3rd INTERNATIONAL CONFERENCE *of the* SUBTERRANEAN TERMITE:

Dr. Minoru Tamashiro Memorial Symposium

SEPTEMBER 18 - 19, 2023

CAMPUS CENTER BALLROOM 3
UNIVERSITY OF HAWAIʻI AT MĀNOA, HONOLULU, HI

Organizing Committee: Dr. Jia-Wei Tay (U.H.), Dr. Reina Tong (U.H.), Dr. Sang-Bin Lee (U.F.)

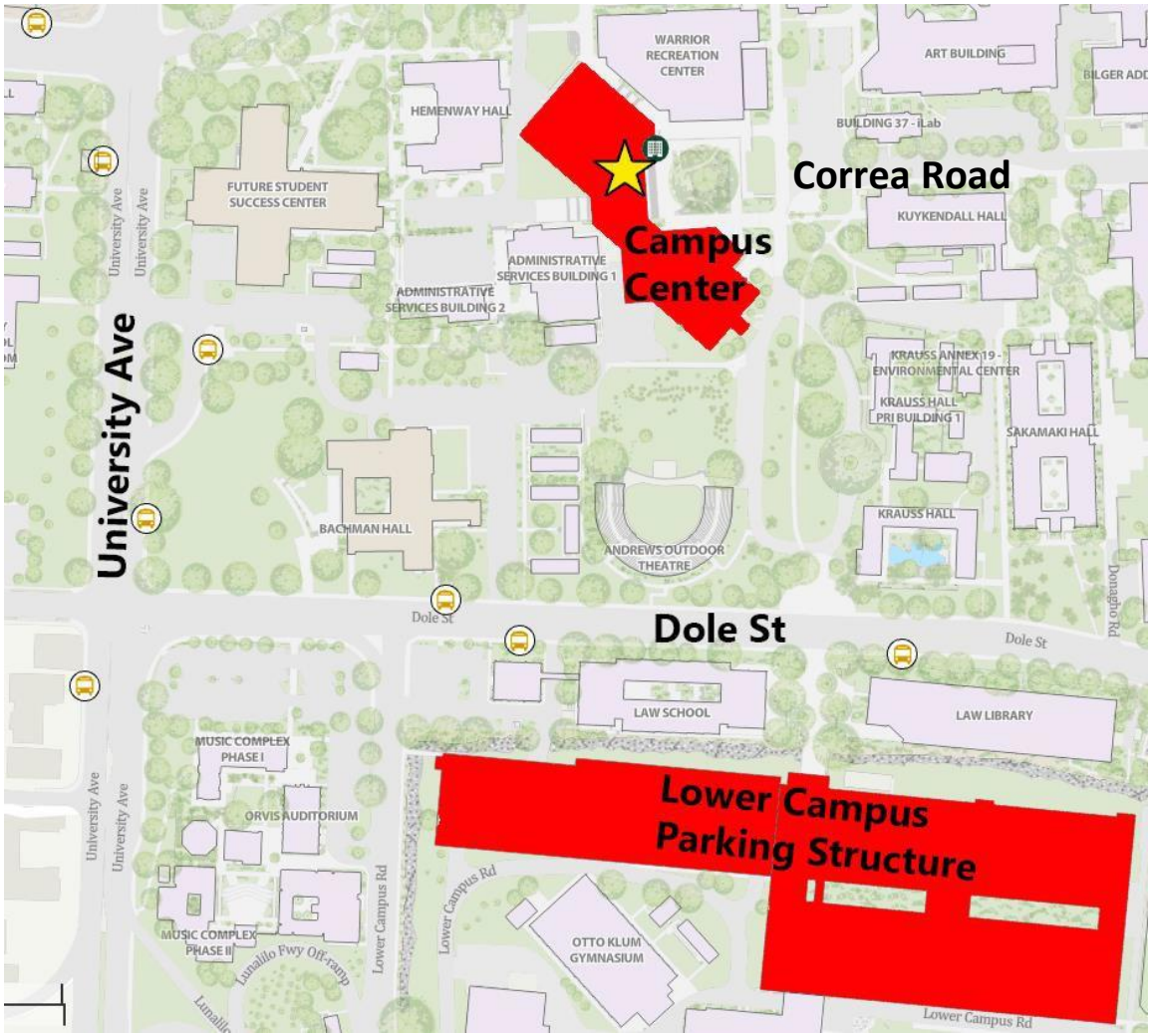
Conference Organizer and sponsor: University of Hawaii Urban Entomology Program

