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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. 62 of the *Fly Times* will appear next April. 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 April 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 April are OK too!

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Issue 61, available online 14 November 2018

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NEWS

Final words on *Systema Dipterorum*

F. Chris Thompson

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After too many years and over a quarter of million names (259,940 as today), I am retiring from the name business. Yes, I will continue to track ant fly and flower fly names (Microdontidae and Syrphidae), but I will leave the rest of *Systema Dipterorum* to Neal Evenhuis and Tom Pape.

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Drosophila bromeliae Sturtevant, another tropical drosophilid in temperate North America

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Summary
Drosophila bromeliae Sturtevant is reported from northern New Jersey, where it was found breeding in pumpkin flowers (*Cucurbita pepo* L.), and in central Massachusetts, both in 2018. The prior northernmost records of the species had been Cuba in 1915 and Valusia County, Florida in 1997, an extension of 13° (~1800 km) north. All species of the *D. bromeliae* group are Neotropical and, where known, breed in flowers. Observations are provided on *D. bromeliae* from New Jersey, as are the main identifying characteristics of the species. This is one of six species of Drosophilidae that have invaded the temperate Nearctic in the past decade, which are briefly reviewed. A request is made for any additional records and samples from North America.

Background
The *Drosophila bromeliae* group consists of 13 named species, the overall distribution being entirely Neotropical, from Cuba and throughout the Caribbean; Mexico (Nayarit) south through Central America and into South America to northern Bolivia (Grimaldi, 2016). Based on intensive studies by Schmitz (2010), species of the group breed in various flowers, some being polyphagous and others restricted to a particular genus of plants. The nominal species of the group, *D. bromeliae* Sturtevant, has the widest distribution, from Cuba and the Bahamas south throughout apparently the entire Caribbean, throughout Central America south of the Yucatan Peninsula, and into South America to northern Brazil (Grimaldi, 2016, Schmitz, 2010). Morphologically, species in the group can be reliably distinguished only on the basis of male genitalia, sometimes by female genitalia depending on the species (Grimaldi, 2016). Since the taxonomic revision of this group (Grimaldi, 2016), a new U.S. record of the species has been found (besides the one reported here from New Jersey), based on overlooked specimens in the AMNH collections. These are a series of 10 males and 12 females collected in Valdez, Volusia Co., Florida, V/16/1997, by Mark and Maria Minno, in flowers of Okeechobee gourd (*Cucurbita okeechobeensis*). The Florida population of this plant is a rare subspecies endemic to several areas in southern Florida; it is listed as federally endangered. It is unknown if southern Florida is part of the natural distribution of *D. bromeliae*, which would not be surprising given occurrence of the fly in Cuba and the Bahamas.

Observations
For the past 32 years the author has monitored Drosophilidae and some other flies that occur on his property in Pompton Plains, Morris County, New Jersey, and vicinity. The town is at the eastern base of the Watchung escarpment, in the northern end of the Atlantic Coastal Plain, a natural corridor extending to Florida. From early July to late August, 2018, abundant *Drosophila bromeliae* were found on blossoms of large pumpkin vines, which were growing out of piles of composted horse manure with pine shavings. Though there were only four pumpkin vines, their cumulative length was approximately 40 meters, usually with dozens of large blossoms at any one time. Other visitors to the blossoms were striped cucumber beetles, *Acalymma vittatum* (Chrysomelidae) and some unidentified bees. The bees, beetles, and flies actively consumed the abundant pollen. There was usually a small pile of pollen at the bottom of the corolla dislodged by the bees and beetles, on which flies fed. There did not appear to be any negative association between flies and beetles. Other than feeding, other fly

activities included resting and courting on the inner and upper surfaces of the petals. Their movements were slow, probably due at least in part to the fine long hairs on the lower portions of the petals. Every opened flower (Fig. 1A) harbored flies, which varied in number from 5 to a maximum of approximately 80 (Fig. 1B) (mean of 20 flies per blossom, N = 13 blossoms, counted 25 August, 2018). Some flies congregated on the outside surfaces of petals (Fig. 1C). Flowers that were exposed to sun had many fewer flies; most flowers were in the shade of trees. The blossoms closed in late evening through the night, and some flies (perhaps not all) cloistered in the closed flowers (they closed earlier in the day at hot temperatures); flies were most abundant in the mornings on the open flowers. On occasional cool mornings in August (ca. 16° C), opened, fresh blossoms contained no flies (the flies may have settled on the warm compost). Senescent flowers, closed and shriveled, usually had no flies, but occasionally a few and these always inside the flower.

