FLY TIMES

ISSUE 62, April, 2019

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Welcome to the latest issue of *Fly Times*! As usual, I thank everyone for sending in such interesting articles. I hope you all enjoy reading it as much as I enjoyed putting it together. Please let me encourage all of you to consider contributing articles that may be of interest to the Diptera community for the next issue, or for larger manuscripts, the Supplement series. *Fly Times* offers a great forum to report on your research activities and to make requests for taxa being studied, as well as to report interesting observations about flies, to discuss new and improved methods, to advertise opportunities for dipterists, to report on or announce meetings relevant to the community, etc., with all the associated digital images you wish to provide. This is also a great place to report on your interesting (and hopefully fruitful) collecting activities! Really anything fly-related is considered. And of course, thanks very much to Chris Borkent for again assembling the list of Diptera citations since the last *Fly Times*!

The electronic version of the *Fly Times* continues to be hosted on the North American Dipterists Society website at http://www.nadsdiptera.org/News/FlyTimes/Flyhome.htm. For this issue, I want to again thank all the contributors for sending me such great articles! Feel free to share your opinions or provide ideas on how to improve the newsletter. Also note, the *Directory of North American Dipterists* is constantly being updated. Please check your current entry and send all corrections (or new entries) to Jim O'Hara – see the form for this on the last page.

Issue No. 63 of the *Fly Times* will appear next October. Please send your contributions by email to the editor at stephen.gaimari@cdfa.ca.gov. All contributors for the next *Fly Times* should aim for 10 October 2019 (maybe then I'll get an issue out actually on time!) – but don't worry – I'll send a reminder. And articles after 10 October are OK too!

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Issue 62, available online 21 May 2019

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NEWS

Second "J.O. Westwood Medal"

Ashley H. Kirk-Spriggs

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Dr Art Borkent (right) was the second recipient of the prestigious "J.O. Westwood Medal", awarded by the Royal Entomological Society of London. Medals are awarded for "The best comprehensive taxonomic work on a group of insects, or related arthropods. Typically, this will be a taxonomic revision or monograph." Art was given the award in recognition of his paper:

> Borkent, A. 2008. The frog biting midges of the World (Corethrellidae: Diptera). *Zootaxa* 1804: 1–456.

Unfortunately, at that time (2010), he was unable to attend the presentation of the Medal and this was officially awarded to Art by Dr Ashley Kirk-Spriggs (left), in the Central Hall of the Natural History Museum, London, during Art's recent visit to the Museum. Art (in collaboration with Patrycja Dominiak), is currently preparing the Ceratopogonidae volume of the Royal Entomological Society's *Handbooks for the Identification of British Insects* series.

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Jessica Gillung Wins International Early Career Award in Entomology for her work on Acroceridae

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Postdoctoral fellow Jessica Gillung of Cornell University, who received her doctorate in entomology from UC Davis, is the recipient of the prestigious Marsh Award for Early Career Entomologist, sponsored by the Royal Entomological Society.

She is the first UC Davis-affiliated scientist to win the award. She will receive a certificate, 1250 pounds ($1,624) and an expense paid trip to London to receive the award at the Ento 19 conference, set Aug. 20-22 at the London School of Hygiene and Tropical Medicine.

The Royal Entomological Society, an international organization devoted to the study of insects, was founded in 1833 as the Entomological Society of London. Its mission is to disseminate information about insects and improve communication between entomologists.

Gillung's work on spider flies, involving genomics, phylogenetics, systematics, and comparative analyses, "has increased our understanding of the biological patterns and processes that have shaped our planet's biodiversity," wrote her major professor and award nominator Lynn Kimsey, director of the Bohart Museum of Entomology and a professor of entomology, UC Davis Department of Entomology and Nematology.

Gillung received her doctorate in entomology from UC Davis in December 2018, studying with Kimsey and mentor Shaun Winterton, insect biosystematist, California Department of Food and Agriculture, and a member of the Royal Entomological Society. Gillung also collaborated with ant specialist and taxonomist Phil Ward, professor, UC Davis Department of Entomology and Nematology.

Gillung is now a postdoctoral associate at Cornell University in the Bryan Danforth lab, where she is researching Apoidea (stinging wasps and bees) phylogenomics, evolution and diversification.

Her dissertation, "Systematics and Phylogenomics of Spider Flies (Diptera, Acroceridae)," focused on the evolution, conservation, biology, and taxonomy of spider flies, a group of spider natural enemies

Gillung's taxonomic work on spider flies, described as landmark, included identification keys and morphology-based diagnoses of species using modern techniques of cybertaxonomy—the application of the internet, digital technologies, and computer resources to increase and speed up the discovery and cataloging of new species, Kimsey wrote. "Using cybertaxonomic tools, Jessica described 25 new spider fly species herself, and in collaboration with fellow entomologists, three fossil species from Baltic amber, described in her first dissertation chapter. Cybertaxonomy is a powerful tool that allows researchers and citizen scientists to collaborate in real time and across great distances to increase the speed and efficiency of biodiversity discovery."

Jessica Gillung, with Jade Winterton at the Grand Canyon, Arizona, in June 2014.

"Jessica unraveled the functional and ecological implications of key morphological traits, as well as their distribution across the Tree of Life," Kimsey said. "In her doctoral dissertation, she established new homologies for the wing venation of spider flies and conducted detailed and assiduous dissections of male reproductive structures (i.e., genitalia) to understand homologies, demonstrating that morphological traits are dynamically evolving systems useful for both classification and inference of evolutionary history."

Since many insect species are threatened, geographically restricted, or relatively rare in nature, Gillung performed non-destructive DNA extraction of specimens housed in entomological collections, including the Bohart Museum of Entomology. Gillung collected molecular data from decades-old insects without damaging the specimens.

Gillung's multifaceted research on genomics, bioinformatics, phylogenetics, plant-pollinator interactions, and biodiversity discovery drew more $120,000 in grants and awards while at UC Davis.

The UC Davis alumnus is known for her "phenomenal leadership activities, her nearly straight-A academic record (3.91 grade point average), her excellence as an entomologist and teacher, her public service and outreach programs (from 2013 to 2018, she reached more than 20,000 people at UC Davis-based events) and her incredible publication record, Kimsey said. "She published 11

refereed publications related to her thesis in very strong journals. Most entomologists do not publish nearly that much, even as a postdoctoral scholar or a junior faculty member."

A recipient of numerous other awards, Gillung won the prestigious international award for "Best Student Presentation Award" at the ninth annual International Congress of Dipterology, held in 2018 in Windhoek, Namibia. She also won the 2019 Early Career Award from the Pacific Branch, Entomological Society of America (PBESA) and the 2018 PBESA Student Leadership Award. PBESA encompasses 11 western states, U.S. territories and parts of Canada and Mexico.

Gillung was a key member of the 2015 PBESA championship Linnaean Team that went on to win the ESA national championship. The Linnaean Games are lively question-and-answer, college bowl-style competition on entomological facts played between university-sponsored student teams.

Gillung also collaborated on a project aimed at encouraging students to attend and participate in the Orlando, Fla., meeting of the International Congress of Entomology. She and several colleagues published a paper entitled "From the Students to the Students: Why YOU need to Attend ICE 2016."

The Royal Entomological Society will publish her biography and photo in its *Antenna* magazine, on the society website, and in the Marsh Christian Trust Award brochure.

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Inventory of Aquatic Hemerodromiinae and Clinocerinae (Diptera: Empididae) inhabiting Tufa Stream Environments of Tropical Karst Ecosystems in Thailand

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Work is now underway to learn more about the Diptera of calcareous waters in karst landscapes in Thailand. The entomology of tropical karstic systems has been greatly neglected even 'though in temperate latitudes karsts are well known as important biodiversity hotspots. In many parts of the world, including Thailand, these "imperiled arcs of biodiversity" are under threat from activities such as cement extraction, removal of vegetation cover by fire and damage to their hydrological systems with agricultural runoff etc.

Although karst biota includes numerous eurytopic generalists, many of the plants and animals occurring there are highly specialised stenotopes; terrestrial forms must adapt to extreme aridity while aquatic organisms must be able to tolerate extreme mineralisation, high pH and in some cases seasonal drying of streams and springs or cataclysmic spates. Although karst landscapes are widely distributed globally, they are widely dispersed, and this fragmentation has inevitably led to restricted gene-flow, intense population divergence and high local and regional endemism.

Karst landscapes account for about 18% of the land area of Thailand and they are widely distributed through the country excepting the Isaan Plateau in the northeast. The limestones of Thai karsts are of variable geological age, forming isolated pockets in some places and extensive mountain ranges in others. Many tourists will be familiar with the spectacular karst islands (including "James Bond Island") of Pang Nga bay in the south of the country of the massive limestone block of Doi Chiangdao (Thailand's second highest mountain) in the north.

Whilst the botany and herp-fauna of Thai karsts have been reasonably well studied, for example, I can find no substantive work on any aspect of their entomology. It was thus exciting for me when my proposal to start correcting this situation gained financial support of the Thailand Research Fund and approval from Mahsarakham University. The basic objectives of the Project are:

- To compile an inventory of aquatic Empididae associated with calcareous waters in Thailand.
- Identify or describe the species present.
- Characterise the communities they form and correlate them with environmental variables
- Geographic and eco-historical isolation of Thailand's karst systems has likely led to high levels of endemism and genetic isolation of populations. Evidence of low gene-flow between disjunct populations will be sought and related to historical patterns of habitat fragmentation using haplotype mapping of CO1.
- Look for evidence of homeostatic refugia. Pleistocene cooling events formerly drove many animals and plants southwards. It is possible that some of them got trapped there in relatively cool spring systems as the climate warmed again. The prime candidate for this is the Empididae subfamily Clinocerinae of which Thailand communities are probably of Palaearctic origin and have become restricted now to the cool climates of the highest mountains.

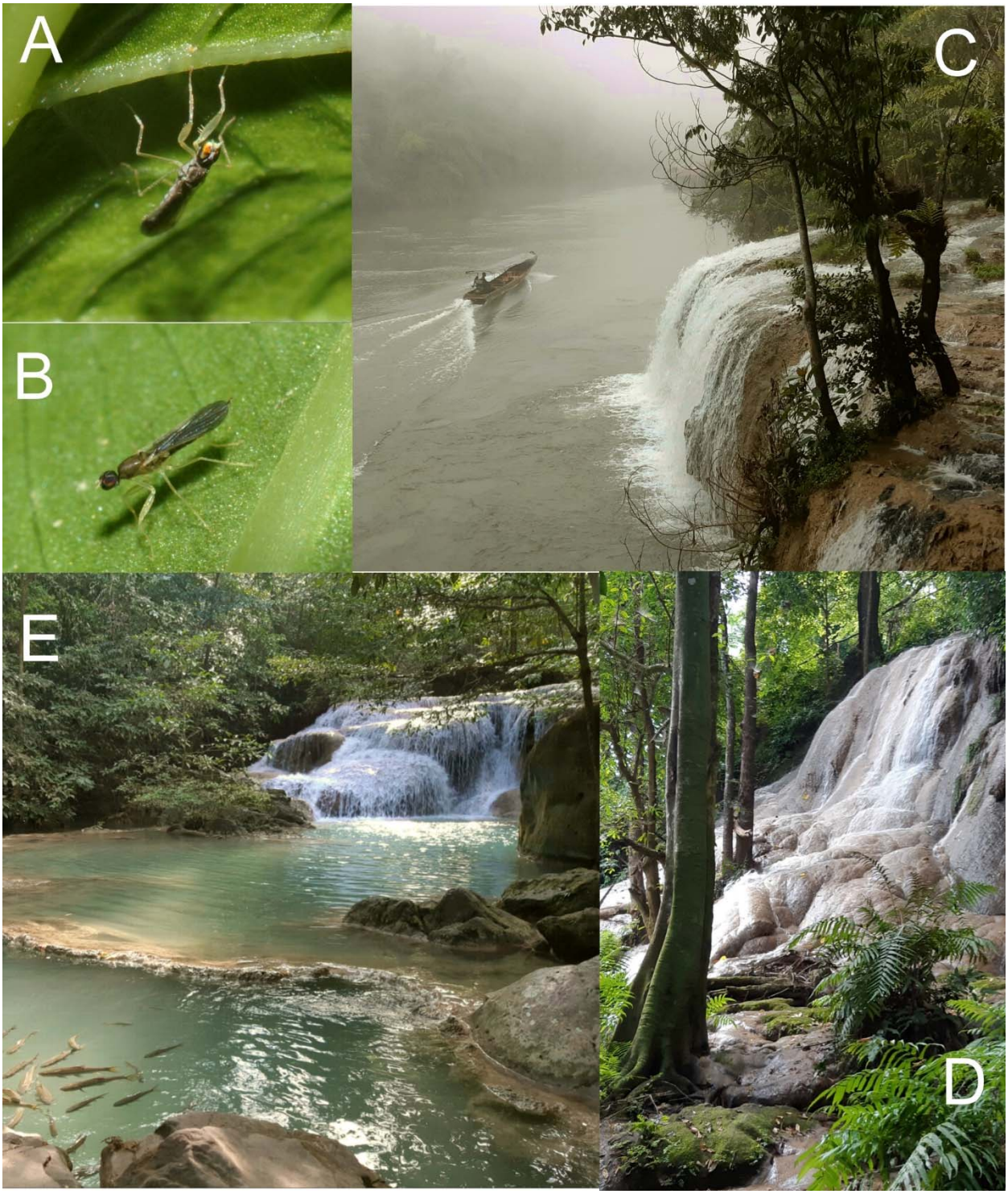

Figure 1. A. *Hemerodromia anomala* Plant is probably strictly associated with tufa formations in fast streams in several different provinces of Thailand. B. *Hemerodromia conspecta* Plant is another species probably strictly associated with tufa streams. Adults of it and *H. anomala* can be found on the undersides of leaves overhanging the water or very close to the streamside, always in dense shade. C. The Sai You Yai waterfall in Kanchanaburi Province is a wide tufa fan that spills into the Kwai Noi River. D. Suan Hom waterfall in Loei Province is a large and very actively growing tufa system where the tufa rapidly engulfs trees and other objects present in the flow. This site has a rich fauna of tufa-specialist Empididae. E. The waterfall at Erawan National Park is a major tourist attraction. It is a fine example of a tufa barrier and pool system.

At the time of writing, seven months into the 2-year project, it has been possible to visit and sample many of Thailand's major karst areas. Although it is possible to easily locate karst areas from large-scale geological maps, selecting precise collecting sites such as sinks, springs, Vauclusian seeps, resurgences and tufa-terraces is far more difficult (though good quality topographic maps exist and mark many such features, they are effectively unavailable, especially to a foreigner working in areas near national borders). Local knowledge can sometimes help in locating new collecting sites, but it is often deeply flawed and unreliable. Finding suitable localities requires boots on the ground and plenty of time to explore. On the other hand, some of the best waterfall and tufa sites are managed as tourist attractions and although easy to locate and visit, they are often in protected areas and severely damaged by tourist activity making them less attractive sampling prospects.

The project seems well set to achieve its objectives. In particular, several obligate tufa species that I had previously described from an isolated karstic complex in Loei Province have now been found at other, remote tufa sites in other provinces. These disjunct populations of species such as *H. anomala* Plant, *H. conspecta* Plant will be ideal subjects to investigate genetic isolation. Other species (such as *H. namtokhinpoon* Plant or *H. anisoserrata* Plant) have yet to be found away from their type localities and it is possible that they will turn out to be very narrow range endemics. The finding of undescribed Hemerodromiinae species (and indeed species already known elsewhere) was inevitable and unsurprising, especially considering the intense focus on a narrow range of habitats (a specialist getting 'low down and dirty' to investigate different micro-habitats will find many taxa that are missed by more generalist collecting campaigns with Malaise traps and sweep nets etc).