UNIVERSITY of HAWAIʻI MĀNOA

Our conference honors **Dr. Minoru Tamashiro** (1924-2021), world-renowned entomologist, decorated WWII veteran, and inspiring mentor and teacher. Dr. Tamashiro founded termite research programs at the University of Hawai‘i and developed a patented non-chemical subterranean termite barrier (Basaltic Termite Barrier) still in use today. We celebrate Dr. Tamashiro’s accomplishments, teachings, and outstanding example. The speakers in our symposium will showcase work that arose from his legacy and beyond.

Dr. Minoru Tamashiro and wife Polly (Elaine)

CAMPUS INFORMATION



Campus Center Ballroom 3
University of Hawai‘i at Mānoa
2465 Campus Rd, Honolulu, HI 96822

- If arriving by a **Ride Share app (Uber)**, entering “**2501 Correa Road**” should take you closest to the Campus Center (at the end of Correa Road).
- Campus Map: https://map.hawaii.edu/manoa/
- Visitor Parking: https://manoa.hawaii.edu/commuter/visitors/
- **Coffee** and **refreshment** will be provided in the Ballroom. Lunch/dinner is not provided.

You will see the Campus Center building at the end of Correa Road. Go up the green staircase, then proceed to an elevator/more stairs leading you to the third floor.

Then, proceed to Ballroom 3 on the left.

PROGRAM SCHEDULE

We are honored to host eight invited speakers and a welcome by Dr. Walter Bowen, Associate Dean and Associate Director for Research, UH College of Tropical Agriculture and Human Resources. Our symposium is moderated by Drs. Faith Oi and Ken Grace.

Monday, September 18, 2023

Time	Speaker	Title
10:00 - 10:05	Dr. Jia-Wei Tay	Welcome & introduction
10:05 - 10:10	Dr. Walter Bowen	Welcome by Associate Dean and Associate Director of Research
10:10 - 10:15	Slideshow and video	Video of Dr. Minoru Tamashiro: “The Wisdom of Hawaii’s Elders”
10:15 - 11:00	Dr. J. Kenneth Grace	Pursuing least-toxic termite management in Hawaii
11:00 - 11:10	*Break*	
11:10 - 11:55	Dr. Nan-Yao Su	M. Tamashiro Lab: An incubator of subterranean termite research
11:55 - 1:30	*Lunch Break*	
1:30 - 2:00	Dr. Vernard Lewis	Dr. Minoru Tamashiro’s impact on subterranean termite foraging behavior research in California
2:00 - 2:20	Joel Melia	A comparison of morphology among *Coptotermes formosanus* on O‘ahu
2:20 - 2:35	Dr. Jia-Wei Tay	Necrophobic behavior in *Coptotermes gestroi* and the chemical profiles of subterranean termite soldiers in Hawaii
2:35 - 3:00	*Group photography session & break*	
3:00 - 3:20	Dr. Farkhanda Manzoor	Half-life, persistence, and degradation of various termiticides under field trials to control subterranean termites (*Heterotermes indicola*)
3:20 - 3:40	Dr. Mark Janowiecki	Alate monitoring after area-wide control of the Formosan subterranean termite, *Coptotermes formosanus* in the French Quarter and Jackson Barracks
3:40 - 4:00	Dr. Carrie Cottone	The New Orleans French Quarter after Operation Full Stop: Where are we today?
4:00 - 4:30	*Optional Lab Open House*	

Tuesday, September 19, 2023

Time	Speaker	Title
10:00 - 10:30	Dr. Edward Vargo	Deciphering the invasion history of the Formosan subterranean termite in the U.S.
10:30 - 11:00	Dr. Chow-Yang Lee	Formosan subterranean termite infestations in California – are they here to stay?
11:00 - 11:30	Dr. Thomas Chouvenc	From a bucket trap to decades of colony field demographic observations on Formosan subterranean termites
11:30 - 1:00	*Lunch Break*	
1:00 - 1:30	Dr. Hou-Feng Li	Hybridization between Formosan and Asian subterranean termites in Taiwan
1:30 - 2:00	Dr. Faith Oi	The impact of extension programs in the management and control of subterranean termites
2:00 - 2:20	*Break*	
2:20 - 2:40	Dr. Nobuaki Mizumoto	Evolution of termite tandem runs: How Formosan termite differs and is similar to other lineages
2:40 – 3:00	Dr. Yuki Mitaka	Identification of an attractant aggregation pheromone used by workers of the termite *Reticulitermes virginicus*
3:00 - 3:20	Dr. Joerg Graf	Insights into the composition and function of the *Reticulitermes flavipes* microbiome
3:20 - 3:40	Dr. Reina Tong	Distribution of termites on Oahu
3:40 – 4:00	Dr. Sang-Bin Lee	History and future of termite research in the United States