Based on the numbers of flies in each fresh blossom, and their increase in numbers from early July to late August, the flies must have been breeding. Pumpkin yield was low (only five fruits from 40 m of vine), possibly the cause of premature flower senescence. To determine if the flies were breeding in the pumpkin blossoms, 5 senescent and 5 fresh blossoms were carefully pulled apart, especially the reproductive structures at the base. Senescent moist petals commonly were riddled with fine holes, presumably from feeding beetles. Bases of petals were thicker, with spongy tissue, and the anthers of male flowers formed a fleshy cone with a central chamber that was almost entirely closed -- ideal substrates for *Drosophila* larvae. However, no eggs or larvae were seen. To further determine if flies were breeding in the flowers, the dissected flowers and 10 additional senescent flowers were spread out in a plastic tray on top of moist, white sheets of paper toweling, under a plastic cover with a central funnel (BioQuip©). The paper toweling was used, rather than sand or vermiculite, to better visualize any puparia that would eventually develop.

From the 20 flowers placed in a container well over 100 puparia and adult flies emerged. The flowers had deliquesced, and the first puparia appeared on the paper toweling 5 days after containment; clumps of puparia appeared on corners a day later. Most adults eclosed 9 days after containment, approximately 3 days after pupariation at ambient temperature. Thus, eggs were entirely unnoticed when the dissected flowers were first inspected, perhaps having been embedded within flower tissue by the ovipositing females.

Eight female flies collected on 25 August were dissected, to check their reproductive status. The colored ovaries can be seen through the translucent pleural membrane, ovaries being light pink and in the males testes are reddish. The crop was also visible, in this case bright yellow from the ingested pumpkin pollen (only a few of the 40 or so flies preserved had not fed). Of the eight females dissected, in six the ovaries were small and not fully developed; in the other two specimens the ovaries were larger, with about 8 ovarioles, but none were gravid, i.e., with a mature egg in the lateral or common oviducts. It is possible that this was a recently eclosed cohort, not yet reproductively matured.

By 20 September, 2018 the squash plants were dying back, and among the 10 flowers left there was a very noticeable decline in the number of flies on them (an average of 15 per flower, ranging from 9 to 24).

Several individuals of *D. bromeliae* were observed in pumpkin flowers in Northampton, Massachusetts on September 15, 2018 by Isabel Novak. Voucher specimens from the NJ and MA localities are in the AMNH collection.

Figure 1. Pumpkin flower hosts of *Drosophila bromeliae* in Morris County, New Jersey (August, 2018). A. Plant. B. Flower with about 80 flies. C. Side of same flower as in B.

Identification
Drosophila bromeliae is dark yellowish to light dusky brown, a rather typical species of *Drosophila* with clear, unmarked wing and bright red eyes. All of the New Jersey flies are distinctly darker than any of the flies from Florida or the neotropics (it's unknown if this is genetically based or due to the cooler temperatures during larval and pupal development). *Drosophila bromeliae* is easily distinguished from North American species of drosophilids by a combination of the flat facial carina (typical of *Drosophila*); well-developed oviscapt; abdominal tergites 1-5 each with a thin, diffuse, dark transverse band interrupted in the middle; the red testes and pink ovaries (seen through the pleural membrane when live or freshly preserved); and especially by the pair of prescutellar setae (enlarged pair of acrostichals) (Figs. 2A-D). The only other North American species of *Drosophila* that have prescutellar setae are the following: species in the *virilis* group (easily separated by the completely dark abdomen); *D. sigmoides* (which has a sinuous posterior crossvein and clouded wing); and some species in the *repleta* group (which have a spotted body).