In conclusion; the project has got off to a promising start and we can anticipate interesting results. Meanwhile there are more sites to visit (and site visits at different seasons too), species to describe, ecological data to crunch and genes to isolate and sequence. Hopefully, at some later date there will be a fascinating story to tell.

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Behavior of adult *Leucopis* sp. (Chamaemyiidae) associated with aphids feeding on flowers of the rough-leaf velvetseed (*Guettarda scabra*: Rubiaceae) in south Florida

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Aphid flies (Chamaemyiidae) are a rare sight, and their small size makes getting pictures of the adults in the field quite challenging. The larvae feed on stenorrhynchous Hemiptera (Gaimari 2010), so finding the flies is a matter of finding the prey. Because some *Leucopis* attack aphids (McLean 1992), they must contend with the aggressive ants protecting their prey. While the predaceous maggots are able to remain undetected by the ants, the adult flies must maneuver carefully around the ants while laying eggs or stealing honeydew (McLean 1992).

We had the opportunity to observe and take pictures of this interaction as it unfolds in a pine rockland habitat in south Florida (Figure 1). As part of our research on the identity of the potential pollinators of the rough-leaf velvetseed (Figure 2), we monitor insect activity on flowers of this plant during late spring and summer at different hours during the day. During our afternoon survey on May this year we saw small groups of aphids on some flowers of our plants (Figure 3), most of them being constantly visited by carpenter ants (*Camponotus floridanus*) (Figure 4). In one of those plants, we noticed an adult *Leucopis* sp. walking rapidly among the aphids as soon as the ant walked away to take care of another herd (Figure 5). The fly tapped the backs of the aphids with its fore legs in a similar fashion as the ants do with their antennae when requesting honeydew. Most of the times, the frantic drumming of the fly on the aphids did not result in a drop of honeydew (perhaps because they have just provided one for the ant) (Figure 6), but when it did, the amount excreted was relatively large in relation to the size of the fly (Figure 7, 8). After drinking two or three consecutive droplets, the fly retreated to process its meal for some minutes, before coming back for more (Figure 9). Whenever the ant was around, the fly would move out of sight and, as far as we could see, it was never detected.

We checked about 40 *G. scabra* plants in the area, but despite our efforts we could not find another adult chamaemyiid, even though aphids were present in some of them. We will continue monitoring these plants for insect activity during the rest of their flowering season, that ends early in Fall. Hopefully by then, we will have better pictures portraying the natural history of *Leucopis* sp. to share.

References

Gaimari S. D. 2010. Chamaemyiidae (chamaemyiid flies). In: Brown B. V., Borkent A., Cumming J. M., Wood D. M., Woodley N. E., Zumbado M. A. (Eds). Manual of Central American Diptera, Volume 2. NRC Research Press, Ottawa, 997-1007.

McLean I. F. G. 1992. Behaviour of larval and adult *Leucopis* (Diptera: Chamaemyiidae). British Journal of Entomology and Natural History, 5: 35-36.

Figure 1 (left). General view of a fragment of pine rockland habitat, at Larry and Penny Thompson Memorial Park, Miami-Dade County, Florida.

Figure 2 (right). The rough-leaf velvetseed *Guettarda scabra,* a shrub native to south Florida and other localities in the Caribbean. It is found only in pine rockland and hardwood hammock habitats where it flowers only during Summer.

Figure 3 (left). Aphids (Hemiptera: Aphididae) feeding on a flower of *Guettarda scabra,* one of the few structures where the tissue is soft in this plant.

Figure 4 (right). A carpenter ant *Camponotus floridanus*, one of the most common inhabitants of the pine rockland habitat keeping an eye on a herd of aphids.

Figure 5 (left). An aphid fly *Leucopis* sp. taking advantage of the absence of an ant to look for a sugary meal from the aphids.

Figure 6 (right). An individual of *Leucopis* sp. touching rapidly the back of aphids with its fore legs in order to trigger the release of honeydew. Sometimes there is none left to share though.

Figure 7 (left). Aphid fly *Leucopis* sp. drinking a drop of honeydew from the anus of an aphid.
Figure 8 (right). Individual of *Leucopis* sp. ingesting a big drop of honeydew.

Figure 9. Adult aphid fly *Leucopis* sp. resting on the tip of a flower bud while digesting its honeydew meal.

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Ashley Kirk-Spriggs relocated to the Natural History Museum, London

Stephen D. Gaimari

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Ashley H. Kirk-Spriggs took up the position of Senior Curator in Charge of Diptera and Siphonaptera at the Natural History Museum, London at the beginning of March 2019. Ashley was born in Cambridgeshire and was educated at St. Ivo Comprehensive School in the U.K., where he developed an interest in entomology at a young age. He obtained a Post-graduate Diploma in Applied Insect Taxonomy (with distinction, 1984) and a Master of Philosophy (1994) degree, both from University of Wales College of Cardiff and a PhD from Rhodes University, South Africa (2012). While still a student, he participated in the Project Wallace Expedition to Sulawesi in 1985 and has travelled and collected widely in South-east Asia, Europe and throughout Africa. He was previously employed at the National Museum of Wales, the National Museum of Namibia, the Albany Museum, South Africa and the National Museum, South Africa. He was Editor of *Cimbebasia* (scientific in-house journal of the National Museum of Namibia (1997–2003) and is currently Coordinator and Editor-in-chief of the *Manual of Afrotropical Diptera* project. He has published over 100 scientific and popular articles and 30 species have been named in his honour.

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Diptera and iNaturalist: A case study from Asiloidea

Even Dankowicz[1] & Chris Cohen[2]

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Matt Bertone recently documented his fly observations while competing in iNaturalist's City Nature Challenge 2018 (Bertone 2018). We wanted to take a step back and give a more detailed description of the platform and how it has been useful for our studies in Diptera. For those unfamiliar, iNaturalist is a website and app for sharing observations of nature, with identifications crowdsourced by a network of amateur and expert naturalists. We both became active identifiers of Diptera on the site over the summer of 2017, and we thought it would be worthwhile to share some of our experiences with the Fly Times community.

As of March 25, 2019, there are over 272,000 Diptera observations on iNaturalist, about 15% of which have not been identified to family, and about 44% of which have not been identified to genus or species. These observations were uploaded by over 42,000 individuals and identified by more than 7,400 people. Just five families make up nearly half of the total observations. These are, in descending order: Syrphidae, Asilidae, Bombyliidae, Tachinidae, and Calliphoridae (Figure 1).

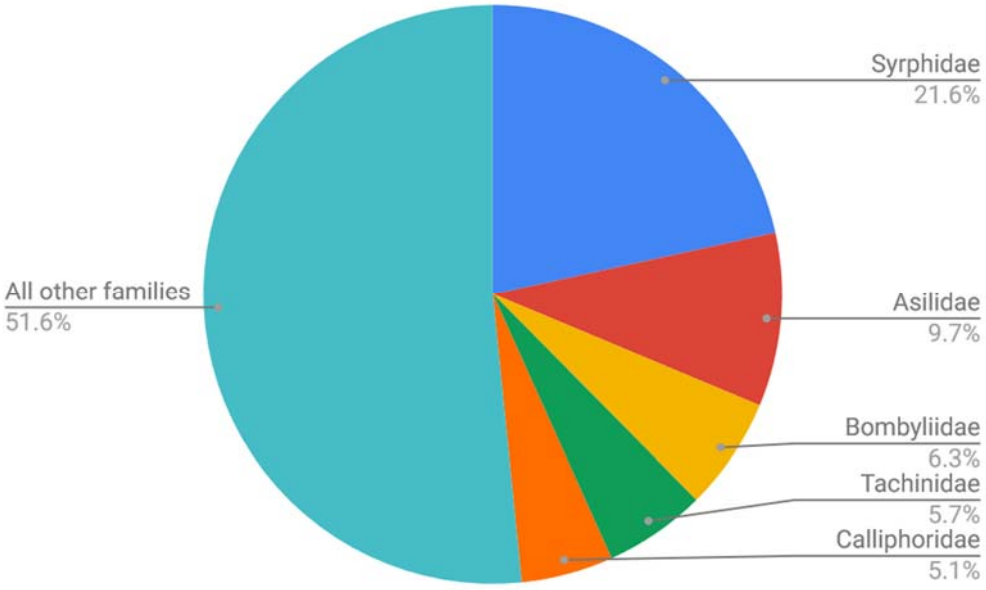

Figure 1. Family composition of >230,000 dipteran observations (identified to family or below) on iNaturalist. Only the top 5 families are listed.

Asilidae on iNaturalist - Chris Cohen

As shown in Figure 1, the family Asilidae is the second-most observed family on iNaturalist, with over 22,000 observations. All 14 currently recognized subfamilies are represented, with at least 500 species identified from observations supplied by over 7,100 people. Several

asilidologists frequent iNat, including Reinoud van den Broek, Rob Cannings, and Tristan McKnight. I have personally identified over 15,000 robber-fly observations to subfamily or below. Even so, around 24% of asilid observations have not been identified to at least genus.

While images can never replace a physical specimen, iNaturalist has been tremendously helpful in learning the global asilid fauna in the absence of a proper insect collection. Browsing iNaturalist can be an addicting experience, as numerous photographs of rare, and occasionally undescribed, flies are uploaded to iNaturalist constantly from all over the world. There are many examples in Asilidae, but I'll list just a few: *Orrhodops occidentalis* (Figure 2a-b) from Mexico; what may be an undescribed *Neocyrtopogon sp.* from Australia (figure 2c); and *Scylaticodes lugens* from Chile (Figure 2d). To my knowledge, these genera have never been photographed in the wild.

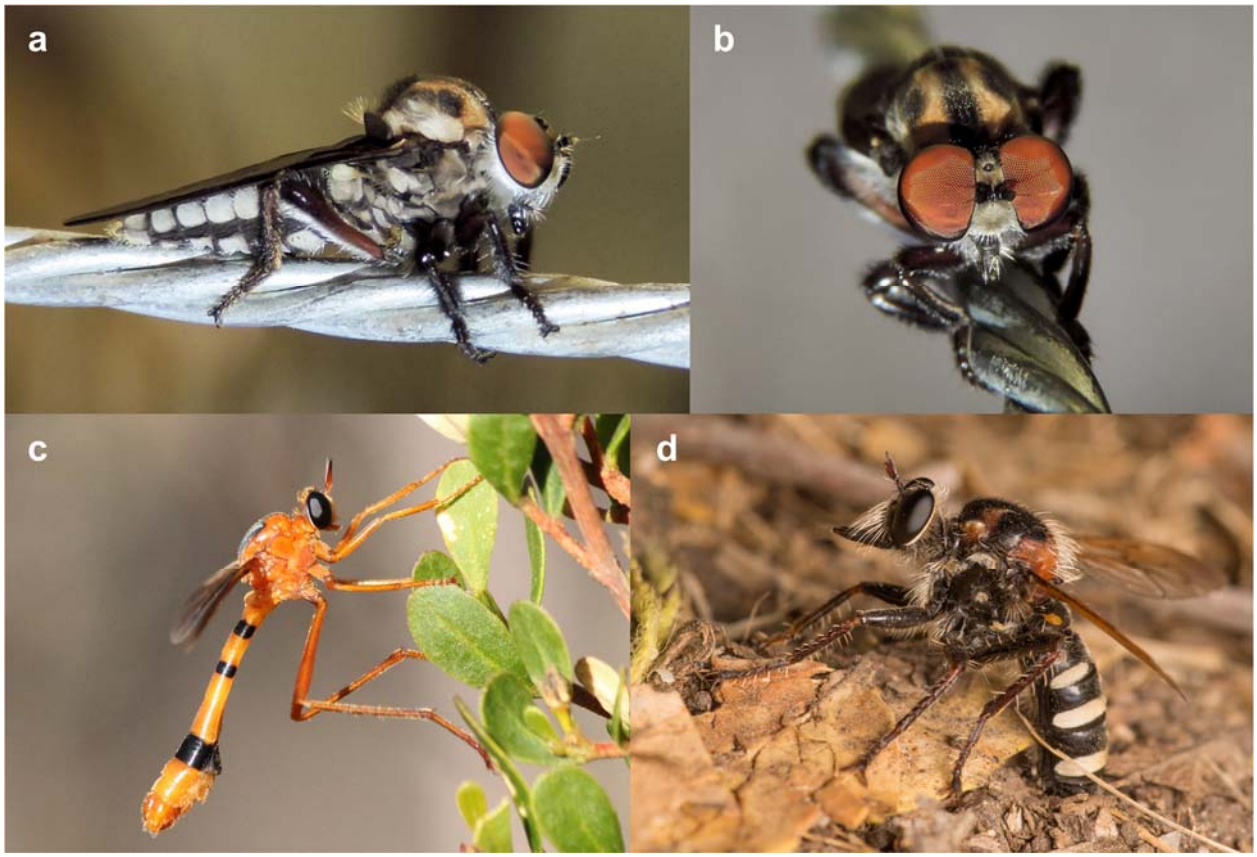

Figure 2. a-b. *Orrhodops occidentalis* © Cheryl Harleston, reproduced with permission (https://www.inaturalist.org/observations/13818313); c. *Neocyrtopogon sp.* © Geoffrey Cox, reproduced with permission (https://www.inaturalist.org/observations/20723481); d. *Scylaticodes lugens* © Patrich Cerpa, reproduced with permission (https://www.inaturalist.org/observations/17954058).

In addition to documenting undescribed or rare species, iNaturalist has also been useful for recording novel observations of behavior and distribution. For example, I identified a potential new record of *Anarolius* from North Africa (Figure 3a), a genus otherwise known only from the Middle East and Central Asia. One of the more remarkable behavioral observations was of a *Plesiomma unicolor* feeding on a spider in its web (Figure 3b). This behavior has been recorded for the Brazilian *Plesiomma fuliginosum* (Bristowe, 1924, 1925), but this is likely the first time it

has been photographed in the genus or recorded for *P. unicolor*. This is an interesting example of convergence in behavior and morphology with Leptogastrinae, which have similar behavior reported for multiple species in different genera (Dennis et al. 2012).

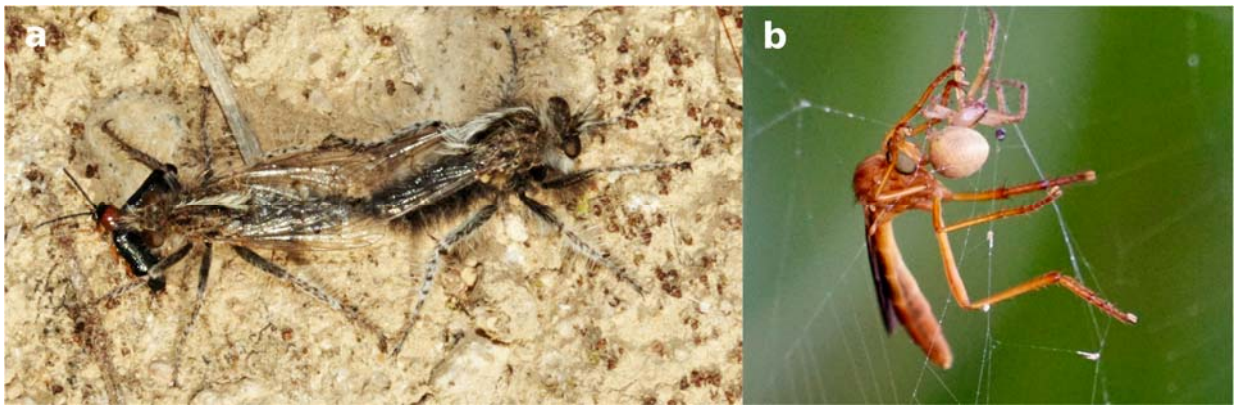

Figure 3. a. *Anarolius sp.* © Christian Langner, reproduced with permission (https://www.inaturalist.org/observations/21325265). b. *Plesiomma unicolor* © Ernest Herrera, reproduced with permission (https://www.inaturalist.org/observations/12292971).

