequently require varying levels of preservation quality and specificity regarding when and where the specimens were collected. Research collections require the greatest level of data curation, as they are primarily used by scientists to understand the historical distribution of insects, as well as long-term trends in insect morphology, host plant association, and evolution. To extrapolate this information collection insects must be identified to the genus level, include fine detail information regarding collection location/date data (ideally GPS coordinates), and a description of the plant they were collected on. Alternatively, teaching collections focus on having high quality specimens of species representing the breadth of insect diversity. These specimens do not require detailed collection location or date information, but must be confidently identified to species.

Through this conversation it became clear that the Fresno State insect collection could not serve as a research collection, as students do not collect insect location, date, or identification data at the level of specificity required for research. Considering this, Dr. Yanega and I decided that the collection would be best organized as an agricultural teaching collection. This style of collection emphasizes the inclusion of arthropods associated with agricultural crops, so that students may learn to identify common pests and beneficial insects by sight. Teaching collections do not require online catalogs, as they are not used by external researchers. Consequently, while the Fresno State collection would require some form of electronic catalog that described the collection contents and their location, it would not need to be remotely accessibly, as is now the standard for research collections. Dr. Yanega then gave a tour of their teaching collection and provided instructions on how to best organize the Fresno State collection. In addition to this tour, Dr. Yanega offered to donate some of the UC, Riverside teaching collection to Fresno State, as the collection was no longer in use, and the faculty who had maintained the collection had retired. After the visit concluded I submitted a formal request to receive insects from the teaching collection, which was approved by the UC, Riverside Museum Committee on March 27th (Appx. 2). I collected the specimens from the UC, Riverside teaching collection on April 30th. The detailed description of the specimens received is included in the description activities for objective 3.

Objective 2: Reorganize and catalog the Fresno State University plant science insect collection with the primary goal of placing the collection in taxonomic order, developing crop/ecological service specific cabinets, and establishing a digital catalog.

Work on objective 2 began in January of 2024, and constituted the bulk of the sabbatical work for this project. Initial work included inspecting each of the 60+ insect drawers in the

collection and cataloging the orders contained within each. Initial cataloging found the collection to be extremely disorganized and poorly maintained. Almost all drawers containing damaged specimens from a diversity of orders (Figure 1). Drawers were not labeled, so it was impossible to know their contents without physically removing drawers from the cabinets one at a time (Figure 2). After initial cataloging was complete, I set about placing the insect specimens in phylogenetic order (from most primitive to most derived). During this process I grouped specimens by order, removed damaged specimens, fumigated drawers to destroy carpet beetles, verified all specimen identifications to the family level, and then organized the families by evolutionary order. Once organization was complete, I set about cataloging the collection. This process involved recording all of the orders and families present in the collection, the number of specimens found within each order, and the way they were preserved. Once damaged specimens were removed, the Fresno state collection was found to contain 5,641 arthropod specimens spread across 35 distinct orders and >260 families. Specimens were grouped first by taxonomic order followed by family. Agriculturally important species (pest and beneficial) were further organized and labeled to the species level for quick identification (Figure 3). Catalog data was recorded in an Excel File (Appx. 3), as this was a cost effective and simple approach that meets the needs for a teaching collection. Once the collection was fully organized, all orders, families and drawers were labelled to allow for rapid location within the collection (Figure 4).

In addition to reorganizing the main insect collection, I established and/or reorganized specialty insect drawers that focused on a particular crop, or learning objective. This work included 'crop drawers' containing insects associated with single crops including: grapes, cotton, cole crops, households, alfalfa and citrus. Diversity drawers demonstrate the diversity of insect morphology including drawers focused on the diversity of antenna, wing, and leg modifications. Finally, I set up activity specific drawers containing specimens required for the PLANT 162 labs and the FFA Ag Pest Identification contest. These drawers made teaching PLANT 162 in the fall 2024 semester significantly easier, and allowed the students better access to quality specimens.

Objective 3: Collect and preserve insects to expand the existing collection, so that it may better reflect contemporary insects associated with California agriculture.

Over the course of the spring 2024 semester, I made regular efforts to collect insects from agricultural commodities in the San Joaquin Valley, including: almonds, pistachio, alfalfa, citrus, tomatoes, cole crops, and small grains. This work included regular trips to local farms to collect specimens by hand. While a large number of specimens were collected, relatively few were added to the collection. This was primarily due to the relatively cool spring semester which slowed insect development and emergence, as well as the fact that over the past 60 years, most of the common species have been already collected by students.

Despite this low capture rate, a large number of specimens were added to the collection, thanks to a donation from the UC, Riverside Entomology Research Museum (as described in my summary of Objective 1). In total, the Fresno State agricultural entomology collection received 483 specimens from UC, Riverside (Appx. 4). These specimens included 137 species, spread across 8 orders and 53 families. Of the 137 species added, 91 were pest species that were not

previously held in the Fresno State collection. This represents a nearly 10% increase in the total size of the Fresno State Collection, as well as a significant expansion in the diversity and quality of pest and beneficial insect specimens within the collection. These specimens have already been put to use in the classroom for PLANT 162, and will be used as part of the FFA Ag Pest Identification contest during the 2025 Fresno State FFA Field Day and Competition this upcoming April.

Benefits as a Faculty Member:

Through this sabbatical I significantly expanded my understanding of insect collection curation and the mechanics of museum curation. I put these skills to use to improve the Fresno State agricultural arthropod teaching collection. The organized and expanded collection has already proven to be tremendously helpful for teaching my PLANT 162 economic entomology course, and will likely yield benefits for PLANT 163 Integrated Pest Management, and PLANT 170T Bee Biology & Apiculture. Additionally, I have established new connections with the museum faculty/staff at UC, Riverside which will be useful in further collection work, and potentially for future research.

Benefits to the University:

The chief benefit the university has received from this sabbatical is an improved and expanded agricultural arthropod collection in the Plant Science Department. Improvement of the collection allows for the greater integration of insect specimens in the classroom allowing for more hands-on observation and education. Additionally, as the collection is now cataloged it has become possible to strategically plan collecting efforts to produce a more comprehensive insect collection that better serves the needs of our students moving forward.

Additionally, the university will benefit thanks to my improved knowledge of insect taxonomy, preservation and taxonomy. As I am the only entomology faculty in the Jordan College, and arguably at Fresno State University as a whole, I am required to maintain a broad base of insect knowledge including their identification, ecology, economic impact, collection, and management. Through this sabbatical I have increased my understanding of insect collection, preservation and taxonomy significantly, allowing me to better serve the students of our department and College.

