International Society of Hymenopterists Symposium

Monday 26 August 2024 – 18:30 – 20:30
Kyoto International Conference Center, Kyoto, Room 510

18:30 **Introduction**

18:35 **Investigating the biodiversity and systematics of Australian 'mummy wasps' (Braconidae: Rogadinae)**

Mollie-Rosae Slater-Baker [1], Michelle Guzik [1], Juanita Rodriguez [2], Erinn Fagan-Jeffries [1,3]

1. The University of Adelaide, Australia, 2. CSIRO, Australia, 3. South Australian Museum, Australia

Rogadinae is a subfamily of parasitoid wasps belonging to the megadiverse family Braconidae. Rogadines are commonly known as 'mummy wasps', as members of the subfamily share the unique trait of mummifying their caterpillar hosts as the larvae develop. These wasps are found throughout Australia, however only a fraction of their estimated diversity is formally documented. A particularly poorly studied tribe, the Betylobraconini, was only found to belong to Rogadinae within the last decade following molecular work. Betylobraconini is largely endemic to Australia and surrounding regions, however the biology of all members of the tribe remains completely unknown, and their likely hosts can only be speculated based on morphology and the habits of related taxa. This project employs a combination of DNA barcoding, phylogenomics and morphological approaches to explore the diversity of the Australian Rogadinae, and forms a foundational taxonomic and systematics framework for further work. With a focus on members of the Betylobraconini, the project also aims to provide a better understanding of the biology and evolutionary history of this poorly understood group.

18:47 **Unpicking the phylogenetic and ecological influences on *Aleiodes* (Hymenoptera: Braconidae) host range and specificity**

Iona Cunningham-Eurich [1,2], Seirian Sumner [2], Gavin Broad [1]

1. Natural History Museum London, United Kingdom, 2. University College London, United Kingdom

Ecological generalism and specialism are key concepts in ecology and evolutionary biology as they determine how organisms use and partition resources that are available to them. They help explain a variety of processes including adaptive radiations, speciation, community structure and adaptation to new environments. Understanding the mechanisms that shape generalism and specialism has never been more important, especially given that current environmental change is impacting how organisms interact with their resources. Parasitoid wasps possess a wide diversity of behaviours and life history traits, making them excellent study systems for ecological and evolutionary questions. Additionally, they provide essential ecosystem services through regulation of insect and arachnid populations and are vital agents of biocontrol, yet compared to other taxa, they remain understudied. Host range and the degree to which a species is a generalist or a specialist are fundamental properties of these wasps as their entire life cycles revolve around their hosts. However, the evolution of specialism and generalism in parasitoid wasps remains poorly understood, despite consequences for biocontrol and ecosystem regulation. Here, we present a case study attempting to understand the evolution of host range specificity in *Aleiodes* (Hymenoptera: Braconidae), a species-rich genus which targets Lepidoptera known to vary in its degree of host specialism across species. We use a taxonomic approach to evaluate the host specificity of *Aleiodes* species for which host data are available and use this to uncover trends relating to the evolution of generalism and specialism. We also assess the influences of host taxonomy, ecology and life-history traits on the formation of *Aleiodes* species host ranges. Namely, we seek to understand whether generalist wasps are more frequently associated with ecologically diverse hosts, and how host availability throughout the year influences host range. We find that *Aleiodes* spp. host range is largely driven by host taxonomy, but that other host traits may also play influential roles. This study has important potential implications for understanding how parasitoid wasps may adapt to environmental change in the future, but for understanding the high levels of ecological and behavioural diversity observed across the Hymenoptera.