Mydidae on iNaturalist - Even Dankowicz

I first became interested in Diptera on iNaturalist two years ago while revising the Oriental mydas-fly genus *Cacatuopyga*, for which material was rare in collections. No *Cacatuopyga* had been identified on iNaturalist, so I began to search the large fraction of Diptera undetermined past order. Since then, global mydas-fly observations have grown from about 250 to more than 800, but *Cacatuopyga* have not been found. Promisingly, while most Mydidae on iNaturalist have come from the United States and Mexico, a growing portion are being submitted from elsewhere in the world.

Some of the most interesting mydid observations have come from Paco's Reserva de Flora y Fauna in Mazatlán, Mexico, where 56 individuals of at least 6 species have been photographed and submitted to iNaturalist, including three of *Mydas hardyi* (Figure 4a-b). These photos of *M. hardyi* reveal that the anal lobe of the wing is folded below the rest of the wing at rest, which was not recorded in the original description by Wilcox et al. (1989) and may also be unique among Diptera. This may be an adaptation for wasp mimicry.

Two other observations (Figure 4c-d) from the same preserve reveal a seemingly undescribed species of the tribe Mydini, with a beautiful gold mystax, distinct pubescent spots on the thorax, and alternating black and yellow bands on the abdomen. The most similar species occur in the genus *Stratiomydas*, but much better photos (or better yet, a specimen!) would be needed to make a confident determination. *Stratiomydas* and other genera of Mydini were split from *Mydas* by Wilcox et al. (1989) based on arguably superficial characters (Woodley 2009), and some are probably paraphyletic (e.g. Almeida 2013).

Why use iNaturalist?

Most FlyTimes readers are probably familiar with Diptera.info and BugGuide, websites traditionally frequented by dipterists looking to identify fly photos. Rare or otherwise noteworthy flies are occasionally uploaded to these sites as well, so what makes iNaturalist special? First, it

is extraordinarily feature-rich. Much like Twitter, the platform's social networking features allows users to tag others in comments, recruiting experts to observations that they may otherwise miss. Observations can be searched and filtered by a variety of criteria, including whether they have already been reviewed by the user. The platform also has an automatic ID tool, which uses machine learning to predict the taxon identity of an observation based on a training set of research grade observations. This tool helps non-experts more quickly ID their observations, and it thus attracts many new users to the platform. The website/app is constantly being updated, and the developers actively solicit feedback and are quick to implement suggested improvements.

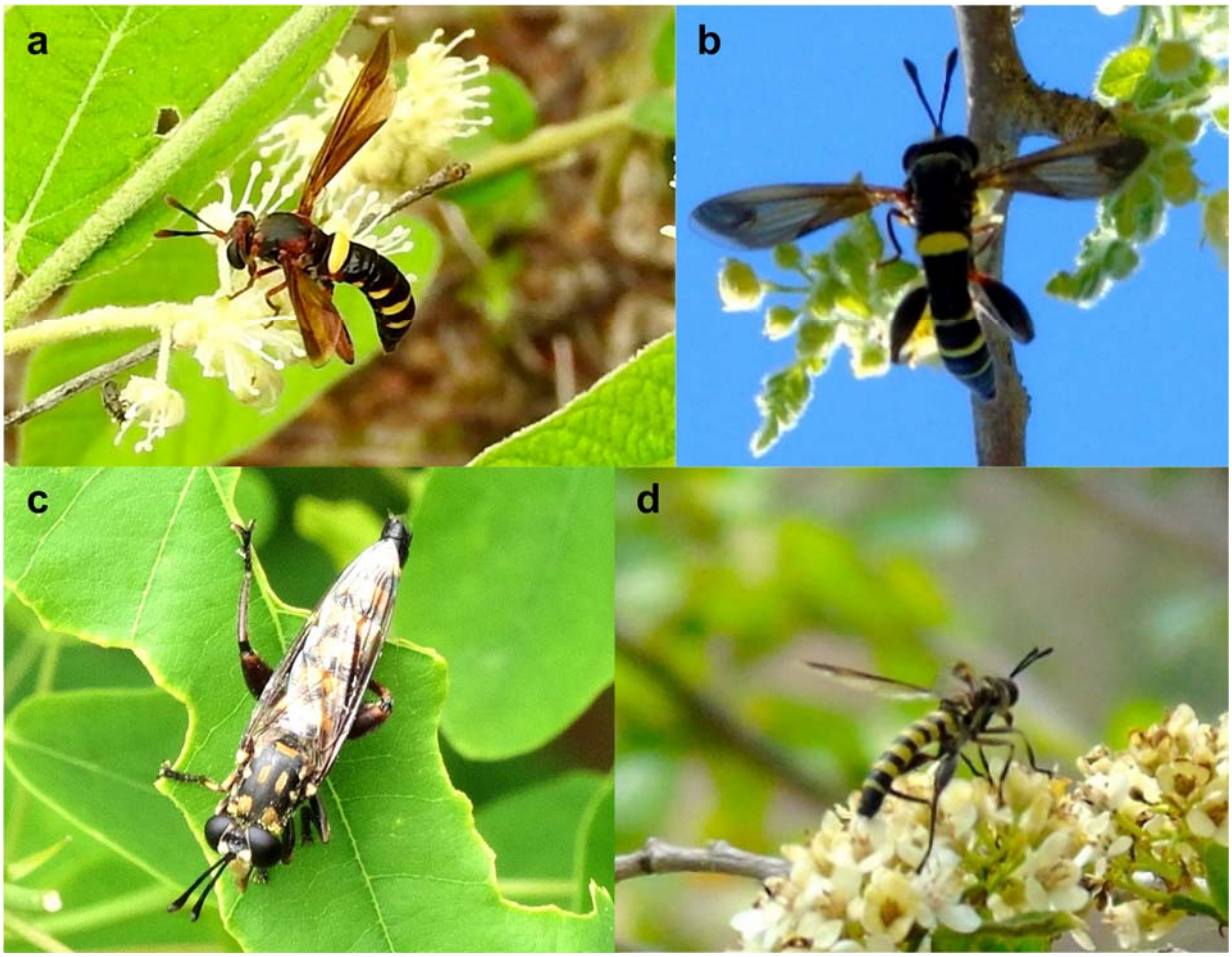

Figure 4: a-b. *Mydas hardyi* (https://www.inaturalist.org/observations/7165755, https://www.inaturalist.org/observations/1804857); c-d. Mydini *sp*. (https://www.inaturalist.org/observations/792245, https://www.inaturalist.org/observations/6636254); All photos © Francisco Farriols Sarabia, reproduced with permission.

One possible hesitation with iNaturalist are the crowdsourced identifications, which allow any two users to make an observation "research grade". While this can lead to initial misidentifications, the community is open to correction. When a recognized expert disagrees with a previous ID, it is often quickly corrected. As a result, iNaturalist is able to facilitate expert involvement while enabling ID of common, distinctive species to be comfortably handled by more amateur volunteers. Another major advantage of this system is that the identity of an

observation defaults to the most specific suggested ID, provided no conflicting IDs are present. Observations can thus be instantaneously identified by one person, without the need for an editor or the submitter to change the name. This has been extremely useful for quickly moving tens of thousands of observations to lower taxonomic levels.

iNaturalist is well-suited for projects involving analysis and manipulation of large natural history datasets. Every verifiable observation has associated metadata: lat long coordinates and their uncertainty, observation date, life stage, sex, etc. Filtering and counting observations is easy, and iNaturalist has a built-in, fully-featured export tool. And there is a lot of data for dipterists to take advantage of; the platform has a much higher volume of observations than BugGuide or Diptera.info. In 2018, there were about 292 ID requests posted to the Asilidae forum on Diptera.info, and about 858 robber-fly observations posted on BugGuide. In that same time period, 10,729 robber-fly observations were posted on iNaturalist! The number of Diptera observations has nearly doubled every year, but unfortunately the number of these which get identified to species level by multiple people ("Research Grade", RG) has not kept pace (Figure 5).

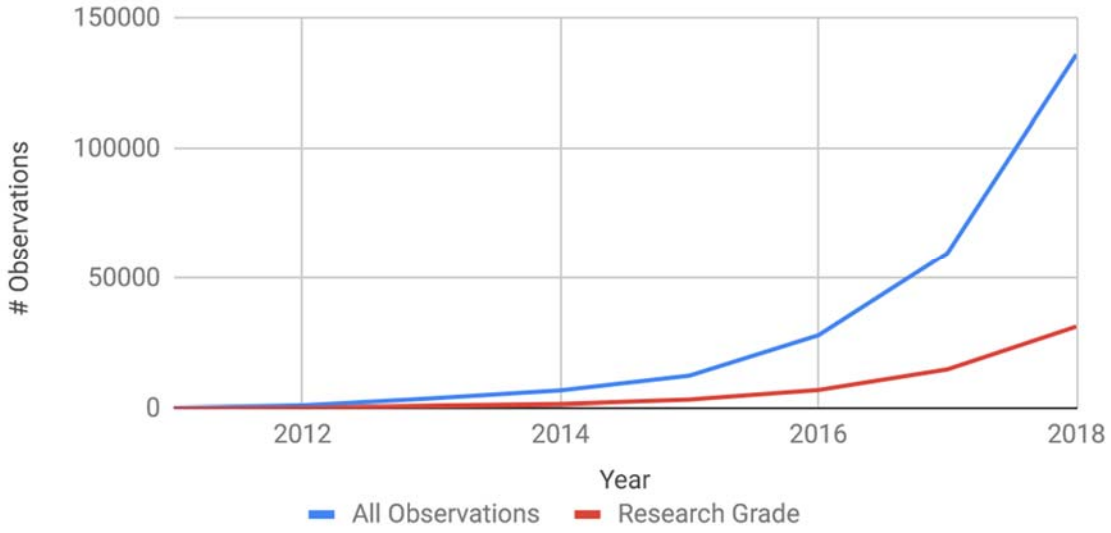

Figure 5. Total number of Diptera observations on iNaturalist over time.

Clearly there is no shortage of dipteran observations, but we are in desperate need of more Diptera experts on the platform. If curated properly, iNaturalist will soon be able to complement natural history collections as a source of large-scale natural history data, particularly from disturbed areas. Furthermore, increasing the number of research grade observations, as well as revalidating existing RG observations, serves to improve the training data for the automatic identification tool. As this machine learning algorithm improves, it is able to more accurately ID a wider variety of taxa, and thus has the potential to increase the rate of biodiversity discovery and the rate at which novel natural history phenomena are recognized.

iNaturalist has been a useful tool in our research and growth as dipterists, and we believe it can serve the same role for all students of Diptera. In addition, providing identifications should be considered a valuable broader impact. Engaging with and educating the iNaturalist community

fosters an increased appreciation and enthusiasm for Diptera, encouraging observers to seek out and photograph ever more flies. Our hope is that many of you will find a place in this vibrant, growing community.

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Wanted: Fresh material of *Cryptochetum iceryae* (Cryptochetidae)

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I recently clarified that the "single spermatheca" of *Piophila casei* is actually the sclerotized ventral receptacle (Kotrba 2019). Now I would also like to clarify the situation for the few remaining acalyptrate taxa with a purportedly single spermatheca. One of these is *Cryptochetum iceryae*, for which a single spermatheca was reported e.g. by Hardy (1980) and McAlpine (1987, Fig. 1). Earlier reports by Sturtevant (1926) and Thorpe (1934), however, indicate an analogous situation as in *Piophila*, i.e. that the respective structure is really the ventral receptacle. Only a new dissection could bring the ultimate proof.

Because in *Cryptochetum* these structures are minute and extremely delicate, maceration of older material is unlikely to generate good results. I am therefore soliciting fresh material of *Cryptochetum iceryae*. The species is originally from Australia, though it is now found in many parts of the world as a parasite of the Cottony cushion scale, *Icerya purchasi*.

Unfortunately, I was not able to find a commercial source. Therefore I would be very thankful, if you could provide female adults of *Cryptochetum iceryae* or closely related species – the fresher, the better – or live pupae, that can be brought to hatch in the lab. Alternatively, dry material or material in alcohol could also work, but the results will be less attractive.

https://nzacfactsheets.landcareresearch.co.nz/factsheet/InterestingInsects/Cottony-cushion-scale-parasitoid.

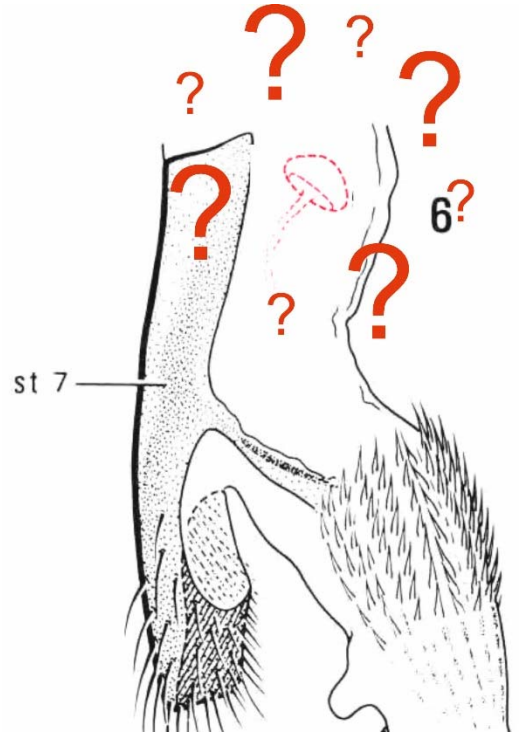

Figure 1. Female genitalia of *Cryptochetum iceryae*, detail from McAlpine (1987), "single spermatheca" in red

Figure 2. A species of *Cryptochetum* from China (*Cryptochetum shaanxiense* Xi & Yang). Photo by S.D. Gaimari.

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Specimen Request: Bee flies in the genus *Lordotus* Loew, 1863

Allan Cabrero

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University of California, Berkeley, Berkeley, California 94720-4780, USA; acabrero@berkeley.edu

I am PhD candidate at UC Berkeley working on the phylogenomics and metagenomics of bee flies (Bombyliidae). For one of the chapters of my dissertation I am working on the molecular systematics, taxonomy and biogeography of the bee fly genus *Lordotus*. These small to large flies range from 4mm to 16mm and are known for their characteristic bright yellow or silver pile (Fig. 1-3). *Lordotus* is restricted to the western United States and Mexico, with a large diversity in the Southwest (29 species). To date I have collected *Lordotus* in Southern California and Arizona, additional specimens from those areas would be a great help. I am also in need of fresh material from other Western states (See list below). They can typically be found visiting flowers or resting along washes and trails, especially on a warm day. If you are out collecting and come across any *Lordotus*, I would appreciate if you could collect some for me. Specimens stored in 95% EtOH are preferred, but recently pinned specimens work as well. Thank you in advance, I appreciate your help!
Specimens from the following states would be a great help towards my project:
Nevada, New Mexico, Utah, Colorado, Texas, Oregon, Idaho

Figure 1 (upper left). *L. luteolus*; Figure 2 (upper right). *L. cingulatus*; Figure 3 (bottom). Lateral and dorsal views of *L. lutescens*

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Continuing Investigations on the Mycetophilidae of Northern Nevada

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Since the beginning of 2017 I have been investigating the Mycetophilidae of northern Nevada, attempting to see what species are here and learn about their biology. I am continuing in 2019 on this work, and in this article I would like to summarize what I have done since the fall of 2018.