Figure 1: Image of a typical Fresno State Agricultural Arthropod Collection drawer prior to the sabbatical work. Note that insects are inefficiently packed within boxes, are mixed by order and family, and have not organizational labels

Figure 2: Image of the fronts of the insect specimen drawers in the Fresno State Agricultural Arthropod Collection prior to the sabbatical work. Note that the drawers are of different design and size (light brown boxes are Cornell style, dark brown are California Academy of science style), and lack consistent labels to help locate specimens.

Figure 3: Image of a Fresno State Agricultural Arthropod Collection drawer after sabbatical work. Note that insects all belong to the same order, are efficiently packed, are clearly labelled, and organized by family and species. Pest species are separated and labeled individually.

Figure 4: Image of the fronts of the insect specimen drawers in the Fresno State Agricultural Arthropod Collection after the sabbatical work. Note all drawers are standardized (Cornell drawers) and are clearly labeled with the orders and families they contain.

Sabbatical Leave Proposal for Spring 2024

Dr. Jacob Wenger
Associate Professor
Department of Plant Science
Jordan College of Agricultural Sciences and Technology

Background information:

The Fresno State Plant Science Department maintains an academic insect collection composed of approximately 6,500 insect specimens spread across 50 standard entomological cabinets. The collections are primarily composed of specimens collected by undergraduate students as part of the insect collections made in PLANT 162 Economic Entomology. Consequently, the collection is representative of agriculturally important species of the San Joaquin Valley. The Fresno State insect collection serves as a primary teaching resource to demonstrate the diversity and morphology of agricultural insects in California and is utilized in both PLANT 162 and PLANT 163 (Integrated Pest Management).

Despite the insect collection's importance as an educational tool, it has never been taxonomically organized, cataloged, or had substandard specimens removed. Consequently, the collection is disorganized, uncatalogued, and contains many broken and substandard specimens. At the collection's current level of organization it is impossible to know which species are contained within the collection, let alone their physical location, without laboriously searching each of the cabinets. Without this information it is difficult to assess the collection's relative completeness or make directed efforts toward improving the sample diversity. Further, the collection's lack of organization has made it difficult to use as a teaching resource and inappropriate for collection-based research.

Remediating the insect collection to bring it into alignment with standard curatorial norms (*e.g.* taxonomic organization, digital cataloging, and removal of damaged specimens) would significantly improve its utility as a teaching and research tool. However, this would require a significant investment of time and energy on my part, as I am an agricultural entomologist and molecular ecologist and have not received formal training in collection curation. I am requesting one semester of sabbatical support to expand my knowledge on collection curation and apply this information to reorganize and catalog the Plant Science Department's insect collection.

Objectives and Proposed Work:

The goal of the proposed sabbatical is to remediate the plant science department's insect collection according to collection curation norms. To accomplish this goal I propose three objectives:

Objective 1: Meet with museum curators at the Bohart Insect Museum at UC, Davis and/or the UC, Riverside Entomological Museum to exchange discipline specific knowledge to improve my knowledge of insect collection curation.

Objective 2: Reorganize and catalog the Fresno State University plant science insect collection with the primary goal of placing the collection in taxonomic order, developing crop/ecological service specific cabinets, and establishing a digital catalog.

Objective 3: Collect and preserve insects to expand the existing collection, so that it may better reflect contemporary insects associated with California agriculture.

Preliminary Arrangements and Contacts:

Objective 1: Though I have not officially requested a tour of either the Bohart or UC, Riverside Entomology Museums I am confident in my ability to coordinate a visit as I have strong ties with both UC, Davis and UC, Riverside. I have previously communicated directly with the director of the Bohart Museum of Entomology (Dr. Lynn Kimsey) and have spoken with several members of the entomology faculty. The Bohart Museum of Entomology has reopened to visits as of Fall 2022, provided visitors coordinate with Museum staff. Similarly, I have strong collaborative ties with two UC, Riverside entomologists (Dr. Houston Wilson, and Dr. Sandipa Gautam) which include grant proposal submissions, student co-advising, and co-authoring peer-reviewed publications. I am confident that these connections can facilitate introductions to museum curators and coordinating educational tours.

Museum background information:

*The Bohart Museum of Entomology***:** Established in 1946 the Bohart Museum houses the seventh largest collection of insects in North America and the largest collection in California, at just over seven million specimens. This collection focuses on the insects of California's diverse landscapes including samples from the coast, Central Valley, mountains, and deserts. The museum also contains specimens from around the world, with Australasia and Indonesia being particularly well represented. The Bohart Museum is heavily involved in outreach and research. They are well known for their entomological education and has established itself as a leader in developing hands-on educational programs, travelling insect displays, curriculum for amateur insect collectors, and coordinating the California Insect Survey. Considering their focus on education the Bohart Museum serves as an excellent model for how to organize and structure the plant science department's educational insect collection. Of particular interest is their recent work in developing traveling boxes of specimens for outreach events, and themed boxes oriented around ecological services provided by insects as well as the economic impact of invertebrates on humans. Finally, the Bohart Museum is currently in the process of digitizing their insect collection. This offers a unique opportunity to expand my knowledge of this process prior to developing an electronic catalog of the Fresno State Collection.

The UC, Riverside Entomology Research Museum contains the second oldest insect collection in the University of California system, dating back to 1924. Their collection houses over four million specimens, primarily drawn from southern California, Arizona, Mexico and South America. The museum is well known for their unique collection of immature insects, which focuses on the preservation of specimens in all life stages (including eggs, larvae, nymphs, and pupae). The UCR museum is well known for their outward facing service orientation including their involvement in several outreach activities, frequent hosting of visiting scholars, and consultation with agriculturalists. The museum was moved to a new building in 1994 which incorporated several cutting-edge curatorial facilities, such that the museum is arguably the most technologically advanced in the state of California. Spending time at this museum would provide excellent insight into the management non-adult insects, which is a specialized field in and of itself. Further, it will provide an opportunity to see a more modern approach to sample curation.

Objective 2: Thanks to a generous gift from the Wonderful Company in the early 2010's the Plant Science department is currently has all the equipment required for housing a modest educational insect collection including: standard Cornell insect drawers, four locking steel insect cabinets, a vial cabinet, and organizational inserts. Beyond this, the university library and plant science department are well stocked with insect taxonomy texts which will aid with specimen identification. Cataloging simply involves recording the location and specimen data of the insects in the collection in an organized fashion. This

does not require specialized programs of equipment. Consequently, no significant arrangements must be made to proceed with the work aside from dedicating time to inspecting and recording all specimens. In the past I have made efforts to organize a subset of the collection, and found that the simple act of cataloging even a single order of insects can take 2-3 weeks. I estimate that reorganizing and cataloging the entire collection will take no fewer that 14-16 weeks of dedicated time.