Definitive separation of *D. bromeliae* from other members of the *bromeliae* species group requires male genitalia (Figs. 2E-F), especially the aedeagus, to lesser extent the surstylus and hypandrium (Grimaldi, 2016). The aedeagus of *D. bromeliae* in lateral view is arched, long and rather slender, the tip lacking subapical spines and ovoid to slightly drop-shaped in full ventral view (Fig. 2F). Eggs are also distinctive, with two very short anterior filaments (Grimaldi, 2016: fig. 6A).

Significance
It is too early to determine if *Drosophila bromeliae* has established perennial breeding populations in northeastern U.S. The summer of 2018 was particularly hot and wet, ideal for seasonal colonization of a tropical species. It also needs to be examined if the species is injurious, to either cucurbits or other fruits and vegetables. Schmitz (2010) reared the species in Brazil from flowers of morning glories (*Ipomoea*: Convolvulaceae), *Hibiscus* (Malvaceae), *Distictela* (Bignoniaceae), and *Thunbergia* (Acanthaceae) (this last genus native to Africa and Asia). I have also found *D. bromeliae* in *Ipomoea* flowers in the Dominican Republic (Grimaldi, 2016). These records and the ones involving curcurbits in the U. S. indicate that the species is quite polyphagous. It can even be maintained in the lab on standard banana-cornmeal medium and Carolina Drosophila Instant medium®, which is very unusual for obligate flower-breeding species in Drosophilidae, and indicating that it is quite adaptable.

Other Invasive Drosophilidae
Drosophila bromeliae joins a growing list of drosophilid species that have dispersed or were introduced to North America in the past decade or so, several of them having become very successful (Miller et al., 2017; Werner and Jaenike, 2017).

The most notorious invasive is *Drosophila (Sophophora) suzukii* (Matsumura), a native of Japan and a major pest of berries and soft fruits. It was first detected in North America from specimens captured in California in 2008 (Hauser et al., 2009; Hauser, 2011), and has since spread throughout the continent up to approximately 47°N latitude in eastern North America (Miller et al., 2017; Werner and Jaenike, 2017), as well as Europe and Asia. It is now common even in mature broadleaf forests in northeastern North America and northern Michigan (D. Grimaldi, Thomas Werner, pers. observ.), breeding in various cultivated and native fruits (Lee et al., 2015).

Like *D. suzukii*, *Zaprionus indianus* Gupta also breeds in various fresh fruits, but also decaying ones as well. It is not nearly as injurious to fruit crops as is *D. suzukii*, though there is concern that it may be out-competing native *Drosophila* in the neotropics. The natural distribution of *Z. indianus* is