During the winter of 2018/19 I identified all the mycetophilids I had caught up to that point – a total of 214 specimens in 11 genera. I attempted to make a list of possible species that might occur in this region, using the Catalog of Diptera of America North of Mexico as a starting point. I found quite a few possible species there and references to them, but also discovered that many of the genera that I did have were not in this catalog. I also found references in the bibliography at the back of the Mycetophilidae chapter in the Manual of Nearctic Diptera. I began looking online for these references, especially using the "Fungus Gnats Online" website. Looking through the papers and the species I was interested in, I found more genera and species that might exist here. Some of the papers I already had on my computer, some that I didn't were easy to download, many others didn't seem to be available online. I might have to make a trip to a university that I know has a good Entomology library to find these. It seems like there has been a lot of work done on these flies in Europe, but relatively little recently here in North America. All the keys to species I have found so far are quite old, and don't cover all the genera I have here. I may have to go through individual descriptions to discover what species I may have collected. It looks like a very large and possibly confusing journey ahead in that area.

In February I gave a talk at the North American Blackfly Conference on what I have found and done with the Mycetophilidae thus far. On February 26, 2019 I started looking for mycertophilid adults and larvae here in Northern Nevada. On that date I put an emergence trap up over an animal burrow. Some insects have emerged from that burrow, but as of April 2, no mycetophilids. I began putting up Malaise traps in various locations on February 28. I want to keep one of them up all year in one location, to get the full emergence of the various species that I found at this location last year, and maybe more that I missed. At one desert site this spring, cows knocked down and trampled one of my Malaise traps, doing some damage. I took this trap to a seamstress/tailor in town, and she repaired all the damage for $10.00. She is used to prom dresses and various types of clothes; this was a first for her.

On March 6 I began using the Berlese funnel (Figure 1) to try to find mycetophilid larvae. So far I have run a variety of leaf litter, mosses, and right now, moldy cattail roots. On March 9 I put some damp leaf litter from a Chinese Elm (Figure 2) in the funnel and collected one adult mycetophilid out of it. It was a female with patterned wings, I had never seen one like this before. My first impression of it was that it was some kind of *Docosia*, but the bristles on the hind coxae were wrong, and the wing venation different. When I ran it through the key in the Manual of Nearctic Diptera it came out to *Acomoptera*, a genus I had not collected here before. I ran it through twice, it came out to *Acomoptera* both times. On March 12 I got two more females from the same source. In these and subsequent specimens there seems to be some variability in the venation of the wings, particularly in the anal veins - some are strong and reach the wing margin, in others they are weaker and do not make it to the wing margins. There also seems to be some variation in the M veins. On March 17-18 I ran some more leaf litter through the Berlese funnel, but found none of these flies. The weather had

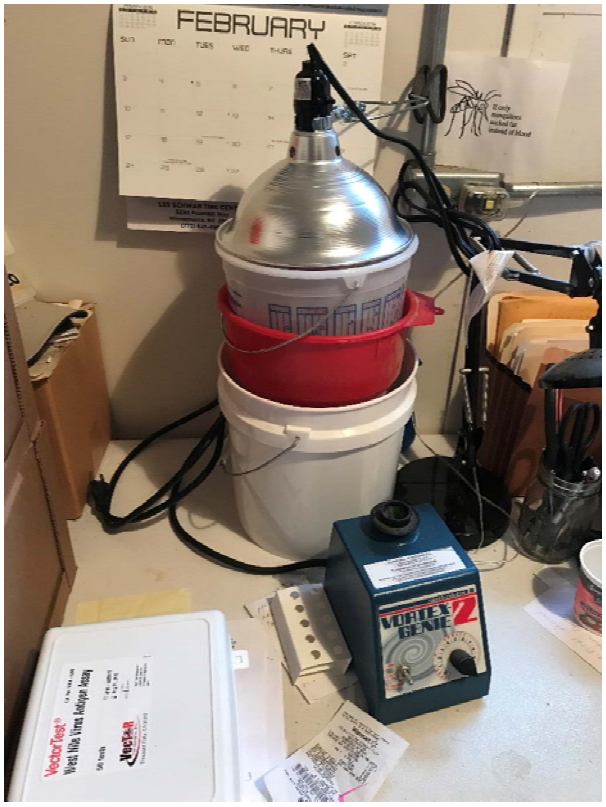

Figure 1 (left). Berlese funnel.
Figure 2 (right). Chinese elm leaf litter.

turned nice and I suspected they had emerged from the leaf litter and were flying around. So I set up a Malaise trap near the leaves, and in 24 hours had caught 41 females and 13 males. Over the remainder of March I found that they seem to go down into the leaves and come out repeatedly. They are easy to catch, they rest on the side of a building and do not try to escape when a vial is placed over them. On March 28 I saw a male and female *Acomoptera* mating on the outer wall of the shed a few feet from the Chinese Elm leaf litter (Figure 3). The male brought his abdomen under him and joined the female, propping himself up on his four hind legs. His front legs were held out in front of him, and his antennae were held vertically. The female was in a resting position, and neither moved in the several minutes I observed them.

I found one specimen of this fly in Buffaloberry (*Sheperdia* sp.) leaf litter collected in Paradise Valley, about 40 miles to the north of Winnemucca. Otherwise I have found them nowhere except the one pile of dead leaves under the Chinese Elm. I have sampled other leaf litter as close as 30 meters away and found nothing. The adults are out flying around on every nice day. The only flowers currently in bloom are those of the Burr Buttercup, *Ceratocephala testiculata*. There is a bloom of thousands of these flowers currently right up next to the leaf litter I have gotten adult *Acomoptera* out of, but so far have not seen even one of them feeding at these flowers, which are being visited by a variety of bees and flies.

As to other species of mycetophilids, I have thus far this spring caught no larvae and only one adult. The adult was an *Exechia* sp. I took a sample of wild rose and willow leaf litter next to the trap stand where a dry ice baited EVS trap used in mosquito surveillance caught a number of this genus last year (Figure 4). When I ran the leaves through the Berlese funnel I caught one adult female. Mushrooms have just started appearing around here, I will be trying to find larvae in them soon.

I feel mystified as to where the species of mycetophilids I have found here are overwintering, and what stage in their life cycle they are doing this. I know now that some of them are doing this as adults. Maybe some of them are doing it as pupae, which might be hard to find. I have seen no larvae


Figure 3 (left). Mating *Acomoptera*.
Figure 4 (right). Overwintering site for *Exechia* sp.

so far this spring. I have run material taken at locations where I have collected adults, so far this has yielded no fruit except the one *Exechia*. I feel like a blindfolded person, groping her way around and by chance only finding what she is looking for, many other things passing her by. I am very aware that Spring is marching on, and that I am probably missing a lot of what is happening. But I feel greatly energized by what I have found this spring, excited, and I am going to fill my spare time in pursuit of an understanding of these interesting flies.

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Polymera **crane flies in the Florida Keys (Limoniidae) – a crane fly cranium cracker**

Lawrence J. Hribar

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Two strange-looking male flies were collected in a dry ice-baited mosquito trap placed on Long Point Key on the 6th of March 2019 and retrieved the following morning. They were black with white hind tarsi and very long antennae banded with white on each flagellomere (Figures 1 & 2). Running them through the keys in the *Manual of Nearctic Diptera* took them to Tipulidae. A bit of searching via the Internet led to the Bug Guide web page where I found photographs of *Polymera rogersiana* Alexander 1929, Limoniidae. It was obvious that the flies were a *Polymera* species, but were they *rogersiana*?

Figure 1. Point-mounted crane fly from Long Point Key, Florida.

My Internet search revealed that there are two *Polymera* species known from Florida, *P. rogersiana* and *P. georgiae* Alexander 1911. Furthermore, Alexander (1916, 1948) reported that *Polymera obscura* Macquart 1838 was found in Cuba and "may range into the Miami section of Florida." *Polymera rogersiana* Alexander was described from specimens collected in Alachua County, Florida. The wings have "clearly defined dark brown spots" (also described as, "clearly delimited dark brown spots") on some veins (Alexander 1929). Rogers (1933a) lists only Alachua County as

the extent of geographic occurrence. The Bug Guide website includes a photo of a specimen from Charlotte County, Florida. Immature stages are associated with disintegrating limestone substrates (Rogers 1933b.)

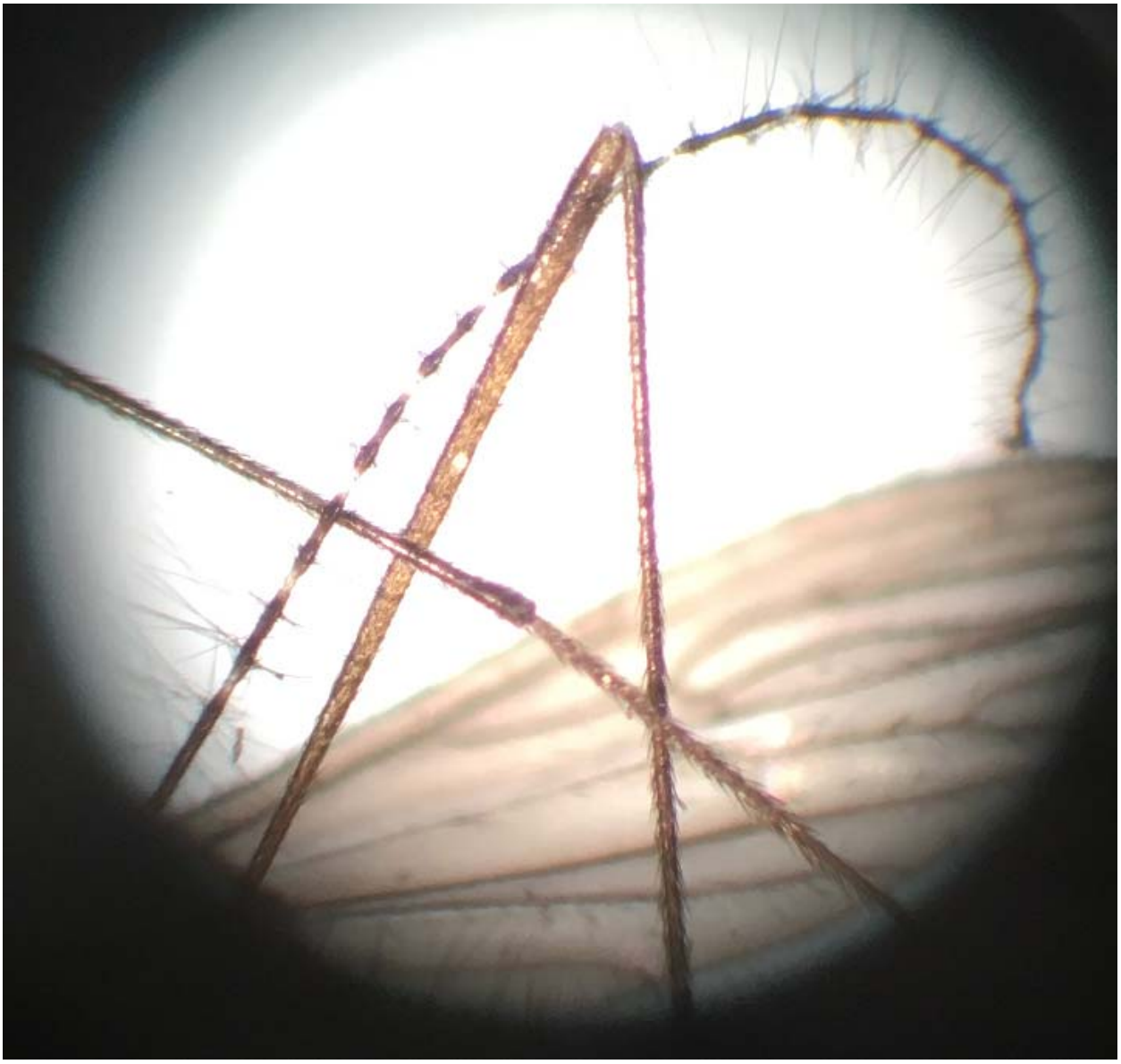

Figure 2. Antenna with white bands and whorls of long setae.

Polymera georgiae Alexander was described from specimens collected on St. Simon's Island, Georgia (Alexander 1911). The currently known distribution is Alachua, Broward, Collier, Dade, Glades, Highlands, Levy, Liberty, Manatee, Orange, Palm Beach, Sarasota, and Suwanee Counties in Florida, as well as Georgia and South Carolina (Alexander 1916, Rogers 1933a).

The wings of all three species have been illustrated. Alexander's (1911) figure of *P. georgiae* shows no spots on the wing. Alexander (1913) illustrated the wing of *P. obscura* depicting the large spots on the wing. Alexander and Byers (1981) illustrated the wing of *P. rogersiana*; the wing spots on this species are drawn as much fainter but still obvious. The specimens from Long Point Key do not have

those spots on the wing. It is likely that the specimens are *P. georgiae* but the wing spots in the photos of *P. rogersiana* on the Bug Guide site are not easily visible due to the wings being slightly out of focus. In the four days since the flies have been collected the hind tarsi have changed from white to a pale yellowish color. To be safe, I'm sticking with definitely *Polymera*, probably *georgiae*.

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A Snow Crane Fly Making Good Use of His Halteres

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While skiing along one of my favourite trails in the Ottawa region in mid February of this year, I came across this male Snow Crane Fly (*Chionea valga* Harris) clambering rather clumsily and quickly over the snow. I took several pictures. My I-Phone surprised me with the picture above showing the halteres spread out, seemingly for balance. The going was rough for this tough dipteran; the snow was quite uneven. These halteres seem to be inflated; they look much bigger here than on my pinned or alcoholic specimens. In those specimens the halteres lie flat along the sides of the abdomen.

Chionea valga Harris, male, Stony Swamp Conservation Area, Ottawa, Ontario, Canada, 21.ii.2019

There are sixteen species of *Chionea* (Limoniidae) in North America and only one, rather widespread species occurs in the Ottawa region. These flies are completely wingless and are thought to avoid predators by emerging in winter.

The hind femora are usually quite stout and aid in navigation, as seen in the image on the left. What I actually saw is the picture on the right. A camera can make quite a difference!

A half hour later I stumbled across a female but she clambered away before I could get out my I-phone. One wonders how these flies can find each other; they are often spotted miles apart, however, I have, in years past, seen them mating on the snow.

I am always on the lookout for Snow Crane Flies when skiing and the temperature is hovering around freezing. George Byers, who introduced me to the world of crane flies, wrote a splendid monograph on this interesting genus.

Byers, George W., 1983. The crane fly Genus *Chionea* in North America. University of Kansas Science Bulletin, 52(6): 59-195.

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Queensland Museum at the World Science Festival Brisbane

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The World Science Festival is a public entertainment concept conceived in New York where it has run for more than a decade. Since 2016, the Queensland Museum Brisbane Australia (QM) has coordinated an annual series of companion events under the title *World Science Festival Brisbane*. This year's festival took place in March and it had ancillary events running in the country centres of Gladstone, Ipswich, Chinchilla, Townsville and Toowoomba. All the QM entomology and arachnology staff were busy running displays, talks, and demonstrations during this time.