Objective 3: Little to no preliminary arrangements are required to achieve objective 3 which focuses on the collection of additional agricultural insect specimens to expand our current representation of contemporary insect pests of California agriculture. The Plant Science Department is also well stocked with entomological collecting and preservation supplies including: kill jars, nets, aspirators, traps, Berlese Funnels, pins, spreading boards, vials, preservation fluids, and pointing supplies. Additionally, I have access to a wide variety of agricultural fields through the university (the University Agricultural Laboratory) and my collaborators at the University of California Kearney Agricultural Research and Extension Center (Parlier), USDA San Joaquin Agricultural Science Center (Parlier), UC Lindcove Citrus Research and Extension Center (Lindcove), and Bayer Crop Science Research Farm (Kerman). Collectively these sites produce several dozen common Central Valley Crops, and as research facilities they actively encourage the growth of pest species allowing for easier collection of sample specimens.

Timeline of Activities:

Objective 1:

January/February 2024: Meet with Entomology Museum curators to expand understanding of insect collection curation, organization and digitization.

Objective 2:

February – April 2024: Reorganization of existing insect collection

- February – March: Inspection of existing drawers and development of preliminary catalog. Remove damaged specimens. For each specimen record:
    - Identification information: Order, Family, Species
    - Collection information: date and location of collection and collector
    - Physical location within collection
- April/May: Reallocate insect specimens around entomology drawers in taxonomic order
    - Update catalog records to reflect current location of specimens
    - Fumigate boxes and treat for dermestid infestations

Objective 3:

January – May 2024: Collection of agriculturally relevant insects to augment existing insect collections. Specific crops and insect specimens dependent upon development stage and insect phenology.

Benefits as a Faculty Member:

As is outlined above, this sabbatical will benefit me directly by expanding my knowledge of entomology to include skills necessary to organizing and maintaining an academic insect collection. Meeting with professional entomology museum curators will greatly expand my understanding of how insect collections are preserved, organized and cataloged. This new knowledge will be directly reflected in the increased quality of the plant science department's insect collection which will allow for greater use of insect specimens in the course work, as well as improving my command over the subject in lecture and laboratory. Further, I will benefit from cultivating stronger ties with entomologists in the University of California system which may allow for future collaboration.

Benefits to the University:

The most obvious benefit to the university of this proposed sabbatical is the improvement of the existing insect collection in the Plant Science Department. Improvement of the collection will provide a number of benefits. First, having an organized and well-tended insect collection will allow for the greater integration of insect specimens in the classroom allowing for more hands-on observation and education. Second, having a cataloged insect collection will allow the collection to be used for research purposes. In the past I have had to decline invitations to include our specimens in regional diversity studies do to the poor state of the collection. However, with better organization and quality assurance the collection could be used as a resource for Fresno State students and external scholars. Third, through cataloging it will become possible to strategically plan collecting efforts to produce a more comprehensive insect collection that better serves the needs of our students.

Less obviously, the university will also benefit from my improved knowledge of insect taxonomy, preservation and taxonomy. Currently I am the only entomology faculty in the Jordan College, and arguably at Fresno State University as a whole. In this capacity I am required to maintain a broad base of insect knowledge including their identification, ecology, economic impact, collection, and management. As the primary resource of insect information on campus it is imperative that I continue to expand my knowledge of the field of entomology to better serve the students of our department and College. Through this sabbatical I will improve my knowledge of the insects common to the San Joaquin Valley as I will spend significant time identifying and organizing them. This will improve my ability to identify common insects of the region, as well as their interrelations, allowing me to improve my performance in the lecture hall, laboratory, field and broader community through my involvement with various agricultural industries and agencies.

Prior Performance on Leave:

Not applicable, no previous leave

FRESNO STATE

Jacob Wenger <jawenger@mail.fresnostate.edu>

UCR ag ent material

12 messages

Douglas Yanega <dyanega@gmail.com> Wed, Mar 27, 2024 at 10:10 AM
To: Jacob Wenger <jawenger@csufresno.edu>

Hi, Jake.

Good news! Our Museum Committee, in consultation with the professors presently using the teaching collections, have approved your request to extract excess Ag Ent teaching specimens to add to the CSUF collection.

The stated conditions in your cover letter are, of course, considered essential and binding; we will additionally keep a record of what is taken, for our own records.

I'm not sure when the best time is for you to do this, my schedule for Mondays in April is filling up fast.

Peace,

--
Doug Yanega Dept. of Entomology Entomology Research Museum
Univ. of California, Riverside, CA 92521-0314 skype: dyanega
phone: (951) 827-4315 (disclaimer: opinions are mine, not UCR's)
https://faculty.ucr.edu/~heraty/yanega.html
"There are some enterprises in which a careful disorderliness
is the true method" - Herman Melville, Moby Dick, Chap. 82

Jacob Wenger <jawenger@csufresno.edu> Wed, Mar 27, 2024 at 3:19 PM
To: Douglas Yanega <dyanega@gmail.com>

Hello Doug,

Excellent news, thank you for coordinating with the UCR Museum Committee.

I'll get back to you tomorrow with a tentative date. It will likely be toward the end of April, as I have to prep for and attend the Pacific Branch meeting.

Thanks again,
Jake
[Quoted text hidden]
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FRESNO STATE
Jordan College of Agricultural Sciences and Technology