Lunch/dinner is not provided --There may be an optional no-host pau hana to be announced at the conference.

DR. NAN-YAO SU

University of Florida

Title: M. Tamashiro Lab: An incubator of subterranean termite research

Abstract:
Stake survey, on-the-ground monitoring station, termite processing protocol, and dye markers developed by M. Tamashiro and students formed the basis for studies of subterranean termites worldwide. Students under his tutelage were privileged to learn of his approach to science (often over frozen mugs of beers) which has been “vertically” transferred to his grand- and great-grand students. The impact of M. Tamashiro on today’s termite research community will be discussed.

DR. J. KENNETH GRACE

University of Hawaii

Title: Pursuing least-toxic termite management in Hawaii

Abstract:

The University of Hawaii at Manoa has a rich history of termite research, with a focus on development of management approaches with minimal impacts on human health and the island environment. Henry Bess initiated a field study of soil insecticide efficacy against *Coptotermes formosanus* in 1958, using the then-novel approach of combining field-weathering of termiticides with laboratory bioassays, but it was insect pathologist Minoru Tamashiro who built a strong program in subterranean termite research at the university, beginning in the late 1960s. Tamashiro and his students studied termite colony development, foraging behavior, and the potential use of nematodes and fungi as microbial control agents. An observation during soil insecticide bioassays that termites could not penetrate certain sizes of screened gravel particles led to the development of the "Basaltic Termite Barrier." This non-chemical termite barrier was the most productive University of Hawaii patent during the 1990s, and was used extensively in state, military, and residential construction in Hawaii. Following Tamashiro's retirement in 1989, these areas of research were continued and expanded upon by J. Kenneth Grace and Julian R. Yates, III, along with talented students, postdoctoral researchers, and technical staff. Grace and postdoctoral researcher Claudia Husseneder developed a novel method of using genetically modified bacteria as a self-replicating toxicant delivery system for termite control, although this has not yet been applied commercially. Efficacy of the Sentricon termite baiting system, fittingly developed by Tamashiro's former student Nan-Yao Su, was established in Hawaii and became a widely used alternative to soil insecticide applications. Research on termite prevention led to adoption of Termi-Mesh, a stainless-steel termite barrier developed in Australia, for use in Hawaii; and, perhaps most significantly, extensive use of wood treated with the diffusible preservative disodium octaborate tetrahydrate in building construction as an alternative to more toxic arsenical preservatives, which were also generally less effective in fully penetrating the treated timbers. With continuing pressure from *C. formosanus* in Hawaii, and the discovery of *Coptotermes gestroi* on Oahu in the late 1990s, research is continuing at UH Manoa under Jia-Wei Tay to further develop effective management methodologies.

DR. FAITH OI

University of Florida

Title: The impact of extension programs in the management and control of subterranean termites

Abstract:
Extension programming is critically important in training pest management professionals in identification and management of subterranean termites. Pest Management University, a University of Florida Extension program, is an academy designed to provide state-of-the-art training in pest biology and control, laws, and regulations. As part of measuring our impacts, we evaluate knowledge gained. Over a decade, we have discovered some disturbing trends. Pre-test scores indicate that even experienced practitioners have difficulty in identification and basic math (required to calculate the correct amount of liquid termiticide). There also appears to be a trend of knowledge reaching a plateau as years increase in the field. These disappointing findings can be remedied by focused, science-based Extension programming. Our hands-on and lecture hybrid methods, delivered by a team with diverse skills, has been able to increase knowledge gained by an average of over 20 points, regardless of years in the industry.

DR. CHOW-YANG LEE

University of California, Riverside

Chow-Yang Lee, Shu-Ping Tseng, Siavash Taravati, Dong-Hwan Choe, and Michael K. Rust

Title: Formosan subterranean termite infestations in California – are they here to stay?