This year Entomology had a full weekend to show our collection off, with over 21,000 people through the QM doors each day. Christine Lambkin (Curator) didn't stop talking the entire weekend and we were all amazed at her stamina. While discussing fly research and presenting taxonomy displays she had a few challenges for the visitors -Where's my Mummy? (matching adults with immatures) and Which one is the 'Bug'? Susan Wright (Collection Manager) had two of our Dodd drawers on display including The Golden Shield which caused many discussions about how the colour lasts, how colour is formed and perceived and "Where did all the Christmas beetles go?" Karin Koch (Collection Manager) had our Giant Insects on show and Chris Burwell (Curator) had the dragonflies and some New Caledonian butterflies. We were gratefully assisted by Vivian Sandoval, one of our honoraries. Chris Burwell also talked about the museum's dragonfly collection and local species for his "Meet the Curator" talk and Susan also spoke about the insect collection during her talk "Let's Talk: A Bugs Life".

An intense weekend talking insects to the crowd at World Science Festival Brisbane. Photo Susan Wright, QM.

Diptera got a special Festival guernsey when a laser light show was held projecting giant fly images on to the sides of the William Jolly Bridge in downtown Brisbane. The fly images taken by Geoff Thompson (QM Collection Imager) using a digital imaging system included Bryan Lessard's favourite soldier fly, the opal galaxy '*Lecomyia notha'* and Chris Lambkin's Bombyliid (Anthracinae) and were projected over three nights – unfortunately some of the shadows and spaces on the supports of the bridge meant that especially the calliphorid (*Amenia*) head appeared a little weird.

Diptera Images on William Jolly Bridge, Brisbane for WSFB. Photo credit: Geoff Thompson (QM).

The image of the '*Lecomyia notha'* specimen (figure right) from Lamington NP IBISCA site 700A, was focus stacked from a total of 202 source images from the Canon 7DMkII, "Ocellus" microscope 10X in four stacks with Zerene stacker software, then merged in Photoshop. That image also featured on the front cover of the WSFB Program Guide.

Dipteran studies at QM continue with several visitors: Dr Keith Bayless who is starting a Schlinger postdoc at ANIC CSIRO Canberra and popped in to look at some families of acalyptrate flies and ended up borrowing a few specimens including one which had two of our fly experts stumped as to which family it was; Dr Bryan Lessard (aka Bry the Fly Guy) from ANIC is starting his new postdoc working on describing new mosquito species; and Dr Silvia Ciocchetta from University of Queensland is starting her new postdoc using our collection to brush up on her mosquito identification skills in readiness for a survey she will be conducting soon. Not to mention our more regular visitor, Greg Daniels, ex- UQIC curator, who specialises in the taxonomy of robber flies (Asilidae).

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New (5th) edition of Merritt, Cummins & Berg (An Introduction to the Aquatic Insects of North America) available soon

Rich Merritt

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For those interested, I would like to announce that An Introduction to the Aquatic Insects of North America will be available in a new 5th edition for Summer and Fall 2019! This text serves as a standard guide to the genera of the immature and adult stages of aquatic and semi–aquatic insects of North America. It offers information on the distribution, tolerance values, trophic relationships, and functional adaptations of aquatic insects. The new edition features over 7000 references, a NEW chapter ("Aquatic Insects of North America: A Photographic Overview" by Greg Courtney and Steve Marshall) and significant revisions to chapters on Ephemeroptera, Plecoptera, Trichoptera, Coleoptera, Diptera* and Tipuloidea. In addition, the book will include revised and expanded keys, as well as new figures to taxonomic chapters, and a digital version of the book that will be available in Fall 2019. The book can be ordered from Kendall/Hunt Publishing Co., Dubuque, IA.

*Added by Greg Courtney (Department of Entomology, Iowa State University, Ames, Iowa 50011, USA):

Significant changes to the Diptera chapter(s) include: (1) The two chapters "Larvae" and "Pupae & Adults" have been combined into a single chapter; (2) Additional genera and new figures have been added to the keys and ecological tables for several families; (3) Keys to certain taxa (e.g., Psychodidae, Ceratopogonidae, and Empidoidea) have been simplified and/or significantly updated to reflect current classifications; (4) All figures have been rearranged taxonomically (vs. previous revisions, which often added all new figures to the end of the chapter); and (5) The text and keys reference many images of live Diptera in the new "Photographic Overview" chapter by Courtney & Marshall.

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Author of forthcoming book on flies seeks your input

Jonathan Balcombe

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I am an ethologist and author of several popular science books, including the New York Times bestselling *What a Fish Knows* (Farrar, Straus & Giroux, 2016). I am currently seeking content for inclusion in a forthcoming book on Diptera.

WINGED VICTORY: The Lurid Lives and Startling Successes of Flies (working title)
is under contract with Penguin Press, expected publication sometime in 2020. I aim to present a glittering extravaganza of the improbable, audacious, and miraculous ways that flies get on in a world that otherwise only seems to be run by humans. Topics include flies as aerialists, pollinators, pests, parasites, predators, food web members, janitors, crime-solvers, botanists, and phlebotomists. Drawing on biology, history, culture, and personal experiences (mine and yours), this book inspires wonder at the diversity, complexity, and success of flies, and raises awareness that our very existence hinges on a network of interacting species. If you have any scientific discoveries or entertaining anecdotes that you'd like to share, please contact me, and thank you in advance.

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Preliminary evaluation of a portable 'in-home' use ovitrap (STUCK®) for adult mosquito surveillance and control

John R. Wallace[1], Phillip Hutchinson[1,2] and Kayli Thomas[1]

[1] Department of Biology, Millersville University, Millersville, PA 17551

[2] Novelty Manufacturing Inc., Lancaster, PA 17603

Introduction

There are more than 100 arthropod-borne or arboviruses that infect humans (Karabatsos 1985). Previous reports have cited World Health Organization estimates of 50 million new cases of dengue annually with more than 2.5 billion people who live primarily in tropical regions at risk of becoming infected with a dengue viral strain (Nathan and Dayal-Drager 2007; Snetselaar et al 2014; WHO 2014). With the global and often human mediated expansion of many mosquito species such as *Aedes aegypti* and *Aedes albopictus* (Diptera: Culicidae) as well as the disease-causing pathogens including arboviruses that cause dengue, chikungunya, Zika, and West Nile, their control is challenging because of their reproductive life history strategy of being container breeders (Womack 1993; Benedict et al 2007; Bonizzoni et al 2013 and Parker et al 2017; Kraemer et al 2019).

Over the last two decades, the identification of cost-effective alternative traps and strategies, especially for poor countries dealing with such expected increases in arboviral infections by *Aedes aegypti* and *albopictus* have led to the utilization of more passive surveillance traps such as oviposition traps or ovitraps (Maciel de Freitas and Loruenco de Oliveira 2011; Mackay et al 2013; Snetselaar et al 2014). These types of traps target gravid female mosquitoes pursuing containers in which to lay eggs (Fay and Elison 1966) and have utilized a suite of treatments from water to visual cues, natural odors from plant infusions to synthetic odors (Ritchie 2001; Ritchie and Long 2003; Ritchie et al 2003; Barbosa et al 2007; Barbosa et al 2010; Maciel de Freitas and Loruenco de Oliveira 2011; Mackay et al 2013; Snetselaar et al 2014).

Current ovitrap strategies include those that passively target multiple life stages (Snetselaar et al 2014; Harburguer et al 2016; Parker et al 2017) to those that are specific to egg-laying females (Barbosa et al 2007; Gama et al 2007; Facchinelli et al 2007; Antonio-Arreola et al 2011; Zeichner and Debboun 2011; Mendonca de Santos et al 2012; Mackay et al 2013). Several of these ovitraps utilize toxic inorganic chemicals to kill larvae and/or adults (Antonio-Arreola et al 2011; Zeichner and Debboun 2011; Mackay et al 2013; Snetselaar et al 2014; Harburguer et al 2016) and others use natural, organic substances such as canola oil (Johnson et al 2017), synthetic pheromones (Barbosa et al 2007) or sticky tape or glue (Gama et al 2007; Facchenelli et al 2007; Mendonca de Santos 2012).

While some of the traps on the market today are for indoor use, several utilize toxins, are comparatively expensive and aesthetically displeasing for use indoors. Whereas, many of the traps developed to date are designed for outdoor use and surveillance. Novelty Manufacturing Company of Lancaster, PA, produces PVC and polyethelene flower boxes, patio planters of durable composit and metal materials. Novelty Manufacturing produced an inexpensive ovi-trap aptly named STUCK®, I was asked to test the efficacy of this trap. The purpose of this preliminary study was to evaluate the efficacy of a portable, chemical-free, in-home ovi-trap for container-breeding mosquito (e.g., *Aedes aegypti*) surveillance and control. Our objectives included: 1) compare different attractants as a

potential mosquito lure; 2) determine trapping efficacy of male v. female mosquitoes; 3) evaluate container design by comparing the container trap to a separate wire grid trap.

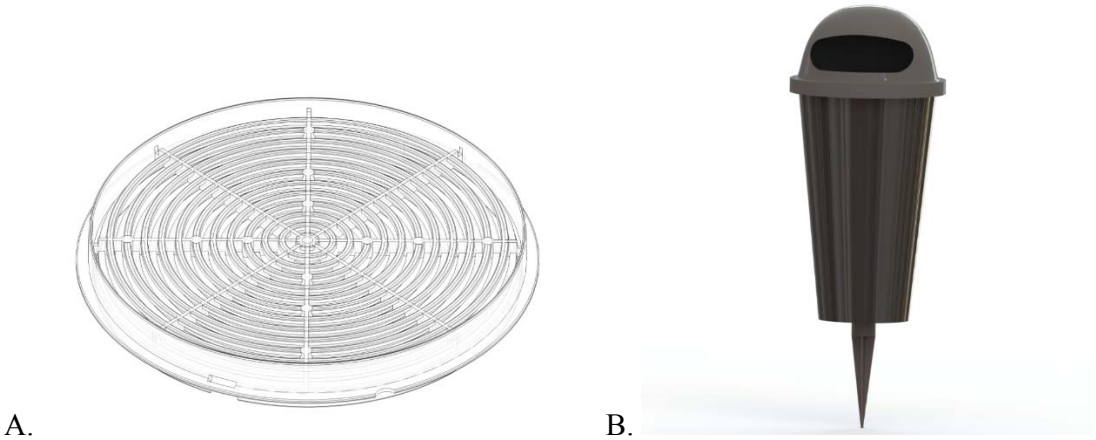
Methods and Materials

Adult mosquito Source

All experiments were carried out using adult female *Aedes aegypti* mosquitoes, which were procured from Benzon Research in Carlisle, PA. Mosquitoes were initially maintained in 30x30x30 cm mesh cages, until the later stages of testing, where they were maintained in 61x61x61cm mesh cages. In both locations they were kept at 26°C +/- 2°C, with a light cycle of 14:10 h (L:D), and 60% RH +/- 10%. All mosquitoes were provided a 10% sucrose solution on cotton. Females were provided bovine calf blood within sausage casing heated to 37°C until satiated (approximately 20 minutes) 48-72 hours prior to the beginning of a trial.

Experimental Design

The oviposition trap (STUCK®) being tested in all experiments is a blow-molded container of high-density polyethylene (750ml volume, 23cm height X 10cm grid width) that was designed to resemble a container habitat and the double grid that rested on each container was coated with Tanglefoot® glue, an adhesive intended to ensnare mosquitoes (Figure 1). The double grid lid was designed to capture resting mosquitoes on the top grid and dropped eggs on the top and bottom grids. Each trap was equipped with a hooded cap with an oval opening on one side to facilitate mosquito entrance. The trap design was recommended by J. Wallace to mimic a natural container for *Aedes aegypti* or *Aedes albopictus* as described by O'Meara et al documenting *Ae. albopictus* invasions in Florida cemeteries. With this recommendation, Novelty Manufacturing modified an existing polyethylene cemetery vase they commercially sell and designed the grid trap and created a hooded cap according to the description provided by J. Wallace.



A. B.

Figure 1A. Double grid design for ovi-trap; B) Image of outdoor, STUCK® trap.

All experiments were conducted inside flight cages (61x61x61cm mesh cages). Approximately 100 blood-fed, gravid females were removed from rearing cages via a mechanical aspirator and placed into the experiment cages. Throughout all experiments, cages were maintained at 26°C with a light cycle of 14:10 h (L:D). Traps of varying treatments were placed randomly in opposing corners of the cage to limit trap location interactions between variables being tested. In all experiments, treatments were compared by means of attracting and ensnaring female mosquitos, measured by a count of mosquitoes present on the grid of a trap at the end of a trial.

Objective 1: Attractant efficacy

Most ovitraps utilize some sort of organic enrichment included with the water inside the ovitrap containers, this enrichment is designed to serve as an attractant for adult, gravid mosquitoes (Trexler et al 1998, Ponnusamy et al 2010). Ong and Jaal (2015) found that Caproic acid attracted significantly more ovipositing *Ae. aegypti* mosquitoes compared to control substances. However, they found that Caproic acid was an attractant at low concentrations and a repellant at higher concentrations (Ong and Jaal 2015). Novelty Manufacturing infused Caproic acid within the glue substance used to ensnare egg-laying mosquitoes. For this objective, we tested the efficacy of this infusion with the glue used using three concentrations of Caproic acid (0.1ppm, 1ppp, 10ppm and a control (no acid infusion). The protocols discussed above for mosquitoes will be used as described above. Therefore, we will test three concentrations of Caproic acid (0.1ppm, 1ppm, and 10ppm, control = no Caproic acid) (Figure 2). There were (n = 6 replicates/treatment. Trap grids were checked after 48 hours and all captured mosquitoes were enumerated.

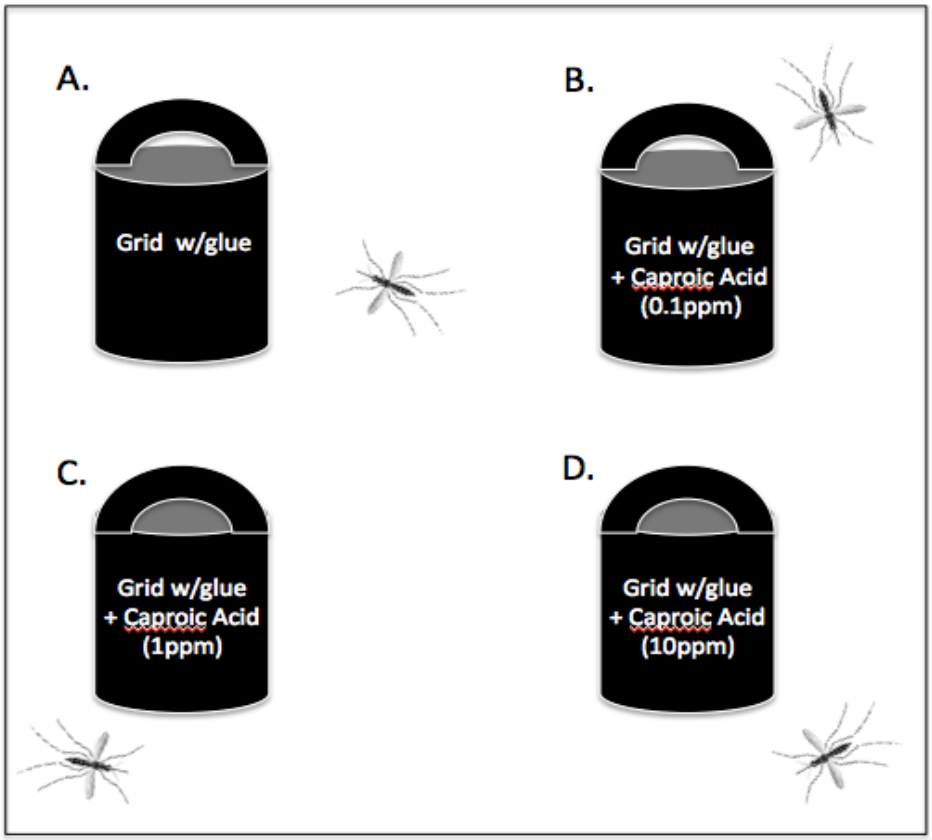


Figure 2. Schematic of experimental set-up for adult oviposition trials with ovi-trap placement inside adult flight cages. A) control glue; B) glue with Caproic acid at 0.1ppm; C) glue with Caproic acid at 1ppm; D) glue with Caproic acid at 10ppm.