18:59 **From pure phytophage to predator: a major shift/transition in the feeding habit of braconid wasps**

A.P. Ranjith [1], Donald L.J. Quicke [1], Buntika A. Butcher [1]

1. Chulalongkorn University, Thailand

Braconid parasitoid wasps are a ubiquitous group of insects, most of which attack Lepidoptera, Coleoptera and Diptera. Among them very few members exhibit pure phytophagy through seed predation and gall induction. Recently, examples of entomophytophagy (*Bracon garugaphagae* Ranjith & Quicke) and purely predatory behaviour (*Bracon predatorius* Ranjith & Quicke) have been reported from insect induced plant galls from India. These two reports are from the very diverse braconid subfamily Braconinae, and both involve members of the cosmopolitan genus *Bracon* as too are two Neotropical examples of seed predation. The report of predatory larval behaviour was the first case of acarophagy from the superfamily Ichneumonoidea. In connection with the continuing studies on the plant galls and associated parasitoids, we have recently found a second case of entomophytophagy exhibited by another unidentified Bracon species from the psyllid induced leaf galls on *Ficus racemosa*. The behaviour of second case of entomophytophagy is in line with the behaviour exhibited by *B. garugaphagae*. All these cases involve diverse morphological adaptations of parasitoid larva's head capsule, and in the case of *B. garugaphagae* novel eversible body tubercles. In the cases of head capsules in the entomophytophagous species the modifications help them to prey on the gall-formers and then to and complete their development by feeding the plant tissues. Similarly, the predatory larvae possess mandibles lacking additional teeth which helps to pierce/chew host body. Collectively, changes in diet and feeding behaviour demonstrate considerable evolutionary plasticity in braconid larval anatomy as a result of changes in feeding habit

19:11 **The integrative taxonomy of the nocturnal Darwin wasp genus *Netelia* (Hymenoptera: Ichneumonidae: Tryphoninae) from Taiwan reveals a four-fold increase in species diversity.**

Hsuan-Pu Chen [1], Shiuh-Feng Shiao [1]

1. National Taiwan University, Taiwan

Netelia Gray, 1860 is a nocturnal Darwin wasps genus comprising 324 species and distributing worldwide, attacking lepidopterans as koinobiont ectoparasitoids. Similar in external morphologies, the species-level identification of *Netelia* largely depends on the complex gonostyles in their male genitalia. This male genitalia-based system, along with the unstandardized descriptions of male genitalia, have led to taxonomic confusion, challenges in female identification, and questionable bionomic records within this genus. In this study, we conducted an integrated taxonomic approach using molecular criteria—including COI-based ASAP and bPTP species delimitation, as well as the monophyly of the nuclear 28S gene tree—to evaluate the morphospecies hypothesis reconstructed from external morphologies, ovarian eggs, and primarily male genitalia. After analyzing 97 morphospecies in more than 700 specimens from Taiwan and Japan, more than 300 newly acquired COI and 28S sequences, and 427 COI sequences from the BOLD systems, the results reveal a four-fold increase in species richness in Taiwanese *Netelia*, which increases from 22 species to over 80 species. Two described species with female holotypes are first connected to their males by COI barcode. Incongruences between morphological and molecular species delimitation were observed. Notably, six morphospecies of the subgenus *Prosthodocis* and three of the subgenus *Netelia* show low genetic divergences and are merged as three species in molecular criteria. Conversely, morphospecies with similar male genitalia in the obesis group of the subgenus *Apatagium* exhibit distinct genetic divergence and are divided into multiple species. The results suggest that the diversity observed in male genitalia morphology may not accurately reflect species diversity within the genus *Netelia*. Incongruences showing low genetic variation in certain morphospecies might result from local morphological adaptation or diversification of male genitalia driven by sexual selection. Meanwhile, cryptic species may also exist within some *Netelia* groups. While this study refrains from making specific taxonomic treatments regarding some widespread species with only limited samplings, it does uncover the underestimated species richness of *Netelia* in Taiwan.