Abstract:

The Formosan subterranean termite (FST), *Coptotermes formosanus* Shiraki, is an invasive termite species that accounts for more than $4 billion in management and damage repairs of structures in the United States annually. In California, it was first discovered a shipyard in San Francisco in 1927, but the population was eliminated. It was not until 1992 that the FST was found again La Mesa. Since then, the FST has been discovered infesting homes in La Mesa (2018), Canyon Hill (2020), Rancho Santa Fe (2021), Highland Park (2021), La Verne (2022), and Hollywood Hills (2022). We collected the termites from these locations and used mitochondrial DNAs and polymorphic microsatellite markers to characterize their genetic relationships and breeding systems. The investigated colonies consisted of simple families and extended families. Structure analyses of microsatellite genotypes revealed at least three introductions of FST in Southern California. The sources of the introductions remain unknown. Most of these infested homes were located in areas with heavily irrigated landscapes. The future of FST dispersal in California is discussed.

DR. HOU-FENG LI

National Chung Hsing University

Guan-Yu Chen, Shih-Ying Huang, Ming-Der Lin, Thomas Chouvenc, Yung-Hao Ching and **Hou-Feng Li**

Title: Hybridization Between Formosan and Asian Subterranean Termites in Taiwan

Abstract:

Two major structural pests, *Coptotermes formosanus* Shiraki (Formosan subterranean termite) and *Coptotermes gestroi* (Wasmann) (Asian subterranean termite) occur in Taiwan. While the former predominates in the northern region and the latter in the southern region, a spatial overlap occurs in central Taiwan. A three-year field investigation was conducted during their dispersal flight season to explore the emergence of hybrid reproductive castes. Unusual morphological characteristics were noted in non-typical alates, subsequently subjected to molecular scrutiny utilizing microsatellite and mitochondrial tools. This analysis confirmed their hybrid lineage, resulting from interbreeding between the two *Coptotermes* species. These hybrid alates displayed dispersal flight patterns concurrent with their parental species in 13 of 15 cases, revealing four advanced hybrids surpassing the F1 generation. Laboratory-based reproductive experiments demonstrated that colonies initiated by hybrid females yielded inviable eggs. Conversely, backcross colonies involving hybrid males intermittently exhibited successful brood development. This study establishes the potential for successful F1 colony establishment through interbreeding of different *Coptotermes* species, thereby generating advanced hybrid alates. However, laboratory findings highlight a notable post-zygotic impediment, manifested as partial infertility among hybrid alates, potentially influencing gene flow between the termite species albeit not entirely obstructing it.