Objective 2: Male v. Female trap efficacy

In order to test whether the trap would be effective in trapping male mosquitoes as well as females, despite their lack of response to a potential oviposition site, 100 mosquitoes of mixed sex were placed in cages with the oviposition traps (n = 12 replicates/treatment). Traps were checked after 48 hours and ensnared mosquitoes were examined for sex.

Objective 3: Container Design
The attractive nature of the trap was a result of the design of the blow-molded container. Preliminary results indicated that water additions with a hooded cap outperformed adult mosquito capture nearly three or four to one compared to traps with lure or no hooded caps (Wallace and Thomas, Unpublished data). However, to determine the efficacy of this design of the oviposition trap was tested against only the sticky grid portion of the trap mounted on a free-standing wire base (n=12 replicates/treatment) (Figure 3). Traps were checked after 48 hours for captured mosquitoes.

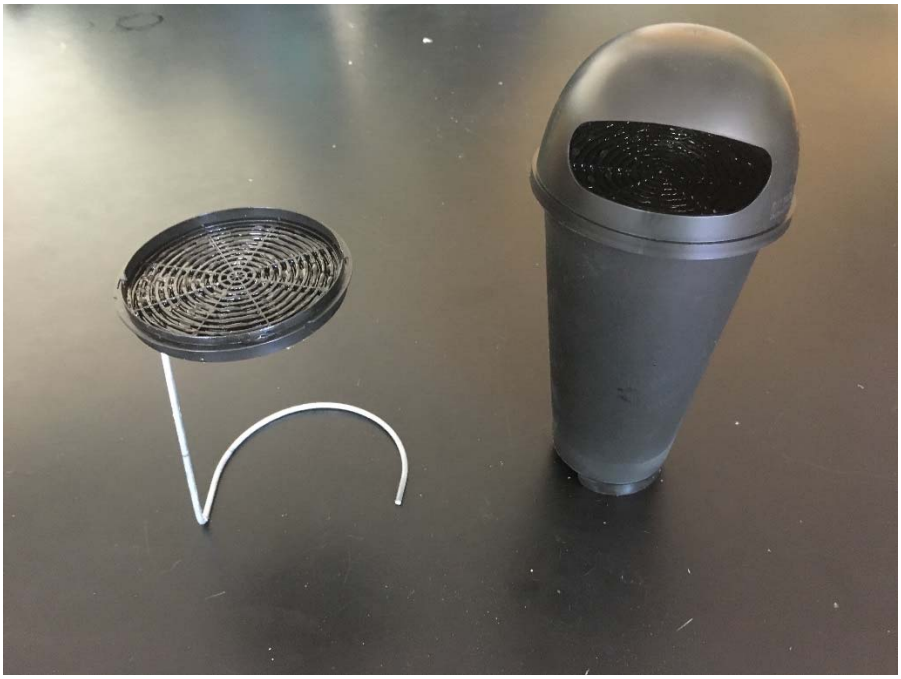


Figure 3. Sticky grid on wire coil (left) and grid inside STUCK® trap (right)

Statistical Analysis
Measured counts of captured mosquitoes were recorded at the end of each trial, and in experiments measuring preference between treatments percentage captured by each type was determined. Computational analysis was performed using StatsPlus statistical software program. Homogeneity of variances was tested by performing a 2 Sample F-Test on all data; a homoscedastic Two-Way T-Test assuming equal variances was performed on data that were homogeneous, and a heteroscedastic T-Test assuming unequal variances was performed on data that were not homogenous. Capture percentage data were arcsin transformed for all comparisons.

Results
Objective 1: Attractant efficacy
Previous studies indicated that the ovi-trap captured significantly more mosquitoes using tap water without yeast infusion compared to those with yeast infusion as an attractant (Wallace and Thomas unpublished data). Caproic acid was tested at varying concentrations with no statistical difference found between 0.1 ppm and control, ($t= 0.50$; $p > 0.05$), however both 1.0 ppm ($t=2.47$; $p < 0.05$) and 10 ppm ($t=2.53$; $p < 0.05$) were found to be significantly more effective in capturing mosquitoes than the control (Figure 4). There was no significant effect of trap location on numbers of mosquitoes trapped.

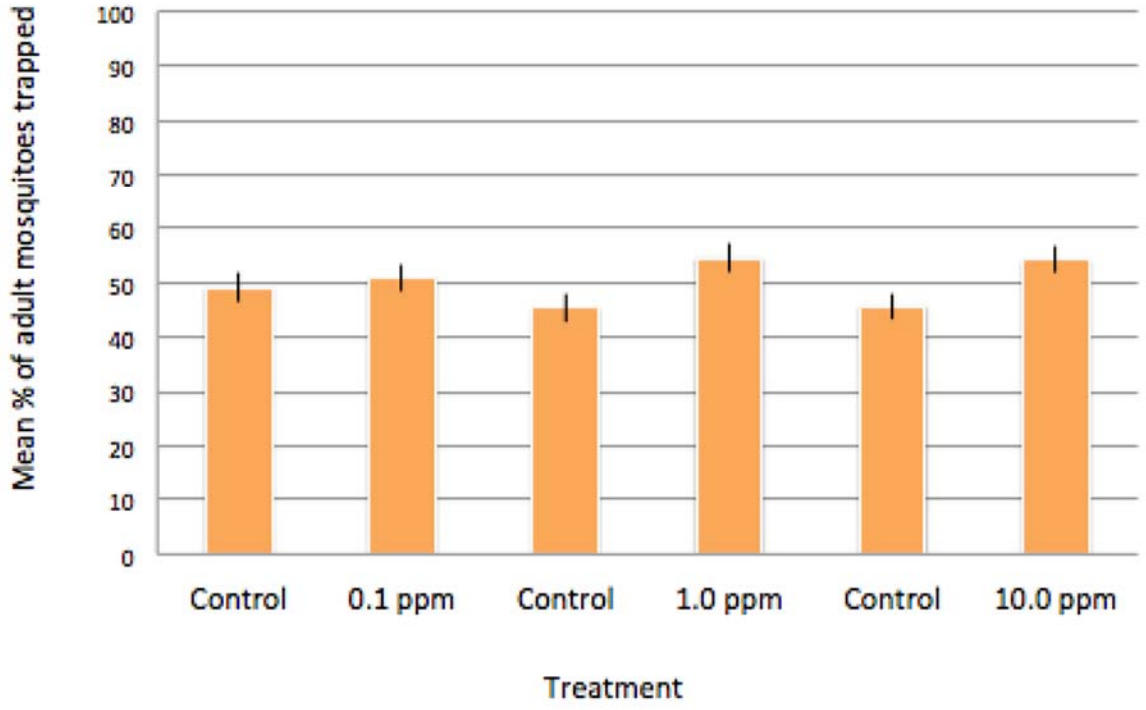


Figure 4. Mean percentage of adult mosquitoes trapped during the attractant assay comparing three concentrations of Caproic acid against a control (no addition of Caproic acid).

Objective 2: Male v. Female trap efficacy
While the term ovi-trap implies a trap designed to capture gravid female mosquitoes, this objective addressed the possibility of the trap attracting and culling male mosquitoes from the environment. The effectiveness of capturing males and females was tested and surprisingly, we found no significant difference in the numbers of males collected v. females ($t= 0.998$; $p > 0.05$).

Objective 3: Container Design
The design of the container was tested by comparing numbers of trapped mosquitoes between the container with sticky grid, and a sticky grid suspended by a metal wire. The container with sticky grid was found to be significantly more effective at capturing mosquitoes by a wide margin ($t= 16.61$; $p < 0.05$) (Figure 6).

DISCUSSION
Maciel de Freitas and Lourenco de Oliveira (2011) posed the question of whether targeting key containers could reduce *Aedes aegypti* population densities and recommended that new approaches be developed to control vector-borne pathogens that cause diseases such as dengue. Such encouragement has spawned the production of numerous traps targeting gravid female mosquitoes, many of which employ a sticky substance to capture mosquitoes (Faccenielli et al 2007; Mendonca de Santos et al 2016). Vector control for container breeding mosquito species in many developing countries is problematic due to the affordability, complexity and toxic nature of several traps on the market. The purpose of this study was to conduct a preliminary study on the efficacy of a new, affordable and most importantly easy-to-use portable sticky trap STUCK®. Contrary to other studies

that have revealed positive results utilizing a hay infusion (Trexler et al 1998; Ponnusamy et al 2008; Parker et al 2017), our earlier studies found that yeast infusion was not as efficacious as tap water only (Wallace and Thomas unpublished data). In fact, in this study, we showed that the infusion of a mosquito semiochemical such as caproic acid into the composite materials used to make the trap served as a potential lure for adult mosquitoes, similar to findings by Ong and Jaal (2015). Because the STUCK® trap is effective with a caproic acid infusion, using it with tap water only reduces the steps involved for the user and simplifies the implementation of the trap for in-home use and control of container-breeding mosquitoes.

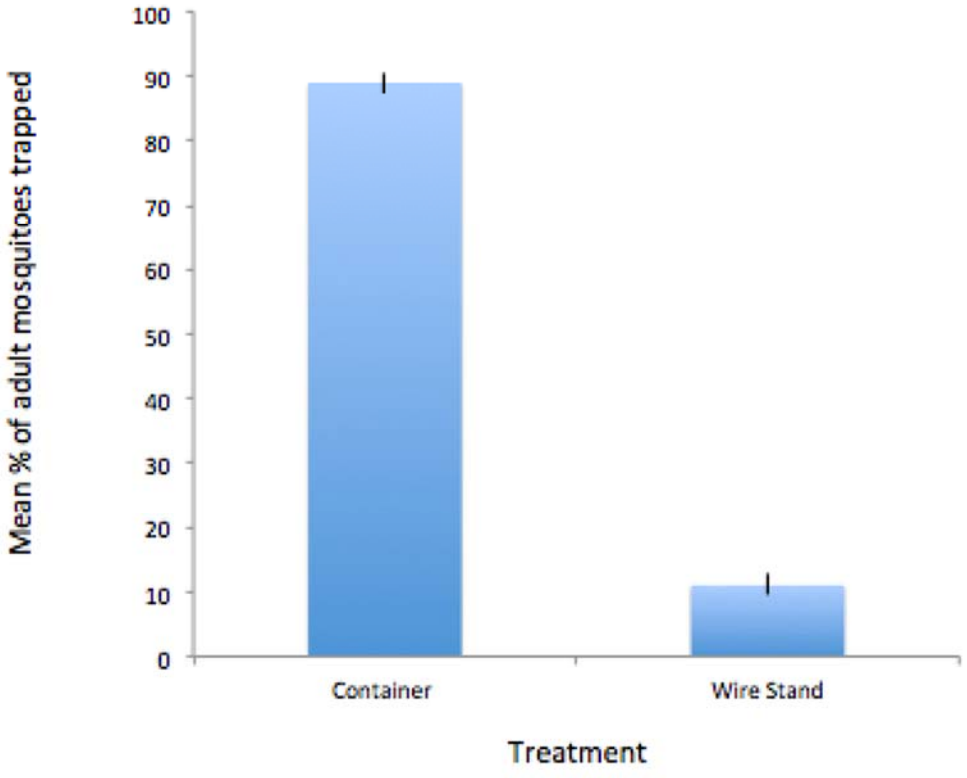


Figure 5. Comparison of the mean percentage of mosquitoes trapped on a container with sticky grid v. a wire stand with sticky grid.

The wide spectrum of ovitraps on the market today have primarily been tested with gravid female mosquitoes, afterall, the name of the trap implies oviposition or 'egg-dumping' which inherently targets female mosquitoes (Snetselaar et al 2014). The use of sterile-insect methods to control mosquito-borne diseases directly reduces the number of males available to mate with blood-fed mosquitoes and indirectly controls the spread of vector-borne pathogens (Alphey et al 2010). To our knowledge, current traps on the market or tested in the literature were not evaluated for their attractiveness of male mosquitoes and the removal of male mosquitoes from local populations. Our study found that the STUCK® trap was not selective for female or male mosquitoes. Trap capture was equally effective for male and female mosquitoes and offers a novel, non-toxic portable trapping method to reduce adult mosquitoes in general, not just female mosquitoes. Whether male mosquitoes were looking for mates or a dark, protective area to rest, their attraction to the STUCK® trap design is unique to other traps that have been tested on the market.

The general design for ovitraps tested in the literature is very similar in terms of color, (typically black) and shape (typically cylindrical), however, the modification of an already commercially available cemetery vase is consistent with published field research indicating the effective utilization by mosquitoes of cemetery vases in the rapid spread of a major dengue vector, *Aedes albopictus* (O'Meara et al 1992). The method of capture, a sticky grid was tested against a grid inside a container resembling anthropogenic/natural container habitats. We found that the grid placed on a wire coil would not attract and capture mosquitoes as effectively as a grid inside the STUCK® trap. This finding suggests that the trap shape, color and resemblance to oviposition sites in nature may be key to the efficacy of the trap in general, especially factoring in water lures or other types of bait attractants.

ACKNOWLEDGMENTS

We would like to thank Novelty Manufacturing for partnering with us on this collaboration and providing funding and equipment necessary for this project. We would also like to thank Benzon Research Inc. for supplying us with the adult mosquitoes used in the experiments. In addition, this research was supported in part by Millersville University through the Biology Student Investigator and Student Research Grants.

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Early high-speed Super 8mm film of larva Simuliidae filter feeding

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At the 17th North American Black Fly Association (NABFA) meeting in Twin Falls, Idaho, USA, in February, I showed a digitized video of high-speed Super 8mm film of larval black flies filter feeding—done in the late 1970's to early 1980's. Numbers of people wanted access to the files. There are two options. The first is via my ResearchGate site where it is deposited https://www.researchgate.net/profile/Douglas_Craig/publications under "Presentation" (see down left hand side). That will get you to the title of the video. Double click on the file title for access to download. The published paper regarding that is also available there. The file is sizable. Then for those who might want more of such material (more hydrodynamical in nature), other videos can be found on DropBox https://www.dropbox.com/sh/2exgk0poivwnrr3/AABRpkrnw20kVoz6M9mr7KPha?dl=0. Be warned, some of the files are massive. Use the material as you wish—it could be of some use in teaching.

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"How Time Flies, Celebrating the 80th birthday of Dr. John C. Deeming"

Neal L. Evenhuis[1] & Stephen D. Gaimari[2]

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We have received and can make available a very nice 36-page PDF document celebrating the 80th birthday of our colleague Dr. John C. Deeming. The birthday tribute was presented at the Department of Natural Sciences, National Museum Wales in Cardiff, on 30 April 2019. Please contact one of us and we would be happy to email you a copy! A few details about the document are below.

The tribute starts with a foreward by Mike Wilson, the Head of Entomology at the Museum, who sets up the purpose of this document, to show the feelings of affection and respect that all of the contributers have for John. After a brief biographical account, there are lists of his 100+ publications (dealing with 27 different dipteran families), the 150+ new taxa described by him, and 21 of the species named in his honor. After this is the bulk of the compendium, starting on page 12, a series of tributes and reminiscences from more than 30 of his friends and colleagues. After this, is a wonderful spread of photographs through the years, and then wrapping up with a selection of John's finest poems. Really this is a very fun and interesting read, and shows what an influential and well-regarded person John Deeming is, so if you want to read it, please ask one of us to send you a PDF.