19:23 **BREAK**

19:33 **Molecular and morphological systematics of *Sycophila* parasitoid wasps (Hymenoptera: Eurytomidae) associated with *Ficus* (Moraceae)**

Atiyeh Naghizadeh [1,2], Simon van Noort [1,2], Charlene Janion-Scheepers [1,2], Hossein Lotfalizadeh [3]

1. University of Cape Town, South Africa, 2. Iziko Museums of South Africa, South Africa, 3. Iranian Research Institute of Plant Protection, Iran

Sycophila Walker (Hymenoptera: Eurytomidae) is the fourth largest genus of Eurytomidae (Chalcidoidea) and comprises 117 valid species worldwide. While tropical and subtropical species of *Sycophila* are mainly associated with figs and are typically considered true parasitoids or inquilines, their diversity and biology are not well understood, especially in the Afrotropical region. In this study,

adult fig wasps collected from 21 different African *Ficus* species were sorted and identified. As a result, five new species of *Sycophila* have been identified based on morphological characterization. The *Ficus* species from which adult fig wasps were collected include *F. abutilifolia*, *F. artocarpoides*, *F. bubu*, *F. burkei*, *F. chirindensis*, *F. conraui*, *F. fischerii*, *F. glumosa*, *F. ingens*, *F. lingua lingua*, *F. louisii*, *F. modesta*, *F. natalensis*, *F. ovata*, *F. petersii*, *F. polita*, *F. sansibarica*, *F. stuhlmannii*, *F. sur*, *F. sycomorus*, and *F. wakefieldii*. Molecular aspects of the study are yet to be pursued. Potential findings of molecular analyses will be used along with the morphological findings to provide a well-resolved phylogeny of this genus. By understanding the biology and ecology of *Sycophila* species it may be possible to develop more targeted and effective methods for controlling non-pollinating fig wasps, which can have a significant negative impact on pollination and hence fig propagation.

19:45 **Systematics of Australian species of *Psyllaephagus* (Hymenoptera: Encyrtidae), parasitic on lerp-forming Psyllids.**

Alana McClelland [1], Juanita Rodriguez [2], Erinn Fagan-Jeffries [1], Miles Zhang [3]; Steven Cooper [1], Andrew Austin [1]

1. University of Adelaide, Australia 2. CSIRO, Australia, 3. University of Edinburgh, United Kingdom

The current taxonomic framework for describing new species of *Psyllaephagus* in Australia is largely intractable, mainly due to damaged or missing types and, as such, the genus has been neglected for almost 40 years. An absence of robust taxonomic and molecular data, and often erroneous associations records among *Psyllaephagus* and their hosts has halted progress on this important group of parasitoids. We present the first molecular phylogeny and species delimitation of the fauna reared for this study, which goes some way to disentangling the taxonomy of the genus in Australia.

19:57 **Unique courtship displays by small hymenopteran insects**

Matvey I. Nikelshparg [1], Vasily V. Anikin [1]

1. Saratov State University, Russia

Hymenoptera are known to possess unique courtship displays. However, detecting such behavior in small wasps, especially in parasitoid ones presents a significant challenge. We were able to record unique details of the courtship rituals of several small wasps in the families Cynipidae, Eurytomidae, Eulophidae, and Eupelmidae. We meticulously described the steps of each display and highlighted the differences and similarities between them. We found that Eupelmidae males perform one of the most complex rituals and attempted to explain its foundation. The study of courtship displays can enhance our understanding of insect behavior and the ecological diversity of Hymenoptera.

20:09 **Brain Soup: Quantifying the number of cells in the brain of Australian native bees**

Faelan Mourmourakis [1], Andrew Barron [1]

1. Macquarie University, Australia

Despite their brains being smaller than the size of a sesame seed, bees display remarkable cognitive capabilities. The European honeybee (*Apis mellifera*) has a brain that contains just under a million cells that enable this complex cognition. When comparing cognition among species, differences in ability are often linked to differences in brain composition, such as brain cell number. However, little is known about the brains of Australian native bees. For the first time, we use the isotropic fractionator “brain soup” method to estimate total brain cell numbers across Australian native bee species. We found that Australian bees possess an impressively large number of brain cells, especially in contrast with North American Hymenopteran species of a similar size. Further investigation is required to expand our knowledge of native Australian insect brains and connect them back to cognitive differences between taxa.

20:21 **WRAP UP**

https://www.hymenopterists.org/

https://www.hymenopterists.org/ish_code_of_conduct_2019/