DR. THOMAS CHOUVENC

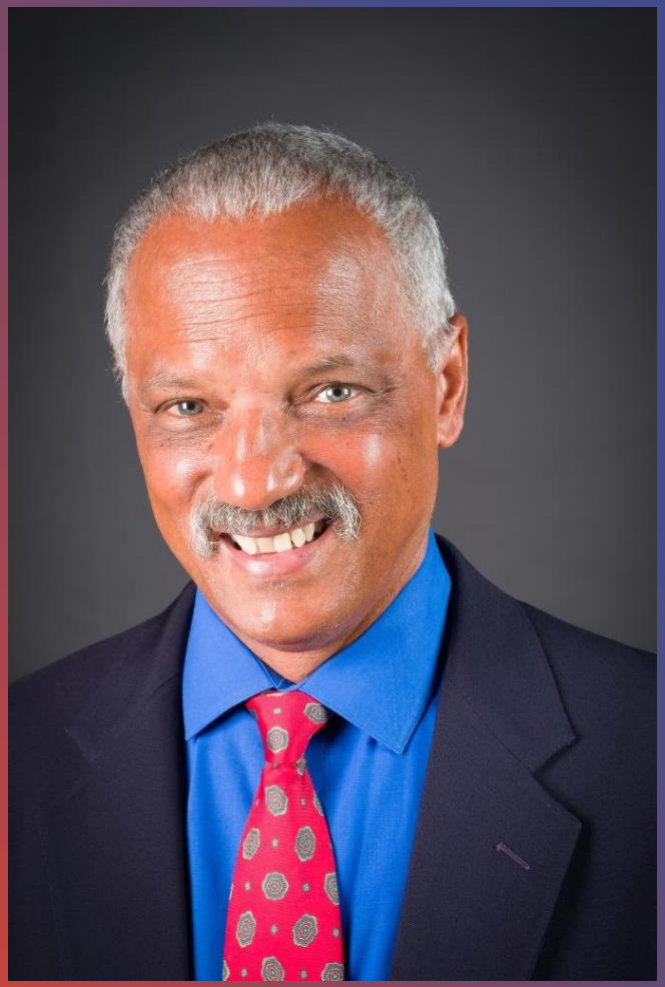
University of Florida

Thomas Chouvenc, Paul M. Ban, Nan-Yao Su

Title: From a bucket trap to decades of colony field demographic observations on Formosan subterranean termites

Abstract:

A eusocial insect colony represents a complex biological entity that must ensure degrees of perennity once it reaches maturity (production of dispersing imagoes over many successive years) to optimize its reproductive success. It is known that a subterranean termite colony invests differentially in different castes over time and adjusts colony functions depending on colony internal and external conditions over many years of activity. However, long-term studies are inherently difficult to perform. Using decades of observations from a standard bucket trap approach, we confirmed that *Coptotermes formosanus* Shiraki field mature colonies go through dramatic demographic changes and breeding structure shifts, even many years after they have reached reproductive success. By analyzing the changes in age demography of *C. formosanus* colonies from four field sites, we here provide a new perspective on how a colony may function over decades, which reveals that each colony demographic trajectory is unique. In a way, throughout its life, a termite colony displays its own “demographic individuality” that drives its growth, its foraging ability, its competitiveness, its age demography, its senescence and ultimately its death. This presentation is therefore a narrated story of the life -and death- of different *C. formosanus* field colonies over decades of observation.

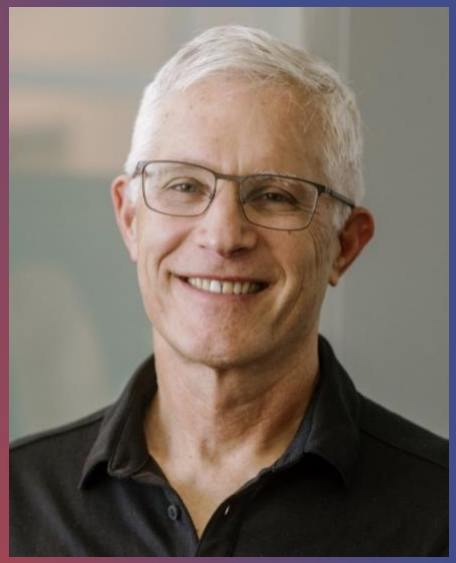


DR. VERNARD LEWIS

University of California Berkeley

Title: Dr. Minoru Tamashiro's impact on subterranean termite foraging behavior research in California

Abstract:
Subterranean termites are the most significant structural pest throughout California. Although the economic impact of subterranean termites in the State has been documented for almost one-hundred years, only in the last thirty have detailed investigations been published. The achievements in California could not have been accomplished without innovative research developed by Dr. Minoru Tamashiro's laboratory at the University of Hawai'i at Mānoa. I will review the history of subterranean termite foraging behavior in California, highlighting Tamashiro's impact on research design and data interpretation. The innovations of in-ground monitoring stations, non-toxic dyes, and the training and mentorship of world-renowned scientists, are a few of Tamashiro's contributions to science and his legacy.



DR. EDWARD VARGO

Texas A&M University

Edward Vargo, Pierre-Andre Eyer, Claudia Husseneder, Kenneth Grace, and Jianchu Mo

Title: Deciphering the invasion history of the Formosan subterranean termite in the U.S.

Abstract:
Native to eastern Asia, the Formosan subterranean termite *Coptotermes formosanus* is one of the most destructive invasive pests in the world, with established populations in Japan, Hawaii and the southeastern US. Using a panel of single nucleotide polymorphisms (SNPs), we retraced the invasion history of this species through approximate Bayesian computation. We found a complex invasion history, with initial introductions to Hawaii which then served as the source for an introduction to the southeastern US. A separate introduction event from southcentral China subsequently occurred in Florida. We also examined the breeding structure of colonies in various native and introduced populations. We found population varied in the proportions of colonies forming simple families (a single queen and king present) and those headed by extended families (multiple inbreeding queens and kings), but no consistent difference between native and invasive populations. Overall, these findings reinforce the pivotal role of bridgeheads in the spread of invasive species and illustrate that the global distribution of *C. formosanus* has been shaped by multiple introductions out of China, which may have prevented and possibly reversed the loss of genetic diversity within its invasive range, and that changes in colony breeding structure cannot account for the invasion success of this species.