Douglas Yanega <dyanega@gmail.com> Wed, Mar 27, 2024 at 3:50 PM

Order	Family	Cabinet #	Drawer #	Order	Family I	# Specimens
Protura		1	1	1	1	1
Zygentoma	Lepismatidae	1	1	2	1	6
Odonata	Aeshnidae	1	1	3	1	22
Odonata	Libellulidae	1	2	3	2	21
Odonata	Coenagrionidae	1	2	3	3	37
Ephemeroptera		1	3	4	1	6
Orthoptera	Tridactylidae	1	3	5	1	5
Orthoptera	Tetrigidae	1	3	5	2	5
Orthoptera	Acrididae	1	3	5	3	57
Orthoptera	Tetigonidae	1	3	5	4	25
Orthoptera	Gryllotalpidae	1	4	5	5	1
Orthoptera	Rhaphidophoridae	1	4	5	6	1
Orthoptera	Gryllacrididae	1	4	5	7	3
Orthoptera	Gryllidae	1	4	5	8	42
Orthoptera	Stenopalmatidae	1	4	5	9	17
Phasmatodea	Phasmatidae	1	4	6	1	4
Phasmatodea	Timematidae	1	4	6	2	1
Mantodea	Mantidae	1	5	7	1	66
Blattodea	Ectoblattidae	1	6	8	1	14
Blattodea	Blaberidae	1	6	8	2	2
Blattodea	Blattidae	1	6	8	3	46
Blattodea	Isoptera	1	6	8	4	18
dermaptera	Anisolabididae	1	6	9	1	22
Dermaptera	Forficulidae	1	6	9	2	34
Embioptera		1	7	10		2
Plecoptera	Perlidae	1	7	11	1	9
Plecoptera	Chloroperidae	1	7	11	2	3
Plecoptera	Taeniopterygidae	1	7	11	3	9
Psocoptera		1	7	12		2
Phthiraptera		1	7	13		4
Thysanoptera		1	7	14	1	1
Hemiptera	corixidae	1	7	15	1	17
Hemiptera	notonectidae	1	7	15	2	28
Hemiptera	belostamatidae	1	7	15	3	44
Hemiptera	Nancoridae	1	7	15	3.5	12
Hemiptera	Gelastocoridae	1	7	15	4	40
Hemiptera	Gerridae	1	7	15	5	29
Hemiptera	Cimicidae	1	7	15	6	1
Hemiptera	Anthocoridae	1	7	15	8	16
Hemiptera	Miridae	1	7	15	9	66
Hemiptera	Reduvidae'	1	8	15	10	62
Hemiptera	Nabidae	1	8	15	11	38

Hemiptera	Berytidae	1	8	15	12	2
Hemiptera	Pyrrhocorridae	1	8	15	13	2
Hemiptera	Largidae	1	8	15	14	6
Hemiptera	Geocorridae	1	8	15	15	17
Hemiptera	Lygaeidae	1	8	15	16	25
Hemiptera	Coreidae	1	8	15	17	66
Hemiptera	Rhopalidae	1	8	15	18	65
Hemiptera	Alydidae	1	9	15	19	1
Hemiptera	Cydnidae	1	9	15	20	10
Hemiptera	Cormelaenidae	1	9	15	21	3
Hemiptera	Scutellaridae	1	9	15	22	4
Hemiptera	Pentatomidae	1	9	15	23	184
Hemiptera	Cicadidae	1	9	15	24	15
Hemiptera	Membracidae	1	10	15	25	48
Hemiptera	Cercopidae	1	10	15	26	7
Hemiptera	Cicadelidae	1	10	15	27	69
Hemiptera	Acanaloridae	1	10	15	28	1
Hemiptera	Fulgoridae	1	10	15	29	1
Hemiptera	Delphacidae	1	10	15	30	4
Hemiptera	Dictylophoridae	1	10	15	31	1
Hemiptera	Psyllidae	1	10	15	32	24
Hemiptera	Aphididae	1	10	15	33	12
Hemiptera	Margarodidae	1	10	15	34	4
Hemiptera	Diaspididae	1	10	15	35	28
Hemiptera	Pseudococcidae	1	10	15	36	6
Hemiptera	Coccidae	1	11	15	37	34
Neuroptera	Polystoechotidae	1	11	16	1	1
Neuroptera	Chrysopidae	1	11	16	2	66
Neuroptera	Hemorobidae	1	11	16	3	5
Neuroptera	Myrmeleontidae	1	11	16	4	11
Neuroptera	Ascalaphidae	1	11	16	5	3
Megaloptera	Corydalidae	1	11	17		4
Raphidioptera		1	11	18		4
Mecoptera	Bittacidae	1	11	19	1	4
Mecoptera	Panopidae	1	11	19	2	1
Neuroptera	Mantispidae	1	11		6	1
Coleoptera	gyrinidae	1	12	20	1	4
Coleoptera	Dytiscidae	1	12	20	1.5	1
Coleoptera	cicindelidae	1	12	20	2	13
Coleoptera	carabidae	1	12	20	3	148
Coleoptera	buprestidae	1	12	20	4	13
Coleoptera	heteroceridae	1	12	20	5	2
Coleoptera	cantharidae	1	12	20	6	19

Coleoptera	lycidae	1	12	20	7	21
Coleoptera	elateridae	1	12	20	8	21
Coleoptera	phenogodidae	1	12	20	8.5	1
Coleoptera	lampyridae	1	12	20	9	10
Coleoptera	histeridae	1	12	20	10	1
Coleoptera	hydrophilidae	1	12	20	11	12
Coleoptera	staphilinidae	2	13	20	12	13
Coleoptera	silphidae	2	13	20	13	17
Coleoptera	trogidae	2	13	20	14	1
Coleoptera	lucanidae	2	13	20	15	5
Coleoptera	scarabidae	2	13	20	16	159
Coleoptera	dermestidae	2	13	20	17	9
Coleoptera	anobiinae	2	13	20	18	2
Coleoptera	Coccinellidae	2	13	20	19	154
Coleoptera	Curculionidae	2	14	20	20	88
Coleoptera	cerambycidae	2	14	20	21	69
Coleoptera	chrysomelidae	2	14	20	22	130
Coleoptera	nitidulidae	2	15	20	23	19
Coleoptera	Silvanidae	2	15	20	24	3
Coleoptera	ostomatidae	2	15	20	25	3
Coleoptera	cleridae	2	15	20	26	2
Coleoptera	Melyridae	2	15	20	27	22
Coleoptera	pedilidae	2	15	20	28	2
Coleoptera	anthicidae	2	15	20	29	4
Coleoptera	melioidae	2	15	20	30	9
Coleoptera	Mycetophagidae	2	15	20	31	1
Coleoptera	tenebrionidae	2	15	20	32	95
Coleoptera	Zopheridae	2	15	20	33	12
Strepsiptera		2	15	25	1	1
Trichoptera	Odontoceridae	2	17	21	1	6
Trichoptera	Psychomyiidae	2	17	21	2	1
Trichoptera	Limnephilidae	2	17	21	3	2
Trichoptera	Philopotamidae	2	17	21	4	19
Lepidoptera	tineidae	2	17	22	1	11
Lepidoptera	attevidae	2	17	22	2	2
Lepidoptera	lyonetidae	2	17	22	3	4
Lepidoptera	yponomeutidae	2	17	22	4	
Lepidoptera	Pterophoridae	2	17	22	5	2
Lepidoptera	tortricidae	2	17	22	6	33
Lepidoptera	oecophoridae	2	17	22	7	5
Lepidoptera	Depressaridae	2	17	22	8	
Lepidoptera	Gelechidae	2	17	22	9	3
Lepidoptera	zygaenidae	2	17	22	10	4