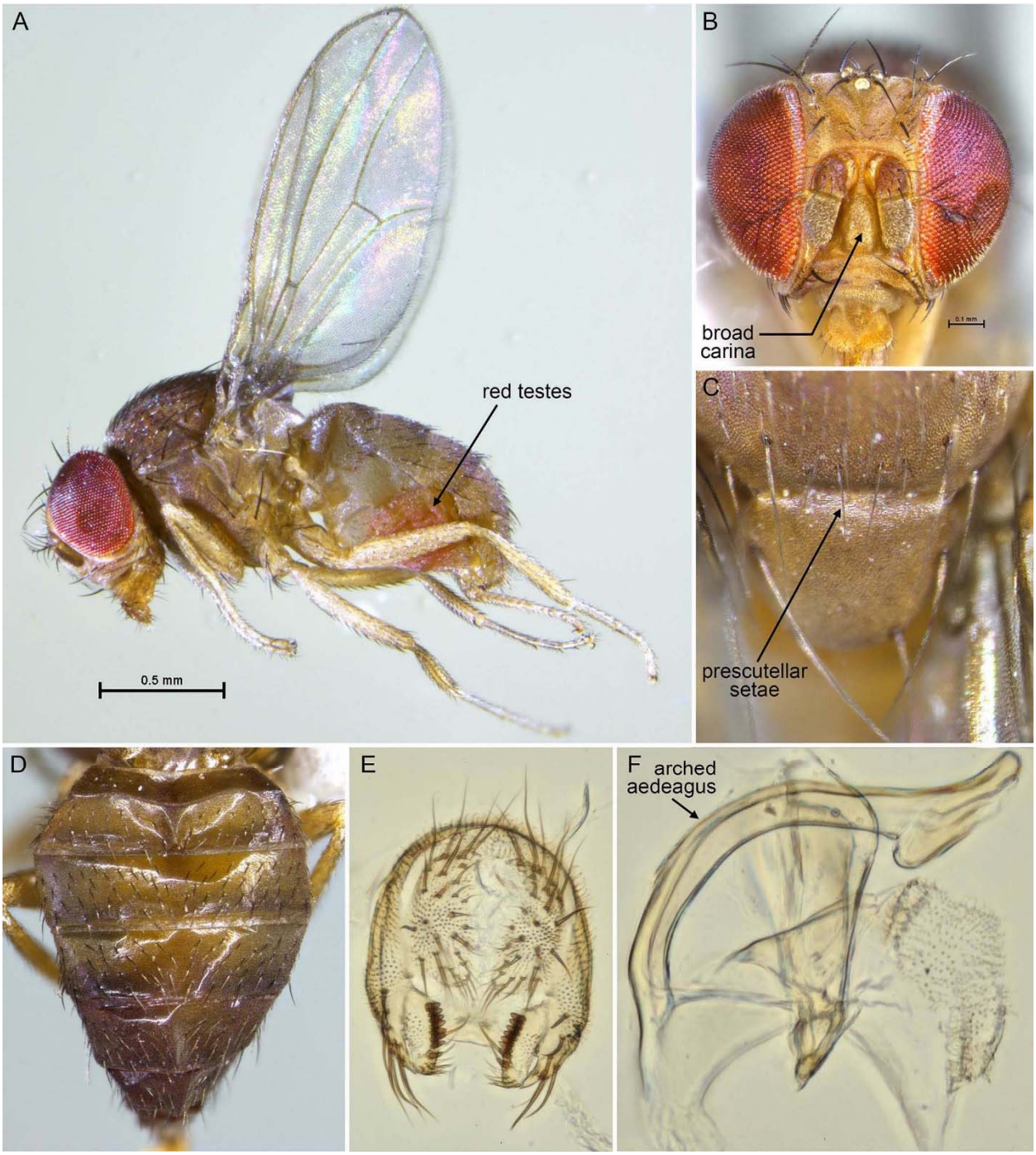

Figure 2. Diagnostic features for identifying *Drosophila bromeliae (*see labels). A. Whole fly (male). B. Head, frontal. C. Dorsoapical portion of thorax. D. Abdomen, dorsal. E. Epandrium with surstyli. F. Aedeagus.

central Africa and southern Asia. It was first detected in the New World in Brazil in 1999, and in the USA in Florida in 2003 (Van der Linde et al., 2006). Since then it has spread throughout the New World tropics (D. Grimaldi, pers. observ.) and occasionally is found in New York and even southern Canada (Miller et al., 2017).

Drosophila cardini is widespread in the neotropics from Bolivia and southern Brazil to Mexico and throughout the Caribbean, including southern Florida. There are two records of it in northeastern North America: from near Guelph, Ontario, Canada and northern New Jersey, USA, collected in 2005 (Miller et al., 2017) (the New Jersey record is also from the author's backyard, collected on stinkhorn fungi). This species has a particularly broad niche, breeding in decaying fruits, vegetables, and fungi. It does not seem to be established in the northern states, although it probably is well established in Florida and U. S. Gulf states.

Two U.S. colonists that are flower-breeding like *Drosophila bromeliae* are *Drosophila gentica* Wheeler and Takada, and *Drosophila* (*Sophophora*) *flavohirta* Malloch, both established in California (Grimaldi et al., 2016). *Drosophila gentica* belongs to the Neotropical *flavopilosa* group, all of which breed in flowers, and in the case of *D. gentica* primarily on the ornamental flowering shrub *Cestrum* (Solanaceae) in both its native Central America as well as in California. It is unlikely to become an agricultural pest. *Drosophila flavohirta* is an anomalous member of the *melanogaster* species group, a native of Australia, and has also been introduced to South Africa and Madagascar. It breeds in flowers of Eucalyptus trees, which are planted throughout California. It can affect honey yield.