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MEETING NEWS

North American Dipterists Society, 2019 Field Meeting
3-7 June 2019
Bull Shoals Field Station, Missouri
Final Announcement

Greg Courtney[1] & David Bowles[2]

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This is a final reminder for the next NADS field meeting, which is scheduled for 3-7 June, 2019, at Bull Shoals Field Station (BSFS). BSFS is in southwestern Missouri, a short drive from Branson and near the Arkansas border. The station and surrounding areas offer a wide variety of ecosystems, which serve as habitat to a diverse assemblage of Diptera. The station has Ozark upland forests (oak-hickory dominant), glades, grasslands, old fields, managed food plots, as well as aquatic habitats. Aquatic habitats include naturally occurring woodland ponds, man-made ponds, streams, springs, and a large reservoir (Bull Shoals). Nearby areas include the Buffalo National River and Ozark – St. Francis National Forest to the south (Arkansas) and Mark Twain National Forest to the north and east (Missouri). These areas expand collecting option even more, to include fens and additional large springs and rivers. Also note that we will set several Malaise traps a week before the meeting, so we should have plenty of interesting material to examine and identify at the start of the meeting.

Please see the BSFS website for additional information: https://bullshoals.missouristate.edu/. Weather during the meeting is likely to be hot (85-90°F). Biting insects, ticks and chiggers, and poison ivy are abundant at BSFS so use of personal protective measures is highly recommended. Venomous snakes also occur in the area, and include pygmy rattlesnakes (common), timber rattlesnakes (common), cottonmouth (occasionally present along waterways, but not known from BSFS), and copperhead (abundant). Potentially dangerous arthropods include black widow spiders (common), brown recluse spiders (abundant), and striped bark scorpions (uncommon).

Collecting permit information
Collecting permits are NOT needed for the Bull Shoals Field Station.

State of Missouri

1. *State parks.* Permits are required in the form of written permission from the Director. There is no fee. Allow 2-3 weeks for processing. Contact christopher.crabtree@dnr.mo.gov, Missouri Department of Natural Resources, **or** David Bowles, who can supply you with the required application form.
2. *Conservation lands – Missouri Dept. of Conservation*. A permit is required for collection of aquatic invertebrates (other than mollusks or crayfish) and terrestrial invertebrates only if you are collecting Species of Conservation Concern or if you are collecting on Missouri Department of Conservation lands. Permit applications can be found at: https://huntfish.mdc.mo.gov/permits/wildlife-collector-permits. Permit fee is $5:00.

State of Arkansas

1. *State Parks – Arkansas Department of Parks and Tourism (State Parks)*. No charge for the permit but they will want to know the specific parks where collecting will occur. A report required is required and a list of species collected will suffice. Allow up to 6 weeks to process application. Contact David Bowles who can send you the proper form.
2. *Other state conservation lands and general collecting in Arkansas.* Arkansas Game and Fish Department. A permit is required. No fee is assessed. No report required. Allow 4-6 weeks for completion. Permit application can be found at: https://www.agfc.com/en/resources/wildlife-conservation/scientific-collection-permits/

Federal Lands

1. *US National Forest* – no permit is required for personal collecting. A permit is required for commercial collecting. Exceptions are protected area such as campgrounds, and unique features such as caves.
2. *Buffalo National River, Arkansas* – US National Park Service permit required and strictly enforced. Obtain permit from Buffalo National River. Contact Charles Bitting at chuck_bitting@nps.gov.
3. *Ozark National Scenic Riverways, Missouri* – US National Park Service permit required and strictly enforced. Obtain from Ozark National Scenic Riverways. The permit application can be found at: https://irma.nps.gov/rprs/.

Tentative schedule:

Monday, 3 June (late afternoon / evening): Check-in at BSFS, possible collecting nearby. Dinner on your own, followed by welcome and introduction to area.

Tuesday-Wednesday, 4-5 June: Breakfast on your own. Field excursions**.** Dinner on your own**,** followed by informal presentations, sorting of the day's collections, and general camaraderie.

Thursday, 6 June: Schedule similar to Tuesday & Wednesday, except dinner (barbeque) @ BSFS (Drury House).

Friday, 7 June: Breakfast on your own, and check-out.

Logistics: Participants who fly are advised to fly to Springfield-Branson National Airport (SGF), then arrange for a rental car. SGF is on the northwest side of Springfield and approximately 65 miles from BSFS (1-1.5 hours). There is also a small airport just south of Branson, but it serves only Frontier Airlines.

Cost: There will be a conference fee of $40, payable in cash when you arrive at BSFS (receipts can be provided). This fee will cover the use of the BSFS classroom & laboratory, the cost of the Thursday night barbeque, and incidentals.

Accommodation costs include the following options.

1) $10/day/person for participants staying in either of the BSFS houses. Note again that this include s shared rooms and bunk beds, with a total of 24 beds. To make reservations for a room, please contact David Bowles.
2) $5/day/person to camp at either BSFS house or on other BSFS property. This will include access to showers and kitchens inside the house. Again, these should be arranged through Dr. David Bowles.

3) Non-BSFS accommodations include numerous motels in Branson.

Specific questions about BSFS or other accommodations can be directed to David Bowles.

Attendee list & presentations
If you plan to attend the meeting, please email Greg Courtney or David Bowles so we can add you to the attendee email list. Also let Greg know if you are interested in giving a presentation, so we can add you to the schedule... and please send a title. THANKS.

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Annual NADS meeting in St. Louis, Missouri

Torsten Dikow[1] & Matthew Bertone[2]

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We are organizing the annual NADS meeting, which will take place during the Entomological Society of America meeting at 8:00 p.m. on Tuesday, 19 November 2019.

We have lined up the below three speakers already and believe this will be a great annual meeting.

1. The obscure and overlooked 'micro-Dolichopodidae' by Justin Runyon
2. Neandersquitoes: back to the future by Erica McAlister
3. Preliminary results of a tick-borne pathogen survey of deer keds in Pennsylvania by Michael Skvarla, Erica Machtinger, Amanda Jones, and Karen Poh

If you are interested, you can submit your presentation for NADS by uploading your title to ESA (https://esa.confex.com/esa/2019/cfp.cgi, Ten Minute Paper (TMP) Oral) and select the NADS meeting (Organized Meeting: North American Dipterists Society (NADS) Meeting) as the hosting symposium by May 24th.

We hope to see you in St. Louis!

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The IX International Congress of Dipterology, Namibia

Peter S Cranston

Australian National University, Canberra, ACT, Australia

In late November 2018 three hundred or so dipterists assembled in Windhoek, the capital of Namibia for the 9th meeting of the International Congress of Dipterology (ICD), held for the first time in Africa. Our host, Ashley Kirk-Spriggs (Fig. 1) originally from Wales and now back in the UK at the Natural History Museum has a remaining affection for Namibia where he had worked, and Ash continues to expose truly unexpected elements in the fly fauna of this arid country. Fellow dipterists were enthusiastic to visit and participate in the meeting and investigate the local biodiversity: many came early and / or stayed on later to explore.

During the conference the *Manual of Afrotropical Diptera*, a multi-authored total overview of the order, was formally launched (Fig. 2). This was a decade-long in preparation is available at a modest price for hardback editions, snd free to download. Editors Ashley Kirk-Spriggs and Bradley Sinclair (Canadian Food Inspection Agency) obtained substantial sponsorship for the project allowing appropriate inexpensive dissemination (see http://afrotropicalmanual.org/ for further details). Given the high diversity of medically-significant flies in Africa, for this reason alone the widest community will welcome this authoritative work.

A second conference event bringing all delegates together was a public lecture to introduce 2019 as 'the year of the fly'. This was to be presented by Steve Marshall, author of the magnificent and definitive '*Flies: The Natural History and Diversity of Diptera*' (2012, Firefly Books), but Steve was unable to attend with a late-breaking medical issue. At short notice Canadian colleague Jeff Skevington (Canadian National Insect Collection, Ottawa) took a break from birding (with the author) and took over the lecture accompanied by Steve's beautiful photographs. At the time of writing this report, Steve's health has improved enough to take study leave in Australia.

Figure 1. Ashley Kirk-Spriggs at ICD reception.
Figure 2. Official launch of *Manual of Afrotropical Diptera.*
Figure 3. *Litoria barringtonensis* frog with feeding *Sycorax* flies. Photo Narelle Power.

The scientific sessions

With three concurrent sessions it was not possible to attend all the presentations that I would have wished, so I'll start with acknowledging some I missed. First, a session on forensic entomology -

thanks to CSI we all know fly larvae play an important role in decomposition. Molecular techniques and new analytical tools are advancing fast this field as reviewed by plenary speaker Martin Hall (Natural History Museum, U.K.). I regretted also missing Adrian Pont's (Oxford Museum, U.K.) tribute to the life of the late Roger Crosskey, an honorary member of the ICD (see Obituary *Antenna* 42: 87-93).

Dipterists are at the forefront of entomological phylogenomic studies and several sessions and posters were concerned with both 'new' results and methodological issues. A trite summary of these many presentations is that well-established evolutionary relationships, including those established on morphological data from all life stages, can be robust and appear also from mega-molecular datasets. Addition of the remarkable amount of novel data from genomics can lead to better support for traditional relationships, new insights, and yet can fail to provide guidance in areas of contention. Thus more data may not be better so we need insights into which subset of genes 'work best', why conflicts remain and how to deal with them. The student prizewinner (see below) addressed many of these methodological issues.

By no means were systematists the dominant contributors. A fascinating half-day session concerned the biology and diversity of the frog-feeding flies (*Corethrella*, family Corethrellidae, and *Sycorax*, family Psychodidae. The mandibulate females feed on the blood of amphibians and those of *Corethrella* locate their hosts by 'voice recognition'. The session was co-organised by Ximena Bernal (Purdue, USA) who in summary addressed the critical question of how the flies actually locate ('hear') their host calling. All other known insect 'hearing' morphologies can be eliminated, not least by the diminutive size of the flies with respect to the wavelength of the sounds that they respond to. An international, especially Brazilian, assembly of researchers assured the audience that the there is much unexplored diversity and studies, including by herpetologists, must continue. Coincidentally during the meeting I was sent an image from an Australian herpetologist showing a hylid frog covered with *Sycorax* flies (Fig. 3) – which seem little known on this continent. There remains much to be discovered in this world-wide special association.

The range of interesting fly-plant interactions is well known in southern Africa including both pollination syndromes and phytophagy. An excellent plenary talk by Netta Dorchin (Tel Aviv University, Israel) on the potentially enormous taxonomic and ecological diversity of the Cecidomyiidae (gall midges) prepared us for later presentations that included galling of the hyper-radiation of southern African succulents belonging to the family Aizoaceae. Genomic studies suggest that the astonishing species-richness of gall midges may be true of many other groups, some unexpected because of their morphological uniformity. Under the term 'open-ended' taxa, presentations on such megadiverse groups, and how to study them, were provided by several authors.

A fascinating session convened by Kurt Jordaens (Royal Museum for Central Africa, Tervuren, Belgium) concerned long-proboscis flies and nectar-producing native flowers with long tubes or spurs. These 'long-tongued' flies belong to the families Nemestrinidae and a part of the austral radiation of the Tabanidae (horseflies). These 'coevolutionary systems' have been studied especially in southern Africa in seasonal rainfall areas of both western (summer dry) and eastern (summer wet) vegetation. An iconoclastic study presented by Ximo Mengual (Zoologisches Research Museum, Bonn, Germany) showed that pollinator dynamics in Cameroon may be more 'fluid' than expected by 'coevolution': long-spurred plants may have sequential visitors. An *Impatiens* (balsam) species is visited early in the day by a short proboscis syrphid while the spur is replete with nectar, but later in the morning an *Apis* (honeybee) drinks from the by-now only half-filled spur. After midday, the depleted spur provides nectar that is accessible only by the long-tongued hoverfly *Rhingia mecyana* -

yet all three visitors can pollinate. The generality of this requires further study, but evidently this undermines the Darwinian view of an evolutionary 'arms race' between the plant and ever more-specialised pollinator.

Another presentation, fortunately without associated olfactory delights, reviewed the diversity of flowers that produce luring smells of faeces, carrion, roadkill and the like. This is well known in the 'stapeliads' a group of stem succulents popular amongst cactus and succulent horticulturalists. They will know of the odour (giving rise to the name 'carrion flowers') and the range of blowflies and relatives lured to them. In genus *Ceropegia*, the trap flowers are pollinated solely by flies, using a lock-and-key system that lures, traps and then releases pollen-laden flies. The system involves only chemical mimicry with no reward provided.

Staying locally, one of the major tourist attractions in the karoo vegetation of western South Africa (Namaqualand) is a mass springtime flowering of multi-coloured daisies. Pollination is largely by flies, notably *Megapalpus capensis,* a bombylid, and no bees are involved. But what pollinates the invasive Namaqua daisy (*Arctotheca calendula*, 'capeweed') so abundant in Australian roadsides verges and grasslands, in the absence of the specific beefly? An honours research project is waiting.

The prizewinners

The winning student talk from amongst many high-quality presentations was Jessica Gillung (University of California, Davis) (Fig. 4) for "Phylogenetic relationships of spider flies (Acroceridae) and the perils of phylogenomics" with Brazilian compatriot Diego A. Fachin (Universidad de São Paulo) the runner up with "A phylogeny of Sarginae (Stratiomyidae) – monophyly, new characters, species-rich genera and the problem of the Chrysochlorininae/ Hermetiinae".

From a large field, the poster competition was won by Isabel C. Kilian Salas (Zoologisches Research Museum, Bonn, Germany) with "Barcoding Dipteran pollinator networks in agroecosystems" and the runner up was Xuankun Li (Australian National Insect Collection, Canberra, Australia) with "Towards a revision of the Bombyliinae of Australia" (Fig. 5).

4. Student oral presentation prize winner Jessica Gillung at the podium.
5. Runner-up poster presentation Xuankun Li beside his poster.

In the fly photography contest, Ana Gonçalves (Centre for Ecology, Evolution and Environmental Changes, Lisbon, Portugal) won with "*Anahydrophus cinereus* (Dolichopodidae) feeding on an

amphipod" (Fig. 6), Stephen Gaimari (California Department of Food and Agriculture, Sacramento) was awarded 2nd place for "Male of *Nothybus longicollis* (Nothybidae) from Sabah, Malaysia" (Fig. 7) and Nathan Butterworth (University of Wollongong, Australia) was 3rd for "*Acridophagus paganicus* (Mythicomyiidae) from Hobart, Australia" (Fig. 8). This latter fly was of particular interest in that it was re-encountered the first time in 100 years TO THE DAY!).

In conclusion, this fascinating meeting attracted geographically and scientifically diverse participants, notably from Brazil (highly represented among the prizewinners) and from throughout subsaharan Africa. Fly research was showcased across the continent, worthy publicity provided for the new regional Manual and the 'year of the fly' was introduced. The scientific content was exceptional, due to a cadre of organisers for the many sessions. Congratulations especially to Ashley Kirk-Spriggs for all aspects of this bold and successful decision to stage such a meeting in Namibia. We look forward to the next meeting to be hosted in California (or just over the border in Nevada) during one of the cooler months in 2021.

Figures 6-8. Photographc prize winners, see text for details

Acknowledgements
I thank the Royal Entomological Society particularly Lin Field (Publications Officer) for supporting my registration associated with the promotion of two 'virtual' issues for the meeting. One issue showcased Diptera papers in *Systematic Entomology*, the other included two papers each from the remaining RES entomological journals. These promoted the full range of our journals to the wide Dipterological community, with all papers free to view and download from bit.ly/diptera. Many people willingly providing images, particularly the three winners of the photographic competition, as did Adrian Pont.