Lepidoptera	cossidae	2	17	22	11	2
Lepidoptera	papilionidae	2	17	22	12	20
Lepidoptera	hesperidae	2	18	22	13	32
Lepidoptera	pieridae	2	18	22	14	30
Lepidoptera	lycaenidae	2	18	22	15	11
Lepidoptera	nymphalidae	2	19	22	16	46
Lepidoptera	Pyralidae	2	20	22	17	21
Lepidoptera	geometridae	2	20	22	18	6
Lepidoptera	Notodontidae	2	20	22	18.5	2
Lepidoptera	Arctiidae	2	20	22	19	49
Lepidoptera	erebidae	2	20	22	20	6
Lepidoptera	noctuidae	2	20	22	21	252
Lepidoptera	lasiocampidae	2	22	22	22	6
Lepidoptera	saturnidae	2	22	22	23	4
Lepidoptera	sphingidae	2	22	22	24	36
Diptera	Tipulidae	2	24	23	1	17
Diptera	Psychodidae	2	24	23	2	2
Diptera	Culicidae	2	24	23	3	10
Diptera	Chironomidae	2	24	23	4	7
Diptera	Bibionidae	2	24	23	5	1
Diptera	Cecidomyidae	2	24	23	6	8
Diptera	Stratiomyidae	2	24	23	7	6
Diptera	Tabanidae	2	24	23	8	14
Diptera	Asilidae	2	24	23	9	21
Diptera	Bombilidae	2	24	23	10	5
Diptera	Dolichopodidae	2	24	23	11	11
Diptera	Phoridae	2	24	23	12	14
Diptera	Pipunculidae	2	24	23	13	1
Diptera	Syrphidae	2	24	23	14	71
Diptera	Ulididae	3	25	23	15	15
Diptera	Phyrgotidae	3	25	23	16	1
Diptera	Tephritidae	3	25	23	17	3
Diptera	Sepsidae	3	25	23	18	5
Diptera	Sciomyzidae	3	25	23	19	5
Diptera	Lauxaniidae	3	25	23	20	9
Diptera	Heliomyzidae	3	25	23	21	5
Diptera	Chloropidae	3	25	23	22	5
Diptera	Anthomyzidae	3	25	23	23	16
Diptera	Agromyzidae	3	25	23	24	95
Diptera	Drosophilidae	3	25	23	25	3
Diptera	Scathophagidae	3	25	23	26	26
Diptera	anthomyiidae	3	25	23	27	6
Diptera	muscidae	3	25	23	28	24

Diptera	Tachinidae	3	25	23	29	19
Diptera	Caliphoridae	3	26	23	30	43
Diptera	Sarcophagidae	3	26	23	31	25
Hymenoptera	Tenthrinidae	3	27	24	1	31
Hymenoptera	cimbicidae	3	27	24	2	4
Hymenoptera	orussidae	3	27	24	3	2
Hymenoptera	siricidae	3	27	24	4	9
Hymenoptera	Braconidae	3	27	24	5	95
Hymenoptera	Ichneumonidae	3	27	24	6	121
Hymenoptera	Euchartidae	3	27	24	7	22
Hymenoptera	Chalcididae	3	27	24	8	37
Hymenoptera	Torymidae	3	28	24	9	4
Hymenoptera	Pteromalidae	3	28	24	10	8
Hymenoptera	Eurytomidae	3	28	24	11	7
Hymenoptera	Ibaliidae	3	28	24	12	4
Hymenoptera	Figitidae	3	28	24	13	3
Hymenoptera	Cynipidae	3	28	24	14	100
Hymenoptera	Evaniidae	3	28	24	15	6
Hymenoptera	Gasteruptiidae	3	28	24	16	4
Hymenoptera	Proctotrupidae	3	28	24	17	6
Hymenoptera	Ceraphronidae	3	28	24	18	3
Hymenoptera	Diapriidae	3	28	24	19	3
Hymenoptera	Scelionidae	3	28	24	20	28
Hymenoptera	Platygastridae	3	28	24	21	2
Hymenoptera	Chrysidae	3	28	24	22	23
Hymenoptera	Bethylidae	3	28	24	23	28
Hymenoptera	Tiphiidae	3	28	24	24	3
Hymenoptera	Mutilidae	3	28	24	25	41
Hymenoptera	Vespidae	3	29	24	34	206
Hymenoptera	Scoliidae	3	30	24	26	25
Hymenoptera	Mymaridae	3	30	24	27	4
Hymenoptera	Trichogrammatidae	3	30	24	28	3
Hymenoptera	Aphelinidae	3	30	24	29	2
Hymenoptera	Eulophidae	3	30	24	30	17
Hymenoptera	Encyrtidae	3	30	24	30.5	14
Hymenoptera	Sapygidae	3	30	24	31	2
Hymenoptera	Formicidae	3	30	24	32	80
Hymenoptera	Pompilidae	3	30	24	33	37
Hymenoptera	Ampulicidae	3	30	24	35	1
Hymenoptera	Sphecidae	3	30	24	36	103
Hymenoptera	Colletidae	3	31	24	37	1
Hymenoptera	Halticidae	3	31	24	38	28
Hymenoptera	Megachilidae	3	31	24	39	20