The most unusual introduction to the U. S. is *Phortica variegata* (Fallén), originally Palearctic in distribution. Males of *Phortica*, and in the closely related genus *Amiota*, have the peculiar habit of swarming around a person's head, like blackflies, so they are easily collected and surveyed. They appear to be attracted to eyes and lacrimal secretions, and in Europe and Asia *Phortica* species transmit thelazid nematodes to dogs, humans, and other mammals (infected cattle, horses and other ungulates have not been reported) (reviewed in Werner and Jaenike, 2017). Based on the few breeding records for *Amiota* and *Phortica*, *Phortica variegata* probably breeds in injured and decaying trees. It was first discovered in Orange County, New York in 2014 and Monroe Co., New York in 2015 (Miller et al., 2017; Werner and Jaenike, 2017), and it appears to be spreading, even abundant and nuisance in eastern Massachusetts.

Why the Spread?

There are several lines of explanation for the dramatic spread of these drosophilids in the past decade or so. One is that there has been increased commercial trade of fruits and horticultural plants, or relaxations in import regulations and surveillance, although I have no data for this. It's unlikely that this entirely explains these invasives, since they have such disparate life histories, breeding in fresh fruits, decaying fruits, fresh flowers, and trees. Another explanation may be climate change, especially since *Drosophila bromeliae* and *D. cardini* were found in New Jersey during particularly hot, wet summers, and the tropical species *Zaprionus indianus* is becoming more common there.

Request

The author would be very appreciative for obtaining information on presence/absence of *Drosophila bromeliae* in other areas of North America, particularly in the southestern U.S., where the species is suspected to be established. Squash, pumpkin, and other cucurbit flowers may be especially sought by the flies, but any large flowers are likely to be attractive, including ornamentals (e.g., *Hibiscus*, *Datura*, etc.). Also, any samples of *Phortica* (or their *Amiota* relatives) would be appreciated (see Werner and Jaenike, 2017 and Miller et al., 2017 for external features to ID the genus). Genitalia would need to be checked here to verify the species identification. *Phortica* and *Amiota* are easily collected in hardwood forests.

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Diptera diversity: a survey of the tropical rainforest of Los Tuxtlas, México

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Introduction

The biodiversity of tropical rainforests has been threatened by an intensive loss of habitat and changes in land use policies (Gutiérrez Granados *et al.* 2018). So, the rapid disruption of tropical forests probably jeopardizes global biodiversity more than any other contemporary phenomenon. Deforestation of tropical forests has been continuously increasing in recent decades, so protected areas are a natural refuge for biodiversity. According to Laurance *et al.* (2012), tropical protected areas are often intimately linked ecologically to their surrounding habitats, and their analysis reveals great variation in reserve 'health', about half of all reserves have been effective, but the rest are experiencing an erosion of biodiversity that is often alarmingly widespread taxonomically and functionally.

Most of the insect groups that live in tropical environments of the Americas are unknown. In the last 50 years, studies of Diptera of the Neotropical region have been marginal, although in this region high biodiversity occurs. Moreover, there is a crisis in the description of new taxa, mainly due to lack of taxonomists in Latin America (Brown 2005).

In the Network of Multitrophic Interactions (INECOL, Mexico) we conducted a long-term project called "Biodiversity and Systematics of the Diptera of Mexico" (BIODIMEX), whose main goal is the knowledge of the diversity of the Mexican Diptera, either in natural and anthropic environments. We emphasize our investigation in the families of Acalyptratae, and other taxa with phytophagous habits, including taxonomic studies, and aspects of their ecology and natural history. These studies are being conducted primarily in the cloud forest and rainforest communities. By example, the study of the Diptera diversity of the canopy and the understory of coffee agroecosystems in Veracruz (Hernández-Ortiz & Dzul-Cauich 2008).