DR. SANG-BIN LEE

University of Florida

Title: History and future of termite research in the United States

Abstract:
The field of termite research in the United States has historically been split into two main areas: pest management and general biology and ecology research. In the 1960s, two major termite research groups were established in the United States. One was led by Dr. Minoru Tamashiro at the University of Hawaii, and the other was led by Dr. William Nutting at the University of Arizona. These two groups trained a large number of termite researchers, who went on to work in universities, government agencies, and private industry. In the 1980s, the use of chlordane and other organochlorine pesticides was banned in the United States. This created a need for new pest management strategies for termites and led to a new opportunity in termite research. Many land grant universities hired termite researchers during this period, and the field of termite research experienced a golden age. However, the golden age of termite research came to an end in the early 2000s as many of the leading termite researchers retired and their positions were not readily replaced. This was due to a number of factors such as the merger of entomology and plant pathology departments in universities, the difficulty of securing grants for termite research, and the lack of a federal agency to support termite research. The field of termite research is now facing challenges. One challenge is the loss of graduate students and postdocs. This is a major pipeline for the future of termite research, and its loss is a serious concern. Another challenge is the lack of funding for termite research. This makes it difficult to conduct new research and develop new pest management strategies. Despite these challenges, there are still a number of termite researchers working in the United States. These researchers are committed to advancing the field of termite research.

DR. JIA-WEI TAY

University of Hawaii

Jia-Wei Tay, Reina Tong, Joanne Yew, and Joel Melia

Title: Necrophobic behavior in *Coptotermes gestroi* and the chemical profiles of subterranean termite soldiers in Hawaii

Abstract:
Laboratory studies were performed to investigate the avoidance behavior of *Coptotermes gestroi* on crushed *C. gestroi* soldiers (Objective 1) and the compounds in soldiers that caused the avoidance behavior. The GC-MS profile of *C. gestroi* were further compared with those of *Coptotermes formosanus* and a newly discovered Oahu colony that has soldiers with unusual morphological characteristics ("unusual *C. formosanus*") (Objective 2). For Objective 1, experiment set-up consisted of two containers connected to one another by a tube. Sand, a piece of wooden block, *C. gestroi* workers and soldiers were added to each container. Treatments (e.g., crushed *C. gestroi* workers or soldiers) were performed on the treated site. Termite distributions were recorded and the total tunneling area were analysed using Image J at treated and untreated sites. *Coptotermes gestroi* was found to move into the untreated site after the treatment of only crushed soldiers on Day 1 post-treatment. Subsequently, GC-MS analyses were performed on *C. gestroi* workers and soldiers. The component enriched in soldiers but not workers, that potentially caused the avoidance behavior, was identified as heptacosane. Meanwhile, "unusual *C. formosanus*" soldiers were collected near Central Oahu. For Objective 2, the GC-MS outputs of the numbers of peaks and the concentrations of heptacosane were compared among soldiers of the *C. gestroi*, *C. formosanus*, and the "unusual *C. formosanus*". GC-MS results show that significantly lower number of peaks were found on *C. gestroi* and the "unusual *C. formosanus*", as compared to *C. formosanus* colonies ($P = 0.0006$). In contrast, significantly lower concentration of heptacosane was found on *C. gestroi*, as compared to *C. formosanus* and the "unusual *C. formosanus*" colonies ($P = 0.0004$). One of the future projects will focus on molecular studies of the Hawaii *C. formosanus* colony, in collaboration with the UF termite lab.