Hymenoptera	Crabonidae	3	31	24	40	43
Hymenoptera	Apidae	3	31	24	41	111

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Common Name	Scientific name	Order	Family
Brown banded cockroach	Supella longipalpa	Blattodea	Ectobiidae
Branch and Twig Borer	Melalgus confertus	Coleoptera	Bostrichidae
Powderpost beetle	Lyctus spp.	Coleoptera	Bostrichidae
Flower buprestid	Acmaeodera spp.	Coleoptera	Buprestidae
Buprestidae spp.	Buprestidae spp.	Coleoptera	Buprestidae
Nautical borer	Xylotrechus nauticus	Coleoptera	Cerambycidae
Cowpea weevil	Callosobruchus maculatus	Coleoptera	Chrysomelidae
Pale striped flea beetle	Systena blanda	Coleoptera	Chrysomelidae
Cereal leaf beetle	Oulema melanopus	Coleoptera	Chrysomelidae
3-lined potato beetle	Lema spp.	Coleoptera	Chrysomelidae
Colorado potato beetle	Leptinotarsa decemliata	Coleoptera	Chrysomelidae
Northern corn rootworm	Diabrotica longicornus	Coleoptera	Chrysomelidae
Western corn rootworm	Diabrotica virgifera	Coleoptera	Chrysomelidae
Blue milkweed beetle	Chrysochus cobaltinus	Coleoptera	Chrysomelidae
Grape bud beetle	Glyptoscellus squamulata	Coleoptera	Chrysomelidae
Parenthesis lady beetle	Hippodamia parenthesis	Coleoptera	Coccinellidae
Mexican bean beetle	Epilachna varivestis	Coleoptera	Coccinellidae
Mealybug destroyer	Cryptolaemus montrouzieri	Coleoptera	Coccinellidae
Stethorcus spp.	Stethorcus spp.	Coleoptera	Coccinellidae
Fuller's Rose Beetle	Naupactus godmanni	Coleoptera	Curculionidae
Black vine weevil	Otiorhynchus sulcatas	Coleoptera	Curculionidae
Plum curculio	Conotrachelus nenuphar	Coleoptera	Curculionidae
Granary weevil	Sitophilus granarius	Coleoptera	Curculionidae
Puncture vine weevil	Microlarinus lareynii	Coleoptera	Curculionidae
Rice weevil	Sitophilus oryzaa	Coleoptera	Curculionidae
Maize weevil	Sitophilus zeamis	Coleoptera	Curculionidae
Potato stalk borer	Trichobaris trinotata	Coleoptera	Curculionidae
Clover leaf beetle	Hypera punctata	Coleoptera	Curculionidae
Cotton boll weevil	Anthonomus grandis	Coleoptera	Curculionidae
Curculionidae	N/A	Coleoptera	Curculionidae
Hide beetle	Dermestes maculata	Coleoptera	Dermestidae
Larder beetle	Dermestes lardarius	Coleoptera	Dermestidae
Blister Beetle spp.	N/A	Coleoptera	Meloidae
Eupompha spp.	Eupompha spp.	Coleoptera	Meloidae
Epicauta spp.	Epicauta spp.	Coleoptera	Meloidae
Cigarette beetle	Lasioderma serrica	Coleoptera	Ptinidae
Drugstore beetle	Stegobium paniceum	Coleoptera	Ptinidae
Spider beetle	N/A	Coleoptera	Ptinidae
Japanese beetle	Popillis japonica	Coleoptera	Scarabaeidae
Grapevine pelidnota	Pelidnota punctata	Coleoptera	Scarabaeidae
Carrot beetle	Bothynus gibbosus	Coleoptera	Scarabaeidae
Pine borer	Ips. Spp.	Coleoptera	Scolytidae

Red turpentine beetle	Dendroctonus valens	Coleoptera	Scolytidae
Monterey Cypress Pine Beetle	Eudociminus mannerheimii	Coleoptera	Scolytidae
Flat grain beetle	Cryptolestes pusillus	Coleoptera	Silvanidae
Sawtooth grain beetle	Oryzaephilus surinamensis	Coleoptera	Silvanidae
Confused flour beetle	Tribolium confusum	Coleoptera	Tenebrionidae
Serpentine leafminer	Liriomyza trifolii	Diptera	Agromyzidae
Agromyzid spp.	N/A	Diptera	Agromyzidae
Vegetable leafminer	Liriomyza munda	Diptera	Agromyzidae
Root Maggots	Various spp.	Diptera	Agromyzidae
Cabbage Maggot	Delia radicum	Diptera	Anthomyiidae
Biting midge (punkie)	N/A	Diptera	Ceratopogonidae
Anopheles spp.	N/A	Diptera	Culicidae
Aedes spp.	N/A	Diptera	Culicidae
Culex spp.	N/A	Diptera	Culicidae
Face fly	Musca autumnalis	Diptera	Muscidae
Little house fly	Fannia canicularis	Diptera	Muscidae
Stable fly	Stomoxys calcitrans	Diptera	Muscidae
Horn fly	Haematobia irritans	Diptera	Muscidae
Black fly	Simullidae spp.	Diptera	Simullidae
Deer fly	Chrysops spp.	Diptera	Tabanidae
White faced fly	Voria ruralis	Diptera	Tachinidae
Wanut husk fly	Rhagoletis completa	Diptera	Tephritidae
Apple maggot fly	Rhagoletis pomonella	Diptera	Tephritidae
Mediterranean fruit fly	Ceratitis capitata	Diptera	Tephritidae
Melon fly	Bactrocera cucurbitae	Diptera	Tephritidae
Oriental fruit fly	Bactrocera dorsalis	Diptera	Tephritidae
Woolly whitefly	Aleurothrixus floccus	Hemiptera	Alerodidae
Spittle bug	Cercopidae spp.	Hemiptera	Cercopidae
Variegated leafhopper	Erythroneura variabilis	Hemiptera	Cicadellidae
Potato leafhopper	Empoasca abrupta	Hemiptera	Cicadellidae
Aster leafhopper	Macrosteles facifrons	Hemiptera	Cicadellidae
Clover leafhopper	Aceratagallia sanguinolenta	Hemiptera	Cicadellidae
Beet leafhopper	Circulifer tenellus	Hemiptera	Cicadellidae
Blue green sharpshooter	Nekolla circellata	Hemiptera	Cicadellidae
European fruit lecanium	Lecanium corni	Hemiptera	Coccidae
Black scale	Saissisetia oleae	Hemiptera	Coccidae
Oystershell scale	Lepidosaphes ulmi	Hemiptera	Diaspididae
Membracidae spp.	Membracidae spp.	Hemiptera	Membracidae
Buffalo treehopper	Strictocephala bubalus	Hemiptera	Membracidae
Black grass bug	Irbisia spp.	Hemiptera	Miridae
Leptocoris spp.	Leptocoris spp.	Hemiptera	Miridae
Potato/Tomato psyllid	Paratrioza cockerelli	Hemiptera	Psyliidae
Psyllidae	Psyllid Spp.	Hemiptera	Psyliidae