The Biosphere Reserve of Los Tuxtlas (BRLT) is located at the central region of the state of Veracruz, being the northernmost tropical rainforest in the Americas. Moreover, that area also belongs to the "Mexican Transition Zone", where flora and fauna of Nearctic and Neotropical origin converge, therefore, its biological diversity requires to be studied.

For instance, some relictual species as *Rhagoletis turpiniae* (Tephritidae) occurs in this Reserve, whose closest relatives are found in North America (Hernández-Ortiz 1993). Currently we continue discovery new species in the BRLT, as *Beebeomyia tuxtlaensis* (Richardiidae), recently described in association with aroid inflorescences (Hernández-Ortiz & Aguirre 2015), and near as 15 other new species of Tephritoidea, which are being described (Hernández-Ortiz *et al.* unpublished data).

As part of this long-term project, we are currently developing a subproject on diversity and seasonal dynamics of the Dipteran families living in the understory of a preserved area in the region of Los Tuxtlas.

The study area

In Mexico, there are few places where there are still preserved rainforest areas. The Biosphere Reserve of Los Tuxtlas (BRLT), is located at the easternmost edge of the volcanic belt that crosses Mexico, presenting a complex series of uprisings running in NW-SE direction (Dirzo & García 1992). This massif arises in the coastal plain of the Gulf of Mexico and is relatively isolated from other mountain systems (Fig. 1).

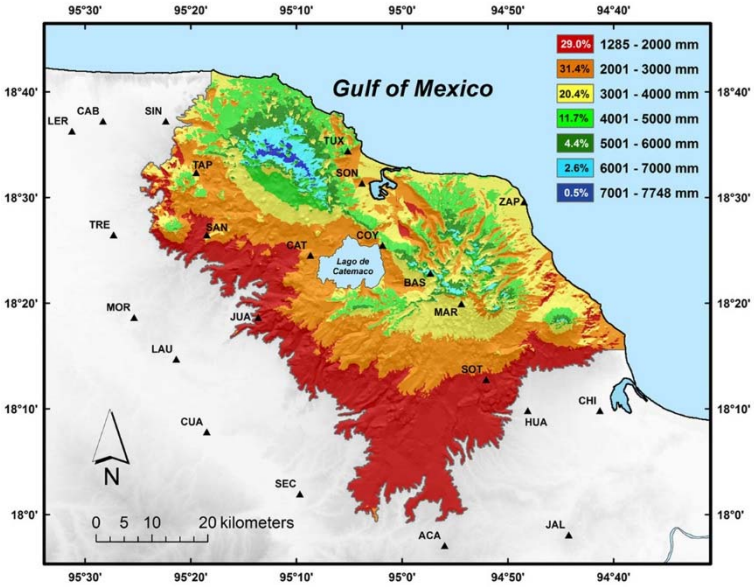

Figure 1. Map of the Los Tuxtlas Biosphere Reserve located in the state of Veracruz, Mexico (Elaborated by Gutiérrez-García & Ricker 2011)

The reserve consists of three core areas, which are the Volcano San Martín Tuxtla, Volcano Santa Martha, and Volcano San Martín Pajapan (29,720 hectares), and the rest (125,402 hectares) make up the buffer zone. Within the reserve, the Tropical Biology Station Los Tuxtlas-UNAM (LTBS) contribute with 640 hectares of high evergreen forest preserved in good condition (IBUNAM 2018) (Figs. 2a, 2b).

Figure 2. Two different aspects within the Los Tuxtlas Biological Station, UNAM (photos: Armando Aguirre)

The climate is warm and humid, with an average annual temperature between 24-26 °C, and is one of the rainiest places in Mexico, exceeding 4000 mm per year (Soto 2004, Gutiérrez-García & Ricker 2011). The area is considered a biodiversity hotspot, as it is the northernmost limit of this type of vegetation in the Neotropics and is under intense anthropogenic pressure (Gutiérrez-Granados *et al.* 2018). Historically this region has undergone extensive deforestation, which has led to a considerable reduction of natural vegetation, leaving a very fragmented landscape of high evergreen forest (Dirzo & García 1992).