Dr. Mark Janowiecki

City of New Orleans Mosquito, Termite, and Rodent Control Board

Mark Janowiecki, Carrie Cottone, and Claudia Riegel

Title: Alate monitoring after area-wide control of the Formosan subterranean termite, *Coptotermes formosanus* in the French Quarter and Jackson Barracks

Abstract:

To protect the historic French Quarter section of New Orleans from *Coptotermes formosanus*, Operation Full Stop, an area-wide termite control strategy, was conducted from 1998-2012. Alate monitoring was used as a determination of success, assuming if termite colonies were eliminated, the number of alates would decrease. Alate trapping in the French Quarter showed a significant decrease in swarm sizes even to this day. In 2014, an area-wide control strategy was established at Jackson Barracks, New Orleans, Louisiana. Alate monitoring at the Barracks began in 2015, but despite the elimination of colonies within Jackson Barracks, there is still high alate pressure. To understand this discrepancy between the French Quarter and Jackson Barracks, in 2021 we characterized the major swarms genetically and found a larger number of contributing colonies in the Jackson Barracks compared to the French Quarter. To fully understand this increased alate pressure, in 2022 we genetically characterized the entire swarm season to understand how colonies contribute over time and space. This will help us better understand the strong alate pressure after elimination of known termite colonies in Jackson Barracks as well as the general utility of swarm abundance as an indicator for area-wide control.

Dr. Carrie Cottone

City of New Orleans Mosquito, Termite, and Rodent Control Board

Carrie Cottone, Claudia Riegel, and Mark Janowiecki

Title: The New Orleans French Quarter after Operation Full Stop: Where are we Today?

Abstract:

Operation Full Stop was a federally funded program involving many different cooperators with the plan of using large, area-wide termite control to protect buildings and trees in the historic French Quarter of New Orleans, Louisiana. This program was funded from 1998 to 2012. After the federal funding ceased, it was unknown whether property owners would maintain termite contracts with private pest control companies. The City of New Orleans Mosquito, Termite and Rodent Control Board continued to monitor termite alates in the French Quarter to measure ongoing relative termite pressure. Our concern was that property owners may not acquire termite contracts for their buildings, thus leaving them vulnerable to termite attack and we would observe an increase in termite alates. However, we observed an overall decrease of termite alates over the years, which was unexpected. Our team then investigated each block within the French Quarter to determine if termite baits were still being employed to control termites. We discovered that approximately half of the buildings within the French Quarter are still protected with bait products, which has most likely contributed this decline in termite alates.

Dr. Nobuaki Mizumoto

Okinawa Institute of Science and Technology

Title: Evolution of termite tandem runs: How Formosan termite differs and is similar to other lineages

Abstract:

Termite tandem run is simple movement coordination between mating partners. Since termites originated 150 million years ago, the evolution fostered great diversity in the behavioral mechanisms of tandem running behaviors. In this talk, I will introduce our series of studies on termite tandem runs across taxa, highlighting how *Coptotermes formosanus* is different and similar to other termite lineages. First, the phylogenetic comparative analysis estimated that the ancestor of termites did tandem runs with both females and males serving the leader role. Subsequently, the ancestor of neoisopteran termites acquired the fixed female-leader role, while several one-piece nesting termites lost tandem running behavior. The computational behavioral analysis revealed that the stability of tandem runs highly depends on the communication system, where *C. formosanus* shows an intermediate level of stability compared with other genera. Such flexibility demonstrates that the evolution of other species-specific life history traits has shaped the mechanisms of movement coordination. Finally, I will share the results suggesting that tandem runs of *C. formosanus* can be different between native and invasive areas. Through this talk, I want to seek the opportunity to collaboratively compare the tandem runs of Formosan termites from all different populations in the world.

Dr. Farkhanda Manzoor

Lahore College for Women University

Farkhanda Manzoor and Mahnoor Pervez

Title: Half-life, Persistence, and Degradation of various termiticides under field trials to control subterranean termites (*Heterotermes indicola*)

Abstract:

The present study was carried out to investigate the persistence, degradation, and vertical movement of Bifenthrin (Pyrethroid), Fipronil (Phenyl pyrazole), and Imidacloprid (Neonicotinoids) termiticides under field trials. Persistency and degradation of trial termiticides were evaluated by a Complete Randomized Block Design (CRBD) plot. The effect of environmental conditions on termiticide was checked by designing two types of trenches i.e. covered (Pre-cast concrete covers) and uncovered followed by three replicates. Termiticides were applied according to manufacturer rates, to provide an accurate amount of active ingredients (A.I) against termites. HPLC analysis at 0, 6, 9, and 12 months results showed the highest persistency and lowest degradation rate of Bifenthrin termiticides in covered and uncovered soil trenches compared to Fipronil, and Imidacloprid. Tested termiticides can be arranged in the following orders on the basis of their estimated half-life such as Bifenthrin> Fipronil> Imidacloprid. Termiticides were more persistent in covered trenches compared to uncovered trenches. So, environmental factors such as light, temperature, and moisture accelerate the termiticide degradation. From laboratory bioassay, it was assured that termiticide active ingredients decrease after 9-month intervals as mortality decreases. It is concluded that Bifenthrin has proved to be the most suitable termiticide in the covered and uncovered field to protect the infrastructure against subterranean pests while fipronil and imidacloprid proved suitable under covered field infrastructure.