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Fly School
23 June–6 July 2019

Giar-Ann Kung

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The second biennial Fly School will be this summer 23 June to 6 July in Los Osos, California. Dalton de Souza Amorim, Brian Brown, Greg Dahlem, David Grimaldi, Jim Hogue, and Brian Wiegmann are the instructors, with special guests Erica McAlister and Michelle Trautwein. We are excited to have 26 students from 14 countries registered for what is sure to be another successful course.

David Grimaldi teaching at Fly School in 2017

FLY SCHOOL

A course for Dipterists

Registration is closed for this year's course. However if you are interested in attending a future course, email dipteracourse@gmail.com to be added to our mailing list.

Announcements will also be posted on twitter @dipteracourse, and on our website, https://dipteracourse.com/.

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OPPORTUNITIES

Open position at the University of Guelph

(submitted by) Steve Marshall

University of Guelph Insect Collection and Insect Systematics Laboratory, School of Environmental Sciences, University of Guelph, Guelph, ON, N1G 2W1, Canada; samarsha@uoguelph.ca

The School of Environmental Sciences (SES) at the University of Guelph invites applications for a tenure-track position at the Assistant Professor level.

The deadline is **June 26, 2019**. For more details, please visit:
http://www.uoguelph.ca/facultyjobs/postings/ad19-28.shtml

The University is seeking qualified applicants in the field of entomology with a research focus in insect diversity, taxonomy and phylogeny in the contexts of agricultural applications, climate change, conservation, biodiversity, and environmental stressors. The ideal candidate will be familiar with and able to conduct research that integrates both morphological and molecular approaches. The successful candidate will be expected to build a robust research program and collaborate on a national and international scale. They will interact with the Curator of the University of Guelph Insect Collection and both utilize and build the potential in the Collection to address broad societal and systematic questions. Applicants must have a PhD in entomology with a publication record demonstrating expertise in insect systematics. Candidates will demonstrate significant potential for research excellence and will be expected to build a strong publication record in internationally recognized, peer-reviewed journals.

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S.W. Williston Diptera Research Fund at the National Museum of Natural History, Smithsonian Institution

Torsten Dikow & S.W. Williston Fund committee

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The S.W. Williston Diptera Research Fund is a small Smithsonian Institution administered endowment fund established for the *increase and diffusion of knowledge about Diptera* and welcomes applications for funding on 1 December 2019.

About US $6,000 are available from the endowment annually. To this day, the fund has supported the travel of graduate students and dipterists to the *International Congresses of Dipterology* and to our museum for collections-based research as well as field work.

For application procedures and general information on S.W. Williston please see https://naturalhistory.si.edu/research/entomology/opportunities/williston-diptera-research-fund.

Please consider donating to this endowment fund to support the increase and diffusion of knowledge about Diptera and particularly the research and travel of a new generation of dipterists.

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DIPTERA ARE AMAZING!

We had several great submissions, from Darren Pollock, Bob Parks and Isaí Madriz, presented here.

Female *Microstylum galactodes* Loew (length ca. 40 mm), in typical "prey-scanning" pose; 5 July 2018 near Kenna, Roosevelt County, New Mexico. Photo by Darren Pollock.

Efferia mortonsoni (Asilidae) male with prey, *Agapostemon* male (Halictidae). Photo by Bob Parks.

Scleropogon kelloggi at Bear Canyon, Huachuca Mountains, Cochise County Arizona. Photo by Bob Parks.

Palpada furcata (Syrphidae) at Hereford, Arizona. Photo by Bob Parks.

Edwardsina sp. (Blephariceridae) from Patagonia (Aysén, Chile). Photo by Isaí Madriz.

Toxophora species (Bombyliidae), at Dutch George Area, Rocky Mountains, Larimer County, Colorado. Photo by Bob Parks.

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BOOKS AND PUBLICATIONS

As usual if we have not included a paper that you think should have been here please feel free to pass it along to Chris (chris.borkent@gmail.com) and we will include it in the next issue. Unfortunately, the online resources do not always catch everything and are a couple of months behind. Also, we are not including "preprint" or "early view" articles until they are published. We also apologize for the missing diacritics in some author's names, this is a product of searching in Zoological Record and Web of Science, where they are removed.

Abu El-Hassan, G.M.M., Badrawy, H.B.M., Fadl, H.H. and Mohammad, S.K. 2019. Review of the horse flies of the genus *Atylotus* Osten Sacken, 1876 (Diptera: Tabanidae) from Egypt, with description of a new species. Zootaxa **4551(1)**: 79-86.

Adghir, A., De Jong, H. and Kettani, K. 2018. The Tipulidae (Diptera) of northern Morocco with a focus on the Rif region, including the description of a new species of *Tipula* (*Lunatipula*) and an updated checklist for Morocco. Annales De La Societe Entomologique De France **54(6)**: 522-538.

Adler, P.H. and Courtney, G.W. 2019. Ecological and societal services of aquatic Diptera. Insects **10(3)**: 23. doi:10.3390/insects10030070.

Alaniz, A.J., Carvajal, M.A., Smith-Ramirez, C., Barahona-Segovia, R.M. and Vieli, L. 2018. Habitat loss of a rainforest specialist pollinator fly as an indicator of conservation status of the South American Temperate Rainforests. Journal of Insect Conservation **22(5-6)**: 745-755.

Alcantara, D.M.C., Graciolli, G. and Nihei, S.S. 2019. Revision of *Noctiliostrebla* (Diptera: Streblidae), parasites of bulldog bats (Chiroptera: Noctilionidae: *Noctilio*). Zootaxa **4560(3)**: 483-521. doi:10.11646/zootaxa.4560.3.4.

Alencar, J., Gil-Santana, H.R., De Mello, C.F., Marcondes, C.B. and Dos Santos-Mallet, J.R. 2019. Ultrastructure and morphometry of the egg of *Coquillettidia albifera* (Prado) with illustrations of male genitalia (Diptera: Culicidae). Zootaxa **4565(1)**: 145-150.

Alpern, J.H.M., Asselin, M.M. and Moehring, A.J. 2019. Identification of a novel sperm class and its role in fertilization in *Drosophila*. Journal of Evolutionary Biology **32(3)**: 259-266.

Amorim, D.S., Oliveira, S.S. and Henao-Sepulveda, A.C. 2018. A new species of *Eumanota* Edwards (Diptera: Mycetophilidae: Manotine) from Colombia: evidence for a pseudogondwanan pattern. American Museum Novitates **3915**: 1-19.

Anbalagan, S., Vijayan, S., Dinakaran, S. and Krishnan, M. 2019. A new species of *Simulium* (*Gomphostilbia*) (Diptera: Simuliidae) from South India. Zootaxa **4551(4)**: 479-486.

Andersen, T. 2018. *Macropelopia* (*Bethbilbeckia*) *chilensis* n. sp. (Diptera, Chironomidae) from Cajon del Maipo, Chile. Norwegian Journal of Entomology **65(2)**: 85-90.

Andersen, T. 2018. A new species of *Claudiotendipes* Andersen, Mendes & Pinho, 2017 from Bolivia (Diptera, Chironomidae). Norwegian Journal of Entomology **65(1)**: 22-25.

Anjos-Santos, D., Diaz, F., Ricardo Spinell, G. and Marcela Ronderos, M. 2018. The immatures of *Bezzia chilensis* Spinelli & Ronderos, 2001 (Diptera, Ceratopogonidae). Zookeys **803**: 141-154.

Araujo, M.R., Uramoto, K., Ferreira, E.N.L., Mesquita, W., Walder, J.M.M., Savaris, M. and Zucchi, R.A. 2019. Fruit fly (Diptera: Tephritidae) diversity and host relationships in diverse environments estimated with two sampling methods. Environmental Entomology **48(1)**: 227-233. doi:10.1093/ee/nvy177.

Araujo, M.X., Aragao, M., Cordeiro, D., Bravo, F., Barros de Carvalho, C.J. and Andena, S.R. 2018. Male and female association in *Trichomyia* Haliday in Curtis, 1839 using a molecular approach (Diptera, Psychodidae, Trichomyiinae), and description of new species from Brazil. Revista Brasileira De Entomologia **62(4)**: 283-287.

Araujo, M.X. and Bravo, F. 2019. Two new species of *Lepidiella* Enderlein, 1937 (Diptera: Psychodidae) from the Neotropical Region with taxonomic comments about the species of the genus. Zootaxa **4551(4)**: 487-493.

Ashe, P., Murray, D.A. and O'Connor, J.P. 2018. Recognition of two additional fossil subfamilies in the Chironomidae (Diptera) - Dungeyellinae subfam. nov. and Cretodiamesinae Kalugina stat. nov. Irish Biogeographical Society Bulletin **42**: 225-242.

Astakhov, D.M. 2018. A new genus of robber flies of the subfamily Laphriinae (Diptera, Asilidae) from the Middle East. Entomologicheskoe Obozrenie **97(1)**: 170-174.

Banerjee, A., Rognes, K. and Whitmore, D. 2018. Two species of *Caiusa* Surcouf (Diptera: Calliphoridae) new to India, with data on larval behaviour and morphology. Biodiversity Data Journal **6**: e27736.

Bao, R., Dia, S.E., Issa, H.A., Alhusein, D. and Friedrich, M. 2018. Comparative evidence of an exceptional impact of gene duplication on the developmental evolution of *Drosophila* and the higher Diptera. Frontiers in Ecology and Evolution **6**: 63.

Baranov, V., Gilka, W., Zakrzewska, M. and Jarzembowski, E. 2019. New non-biting midges (Diptera: Chironomidae) from Lower Cretaceous Wealden amber of the Isle of Wight (UK). Cretaceous Research **95**: 138-145. doi:10.1016/j.cretres.2018.11.012.

Barrios-Leal, D.Y., Neves-da-Rocha, J. and Manfrin, M.H. 2019. Genetics and distribution modeling: The demographic history of the cactophilic *Drosophila buzzatii* species cluster in open areas of South America. Journal of Heredity **110(1)**: 22-33. doi:10.1093/jhered/esy042.

Barros, L.M., Soares, M.M.M., De Freitas-Silva, R.A.P. and Ale-Rocha, R. 2019. Neotropical *Chvalaea* Papp & Foldvari (Diptera: Hybotidae: Ocydromiinae): new records, an illustrated key to species and description of three new species. Zootaxa **4571(3)**: 347-362. doi:10.11646/zootaxa.4571.3.3.

Bartlett, J.C., Convey, P. and Hayward, S.A.L. 2019. Life cycle and phenology of an Antarctic invader: the flightless chironomid midge, *Eretmoptera murphyi*. Polar Biology **42(1)**: 115-130. doi:10.1007/s00300-018-2403-5.

Bar-Ziv, M.A., Subach, A., Hirsch-Ionescu, A., Belmaker, J., Zweifler, A. and Scharf, I. 2018. Comparison of wormlions and their immediate habitat under man-made and natural shelters: suggesting factors making wormlions successful in cities. Zoology (Jena) **130**: 38-46.

Bernhardt, V., Finkelmeier, F., Verhoff, M.A. and Amendt, J. 2019. Myiasis in humans a global case report evaluation and literature analysis. Parasitology Research **118(2)**: 389-397. doi:10.1007/s00436-018-6145-7.

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Bistline-East, A., Carey, J.G.J., Colton, A., Day, M.F. and Gormally, M.J. 2018. Catching flies with honey(dew): Adult marsh flies (Diptera: Sciomyzidae) utilize sugary secretions for high-carbohydrate diets. Environmental Entomology **47(6)**: 1632-1641. doi:10.1093/ee/nvy155.

Blaschke, J.D., O'Hara, J.E. and Moulton, J.K. 2019. Biodiversity survey and molecular identification of the Phasiinae (Diptera: Tachinidae) of Great Smoky Mountains National Park, USA. Proceedings of the Entomological Society of Washington **121(1)**: 1-14. doi:10.4289/0013-8797.121.1.1.

Borkent, A. 2019. The phylogenetic relationships of Cretaceous biting midges, with a key to all known genera (Diptera: Ceratopogonidae). American Museum Novitates**(3921)**: 1-48.

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Braby, M.F. 2018. Are taxonomic publications involving nomenclatural acts on Early View Code compliant? Austral Entomology **57(4)**: 371-376. doi:10.1111/aen.12372.

Brahma, S. and Hazra, N. 2018. Additions to the species of *Dasyhelea* KIEFFER, 1911 (Diptera: Ceratopogonidae) from West Bengal, India. Polish Journal of Entomology **87(4)**: 349-369.

Caldwell, B.A. and Jacobsen, R.E. 2018. A new species of *Heterotrissocladius* Sparck, 1923 (Diptera: Chironomidae: Orthocladiinae) from Georgia, USA. Journal of Limnology **77**: 59-64.

Canneva, B. 2019. A new species of *Laurenceomyia* Wagner & Stuckenberg, with a key to species and new records for Psychodidae (Diptera) from Uruguay. Zootaxa **4544(3)**: 407-418.

Carapelli, A., Soltani, A., Leo, C., Vitale, M., Amri, M. and Mediouni-Ben Jemaa, J. 2018. Cryptic diversity hidden within the leafminer genus *Liriomyza* (Diptera: Agromyzidae). Genes **9(11)**: 17. doi:10.3390/genes9110554.

Carmo, D.D.D. and Henriques, A.L. 2019. Taxonomy of *Tabanus trivittatus* species-group (Diptera: Tabanidae), with description of five new species. Zootaxa **4554(1)**: 63-100. doi:10.11646/zootaxa.4554.1.2.

Carvalho-Filho, F.D.S., Duarte, L.B. and Gottschalk, M.S. 2019. A new species of *Rhinoleucophenga* (Diptera: Drosophilidae), parasite of the scale insect pest *Praelongorthezia praelonga* (Sternorrhyncha: Ortheziidae) from the Brazilian Amazon. Zootaxa **4551(5)**: 583-592.

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Chandler, P.J. 2018. Corrections and changes to the Diptera Checklist (40). Dipterists Digest Second Series **25(2)**: 170.

Chialvo, C.H.S., White, B.E., Reed, L.K. and Dyer, K.A. 2019. A phylogenetic examination of host use evolution in the *quinaria* and *testacea* groups of *Drosophila*. Molecular Phylogenetics and Evolution **130**: 233-243. doi:10.1016/j.ympev.2018.10.027.

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Corcos, D., Centorame, M. and Cerretti, P. 2018. DNA barcodes reveal a new host record for *Carcelia atricosta* Herting (Diptera: Tachinidae) in Italy. Redia **101**: 9-11.

Costa, D.N.R., Mathis, W.N. and Marinoni, L. 2019. Revision of *Scatella* (*Neoscatella*) (Diptera: Ephydridae) from the New Zealand subregion. Austral Entomology **58(1)**: 85-95. doi:10.1111/aen.12316.

Courtney, G.W. and Hogue, C.L. 2018. A review of the net-winged midges (Diptera: Blephariceridae) of the West Indies, with description of a new species from Puerto Rico. Aquatic Insects **39(2-3)**: 117-154.

Craddock, E.M., Kambysellis, M.P., Franchi, L., Francisco, P., Grey, M., Hutchinson, A., Nanhoo, S. and Antar, S. 2018. Ultrastructural variation and adaptive evolution of the ovipositor in the endemic Hawaiian Drosophilidae. Journal of Morphology **279(12)**: 1725-1752.

Cranston, P.S. 2018. *Kribiodorum* Kieffer (= *Stelechomyia* Reiss) (Diptera: Chironomidae) extends into the Oriental region: three new species and expanded diagnoses. Zootaxa **4486(4)**: 535-547.

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