Our study was conducted in a rainforest fragment of the LTBS, nevertheless, we are also conducting other comparable studies in the buffer zone. In this research we use three Malaise traps arranged in a hectare of preserved forest. These traps were monitored for 365 consecutive days, recovering every 15 days all specimens caught in each trap, which together accounted for 72 samples. All specimens were identified and quantified at family level follows Buck *et al.* (2009), and samples were preserved in 70% ethanol for subsequent studies in the Network of Multitrophic Interactions at INECOL (Xalapa, México).

Preliminary results

During an annual cycle of continuous collection in the understory of the tropical rainforest, we captured near as 68,000 specimens, belonging to 51 families of the order Diptera. The suborder Brachycera showed the greatest richness with 34 families, accounting for only 8.3% of the total abundance. In contrast, the suborder Nematocera was represented by 17 families joined together 91.7% of total captures (Table 1).

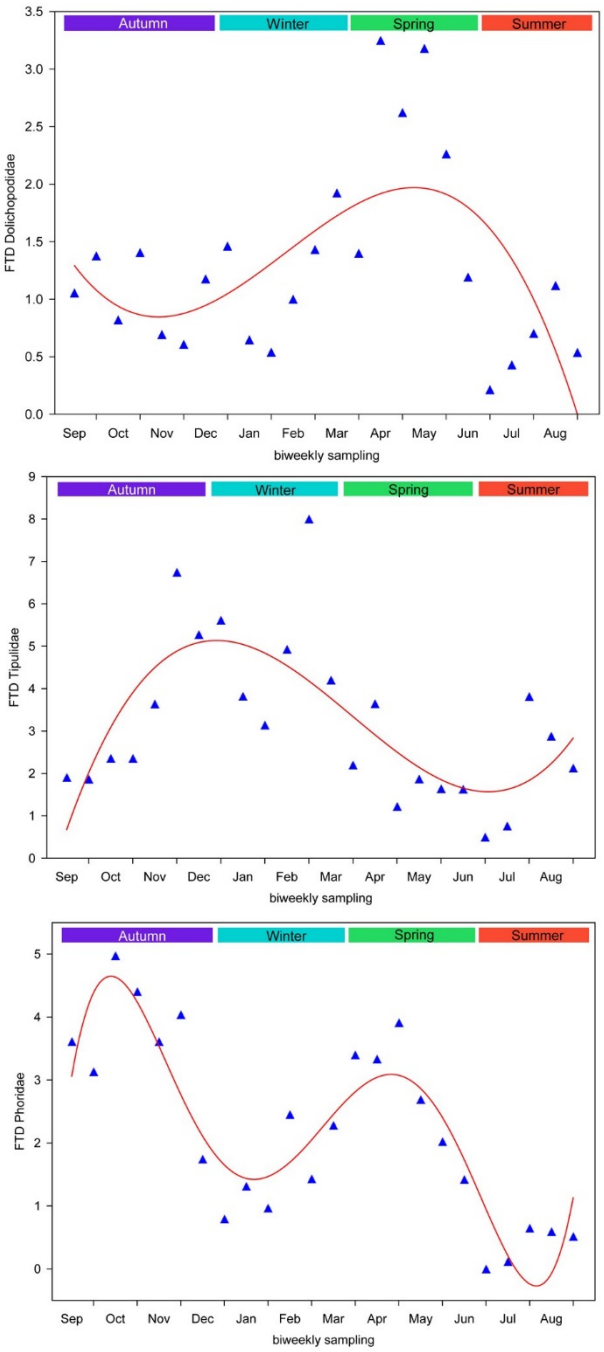

Figure 3. Examples of the seasonal dynamics of three families collected along annual cycle: Dolichopodidae (top); Tipulidae (medium); Phoridae (bottom)

In terms of abundance, the families Cecidomyiidae and Sciaridae were the best represented by nearly 70% of all individuals. Among 10 most abundant families, we also recorded the Ceratopogonidae, Tipulidae, Mycetophilidae, Phoridae, Chironomidae, Psychodidae, Dolichopodidae and Drosophilidae. Almost one half of the families were recorded by less than 10 individuals, mostly belong to the suborder Brachycera. Despite this, it stands a single specimen of the family Inbiomyiidae, which is a first-time record for Mexico. So far, described species have been found in 8 Central and South American countries from Guatemala in the north to

Bolivia and French Guiana in the south (Buck & Marshall 2006). This novel finding shows the importance of the systematic sampling conducted to assess the diptero-fauna of this region of Mexico.