Dr. Yuki Mitaka
Texas A&M University

Yuki Mitaka, Anjel M. Helms, Edward L. Vargo

Title: Identification of an attractant aggregation pheromone used by workers of the termite *Reticulitermes virginicus*

Abstract:
The colony organization of social insects is primarily maintained through pheromone-mediated communication. In most subterranean termites, workers forage for new decaying wood resources to expand their nesting areas, and after they discover a new available wood, they gather and stay there, suggesting that an aggregation pheromone is involved in this colonization process. A recent study revealed that workers of the Japanese subterranean termite *Reticulitermes speratus* secrete an aggregation pheromone to attract and arrest nestmate workers. However, it has been unclear whether such pheromones are also used by other termite species. In this study, we identified the chemical profile of the worker aggregation pheromone in the termite *Reticulitermes virginicus*. Bioassays and gas chromatography-mass spectrometry analysis indicated that the pheromone consists of the mixture of 3-ocatanone, 3-octanol, and palmitic acid, and these compounds synergistically act as a worker attractant but do not have an arrestant activity unlike the aggregation pheromone of workers of *R. speratus*. This result suggests that aggregation pheromones are widely used, at least in *Reticulitermes* termites, and that their compositions and functions may differ among species. This work contributes to further understanding the mechanism of chemical communication underlying the foraging strategy in termites.

Dr. Joerg Graf

University of Hawaii

Joerg Graf, Jacquelynn Benjamino, Steven Lincoln, Michael E. Stephens, Ranjan Srivastava and Daniel J. Gage

Title: Insights into the composition and function of the *Reticulitermes flavipes* microbiome

Abstract:

The complex microbiome residing in the hindgut of lower termites is essential for the host to obtain nutrients and energy from the ingested wood. In *Reticulitermes flavipes,* the eastern subterranean termite, the microbiome consists of bacteria, archaea and protists. The protists form close associations with bacteria, including *Endomicrobium* species, which are intracellular symbionts. Using a combination of 16S rRNA tag sequencing and genome and transcriptome sequencing of the symbionts within individual protists, we investigated the effect of diet on the composition of the microbiome and the specialization of Endomicrobia within different protist species. Over 42 days the species composition of the microbiome changed when the diet was changed from mulch to birch, maple, oak, spruce or cardboard but remained constant on the original mulch. Using an artificial neuronal network we were able to predict changes in the microbiome and establish an connectivity network. The change in the overall composition was driven by low abundant members of the community. The analysis of the endosymbionts of three species of single protists (*Pyrsonympha vertens*, *Trichonympha agilis*, and *Dinenympha* species II.) revealed specialization not just in gene expression of the *Endomicrobium* species but also in gene content. Our analysis suggests that key genes in carbon metabolism were acquired through horizontal gene transfer from other members of the termite microbiome. These findings reveal the dynamics of the microbiome in response to dietary switches and the ability of symbionts to adapt to this unique environment.

Joel Melia

University of Hawaii

Joel Melia, Reina Tong, and Jia-Wei Tay

Title: A comparison of morphology among *Coptotermes formosanus* on O‘ahu

Abstract:

O‘ahu, the most populated island in the Hawaiian Archipelago, is a hotspot for invasive termites. The Formosan subterranean termites, *Coptotermes formosanus*, is recognized as one of the most destructive invasive termite species in the world. Recently, a visually distinct and unusual *C. formosanus* colony was located on the island of Oahu. Due to their unusual shape and size, individuals from the colony were collected for comparison and molecular analyses. Unique morphology may show novel ecological behaviors with potential greater implications regarding O‘ahu’s peculiar island ecology. Efforts are underway to collect morphological data for comparison amongst the known *C. formosanus* colonies of the island.

Dr. Reina Tong
University of Hawaii

Title: Distribution of termites on Oahu

Abstract:
Results of an updated roadside distribution survey of termites on Oahu is presented and compared to previous surveys from the last decade.