Apanteles spp.	Apanteles spp.	Hymenoptera	Braconidae
Copidosoma truncatellum	Copidosoma truncatellum	Hymenoptera	Encyrtidae
Diglyphus spp.	Diglyphus spp.	Hymenoptera	Eulophidae
Carpenter ants	Camponotus	Hymenoptera	Formicidae
Southern fire ants	Solenopsis xyloni	Hymenoptera	Formicidae
California velvety ants	Liometopum apiculatum	Hymenoptera	Formicidae
Pavement ant	Tetramorium caespitum	Hymenoptera	Formicidae
Harvester ant	Pogonomyrmex spp.	Hymenoptera	Formicidae
Bathyplectes curculionis	Bathyplectes curculionis	Hymenoptera	Ichneumonidae
Hyposoter exiguae	Hyposoter exiguae	Hymenoptera	Ichneumonidae
Grape leafroller parasite	N/A	Hymenoptera	N/A
Domestic silk moth	Bombyx mori	Lepidoptera	Bombycidae
Cotton leaf perforator	Bucculatrix thurberiella	Lepidoptera	Bucculatricidae
European corn borer	Ostrinia nubilalis	Lepidoptera	Crambidae
Celery leaf tier	Udea rubigalis	Lepidoptera	Crambidae
Sugar cane borer	Diatraea saccharalis	Lepidoptera	Crambidae
Beet webworm	Loxostege sticticalis	Lepidoptera	Crambidae
Genista broom worm (sod webv	Uresiphita reversalis	Lepidoptera	Crambidae
Spongy Moth	Lymantria dispar	Lepidoptera	Erebidae
Salt marsh caterpillar	Estigmene acrea	Lepidoptera	Erebidae
Pale tiger moth	Halisidota tessellaris	Lepidoptera	Erebidae
Angoumois grain moth	Sitotroga cerealella	Lepidoptera	Gelechiidae
Cotton stem moth	Platyedra subcinerea	Lepidoptera	Gelechiidae
Pink bollworm	Pectinophora gossypiella	Lepidoptera	Gelechiidae
Peach twig borer	Anarisia lineatella	Lepidoptera	Gelechiidae
Tomato pinworm	Keiferia lycopersicella	Lepidoptera	Gelechiidae
Omnivorous looper	Sabulodes caberata	Lepidoptera	Geometridae
Loopers (assorted) Spp.	N/A	Lepidoptera	Geometridae
Forest tent caterpillar	Malacosoma disstria	Lepidoptera	Lasiocampidae
Variegated cutworm	Peridroma saucia	Lepidoptera	Noctuidae
Cabbage looper	Trichoplusia ni	Lepidoptera	Noctuidae
Tobacco budworm	Heliothis virescens	Lepidoptera	Noctuidae
Corn earworm	Helicoverpa zea	Lepidoptera	Noctuidae
Beet armyworm	Spodoptera exigua	Lepidoptera	Noctuidae
Alfalfa looper	Autographa californica	Lepidoptera	Noctuidae
Armyworm	Pseudaletia unipuncta	Lepidoptera	Noctuidae
Celery looper	Autographa falcifera	Lepidoptera	Noctuidae
Red humped caterpillar	Scizura conciana	Lepidoptera	Notodontidae
California oak moth	Phyrgonidia californica	Lepidoptera	Notodontidae
Artichoke plume moth	Platyptilia carduidatylus	Lepidoptera	Pterophoridae
Plume moth spp.	N/A	Lepidoptera	Pterophoridae
Mediterranean flour moth	Anagasta kuehniella	Lepidoptera	Pyralidae
Navel orangeworm	Amyelois transitella	Lepidoptera	Pyralidae

Indian meal moth	Plodia interpunctella	Lepidoptera	Pyralidae
Tobacco hornworm	Manduca sexta	Lepidoptera	Sphingidae
Western avocado leafroller	Amorbia essigana	Lepidoptera	Tortricidae
Omnivorous leafroller	Platynota stultana	Lepidoptera	Tortricidae
Codling moth	Cydia pomonella	Lepidoptera	Tortricidae
Fruit tree leafroller	Archips argyrospila	Lepidoptera	Tortricidae
Slant faced grasshoppper	N/A	Orthoptera	Acrididae
Gray garden slug	Deroceras reticulatum	Stylommatophora	Agriolemacidae
Tawny garden slug	Limacus flavus	Stylommatophora	Limacidae

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Sabbatical Leave Proposal for Spring 2024

Dr. Jacob Wenger
Associate Professor
Department of Plant Science
Jordan College of Agricultural Sciences and Technology

Background information:

The Fresno State Plant Science Department maintains an academic insect collection composed of approximately 6,500 insect specimens spread across 50 standard entomological cabinets. The collections are primarily composed of specimens collected by undergraduate students as part of the insect collections made in PLANT 162 Economic Entomology. Consequently, the collection is representative of agriculturally important species of the San Joaquin Valley. The Fresno State insect collection serves as a primary teaching resource to demonstrate the diversity and morphology of agricultural insects in California and is utilized in both PLANT 162 and PLANT 163 (Integrated Pest Management).

Despite the insect collection's importance as an educational tool, it has never been taxonomically organized, cataloged, or had substandard specimens removed. Consequently, the collection is disorganized, uncatalogued, and contains many broken and substandard specimens. At the collection's current level of organization it is impossible to know which species are contained within the collection, let alone their physical location, without laboriously searching each of the cabinets. Without this information it is difficult to assess the collection's relative completeness or make directed efforts toward improving the sample diversity. Further, the collection's lack of organization has made it difficult to use as a teaching resource and inappropriate for collection-based research.

Remediating the insect collection to bring it into alignment with standard curatorial norms (*e.g.* taxonomic organization, digital cataloging, and removal of damaged specimens) would significantly improve its utility as a teaching and research tool. However, this would require a significant investment of time and energy on my part, as I am an agricultural entomologist and molecular ecologist and have not received formal training in collection curation. I am requesting one semester of sabbatical support to expand my knowledge on collection curation and apply this information to reorganize and catalog the Plant Science Department's insect collection.

Objectives and Proposed Work:

The goal of the proposed sabbatical is to remediate the plant science department's insect collection according to collection curation norms. To accomplish this goal I propose three objectives:

Objective 1: Meet with museum curators at the Bohart Insect Museum at UC, Davis and/or the UC, Riverside Entomological Museum to exchange discipline specific knowledge to improve my knowledge of insect collection curation.

Objective 2: Reorganize and catalog the Fresno State University plant science insect collection with the primary goal of placing the collection in taxonomic order, developing crop/ecological service specific cabinets, and establishing a digital catalog.

Objective 3: Collect and preserve insects to expand the existing collection, so that it may better reflect contemporary insects associated with California agriculture.

Preliminary Arrangements and Contacts:

Objective 1: Though I have not officially requested a tour of either the Bohart or UC, Riverside Entomology Museums I am confident in my ability to coordinate a visit as I have strong ties with both UC, Davis and UC, Riverside. I have previously communicated directly with the director of the Bohart Museum of Entomology (Dr. Lynn Kimsey) and have spoken with several members of the entomology faculty. The Bohart Museum of Entomology has reopened to visits as of Fall 2022, provided visitors coordinate with Museum staff. Similarly, I have strong collaborative ties with two UC, Riverside entomologists (Dr. Houston Wilson, and Dr. Sandipa Gautam) which include grant proposal submissions, student co-advising, and co-authoring peer-reviewed publications. I am confident that these connections can facilitate introductions to museum curators and coordinating educational tours.

Museum background information:

*The Bohart Museum of Entomology***:** Established in 1946 the Bohart Museum houses the seventh largest collection of insects in North America and the largest collection in California, at just over seven million specimens. This collection focuses on the insects of California's diverse landscapes including samples from the coast, Central Valley, mountains, and deserts. The museum also contains specimens from around the world, with Australasia and Indonesia being particularly well represented. The Bohart Museum is heavily involved in outreach and research. They are well known for their entomological education and has established itself as a leader in developing hands-on educational programs, travelling insect displays, curriculum for amateur insect collectors, and coordinating the California Insect Survey. Considering their focus on education the Bohart Museum serves as an excellent model for how to organize and structure the plant science department's educational insect collection. Of particular interest is their recent work in developing traveling boxes of specimens for outreach events, and themed boxes oriented around ecological services provided by insects as well as the economic impact of invertebrates on humans. Finally, the Bohart Museum is currently in the process of digitizing their insect collection. This offers a unique opportunity to expand my knowledge of this process prior to developing an electronic catalog of the Fresno State Collection.

The UC, Riverside Entomology Research Museum contains the second oldest insect collection in the University of California system, dating back to 1924. Their collection houses over four million specimens, primarily drawn from southern California, Arizona, Mexico and South America. The museum is well known for their unique collection of immature insects, which focuses on the preservation of specimens in all life stages (including eggs, larvae, nymphs, and pupae). The UCR museum is well known for their outward facing service orientation including their involvement in several outreach activities, frequent hosting of visiting scholars, and consultation with agriculturalists. The museum was moved to a new building in 1994 which incorporated several cutting-edge curatorial facilities, such that the museum is arguably the most technologically advanced in the state of California. Spending time at this museum would provide excellent insight into the management non-adult insects, which is a specialized field in and of itself. Further, it will provide an opportunity to see a more modern approach to sample curation.

Objective 2: Thanks to a generous gift from the Wonderful Company in the early 2010's the Plant Science department is currently has all the equipment required for housing a modest educational insect collection including: standard Cornell insect drawers, four locking steel insect cabinets, a vial cabinet, and organizational inserts. Beyond this, the university library and plant science department are well stocked with insect taxonomy texts which will aid with specimen identification. Cataloging simply involves recording the location and specimen data of the insects in the collection in an organized fashion. This

does not require specialized programs of equipment. Consequently, no significant arrangements must be made to proceed with the work aside from dedicating time to inspecting and recording all specimens. In the past I have made efforts to organize a subset of the collection, and found that the simple act of cataloging even a single order of insects can take 2-3 weeks. I estimate that reorganizing and cataloging the entire collection will take no fewer that 14-16 weeks of dedicated time.

Objective 3: Little to no preliminary arrangements are required to achieve objective 3 which focuses on the collection of additional agricultural insect specimens to expand our current representation of contemporary insect pests of California agriculture. The Plant Science Department is also well stocked with entomological collecting and preservation supplies including: kill jars, nets, aspirators, traps, Berlese Funnels, pins, spreading boards, vials, preservation fluids, and pointing supplies. Additionally, I have access to a wide variety of agricultural fields through the university (the University Agricultural Laboratory) and my collaborators at the University of California Kearney Agricultural Research and Extension Center (Parlier), USDA San Joaquin Agricultural Science Center (Parlier), UC Lindcove Citrus Research and Extension Center (Lindcove), and Bayer Crop Science Research Farm (Kerman). Collectively these sites produce several dozen common Central Valley Crops, and as research facilities they actively encourage the growth of pest species allowing for easier collection of sample specimens.

Timeline of Activities:

Objective 1:

January/February 2024: Meet with Entomology Museum curators to expand understanding of insect collection curation, organization and digitization.

Objective 2:

February – April 2024: Reorganization of existing insect collection

- February – March: Inspection of existing drawers and development of preliminary catalog. Remove damaged specimens. For each specimen record:
    - Identification information: Order, Family, Species
    - Collection information: date and location of collection and collector
    - Physical location within collection
- April/May: Reallocate insect specimens around entomology drawers in taxonomic order
    - Update catalog records to reflect current location of specimens
    - Fumigate boxes and treat for dermestid infestations

Objective 3:

January – May 2024: Collection of agriculturally relevant insects to augment existing insect collections. Specific crops and insect specimens dependent upon development stage and insect phenology.

Benefits as a Faculty Member:

As is outlined above, this sabbatical will benefit me directly by expanding my knowledge of entomology to include skills necessary to organizing and maintaining an academic insect collection. Meeting with professional entomology museum curators will greatly expand my understanding of how insect collections are preserved, organized and cataloged. This new knowledge will be directly reflected in the increased quality of the plant science department's insect collection which will allow for greater use of insect specimens in the course work, as well as improving my command over the subject in lecture and laboratory. Further, I will benefit from cultivating stronger ties with entomologists in the University of California system which may allow for future collaboration.

Benefits to the University:

The most obvious benefit to the university of this proposed sabbatical is the improvement of the existing insect collection in the Plant Science Department. Improvement of the collection will provide a number of benefits. First, having an organized and well-tended insect collection will allow for the greater integration of insect specimens in the classroom allowing for more hands-on observation and education. Second, having a cataloged insect collection will allow the collection to be used for research purposes. In the past I have had to decline invitations to include our specimens in regional diversity studies do to the poor state of the collection. However, with better organization and quality assurance the collection could be used as a resource for Fresno State students and external scholars. Third, through cataloging it will become possible to strategically plan collecting efforts to produce a more comprehensive insect collection that better serves the needs of our students.

Less obviously, the university will also benefit from my improved knowledge of insect taxonomy, preservation and taxonomy. Currently I am the only entomology faculty in the Jordan College, and arguably at Fresno State University as a whole. In this capacity I am required to maintain a broad base of insect knowledge including their identification, ecology, economic impact, collection, and management. As the primary resource of insect information on campus it is imperative that I continue to expand my knowledge of the field of entomology to better serve the students of our department and College. Through this sabbatical I will improve my knowledge of the insects common to the San Joaquin Valley as I will spend significant time identifying and organizing them. This will improve my ability to identify common insects of the region, as well as their interrelations, allowing me to improve my performance in the lecture hall, laboratory, field and broader community through my involvement with various agricultural industries and agencies.

Prior Performance on Leave:

Not applicable, no previous leave