We also perform analyses based on frequency-abundance indices to estimate rates of daily captures per trap (FTD). During rainy season, capture of flies was nearly four times higher compared to dry season, meanwhile, in terms of family-richness no significant fluctuation was observed, as it ranged from 60-70% between seasons.

The results of population indices exhibited several contrasting seasonal patterns, apparently depending to family assessed. For instance, the Phoridae showed two seasonal peaks during fall and spring; Dolichopodidae populations observed a single trend of growth during spring; while population indices of Tipulidae augmented between fall and winter. Such changes of the seasonal dynamics could be directly linked to certain climatic features, but it could be also explain based on specialized feeding habits for each taxon which is under analysis (Fig. 3).

Table 1. List of the families of Diptera found in the understory of the Los Tuxtlas Biological Station UNAM, Mexico.

Diptera Family	Rel-Abundance	Diptera Family	Rel-Abundance
Agromyzidae	< 10	Lygistorrhinidae	< 10
Anisopodidae	< 10	Micropezidae	11 - 100
Anthomyiidae	< 10	Milichiidae	11 -100
Asilidae	11 - 100	Muscidae	11 - 100
Bibionidae	< 10	Mycetophilidae	501 - 5000
Calliphoridae	< 10	Neriidae	< 10
Carnidae	< 10	Periscelididae	< 10
Cecidomyiidae	> 5000	Phoridae	501 - 5000
Ceratopogonidae	501 - 5000	Platystomatidae	< 10
Chironomidae	501 - 5000	Psychodidae	501 - 5000
Chloropidae	11 - 100	Rangomaramidae	101 - 500
Clusiidae	11 - 100	Rhagionidae	11 - 100
Conopidae	< 10	Sarcophagidae	11 - 100
Culicidae	11 - 100	Sciaridae	> 5000
Diadocidiidae	< 10	Simuliidae	< 10
Ditomyiidae	101 - 500	Sphaeroceridae	11 - 100
Dixidae	< 10	Stratiomyiidae	101 - 500
Dolichopodidae	501 - 5000	Syrphidae	< 10
Drosophilidae	501 - 5000	Tabanidae	< 10
Empididae	101 - 500	Tachinidae	11 - 100
Ephydridae	< 10	Tephritidae	< 10
Fanniidae	< 10	Tipulidae	501 - 5000
Inbiomyiidae	< 10	Ulidiidae	< 10
Keroplatidae	11 - 100	Xylomyidae	11 - 100
Lauxaniidae	101 - 500	Xylophagidae	< 10
Lonchaeidae	< 10		

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Predation by Asilidae (Diptera) in eastern New Mexico and Texas: a preliminary analysis of 5000 prey records

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Introduction

Asilidae, or robber flies or assassin flies, are a dominant group of predatory insects, common and diverse in a variety of habitat types, but notably in open, grassland or prairie-like areas (Wood 1981, Dikow 2009). Adults are often large and conspicuous in their prey-capturing activities, which has led to many papers documenting prey choice in many asilid taxa. It is generally acknowledged that most species of robber flies are generalist predators, and will select prey items based not on taxonomic group, but rather local abundance and/or size and color (Shelly and Pearson 1978, O'Neill 1992, Cannings 2014, Londt and Dikow 2017). As mentioned by Londt (2006: 317), information on prey selection "mostly takes the form of isolated prey records that are difficult to gather for analysis and verification". A very important resource is the "predator-prey" database (Lavigne 2003) which documents many thousands of worldwide asilid prey records, gleaned from relevant literature.

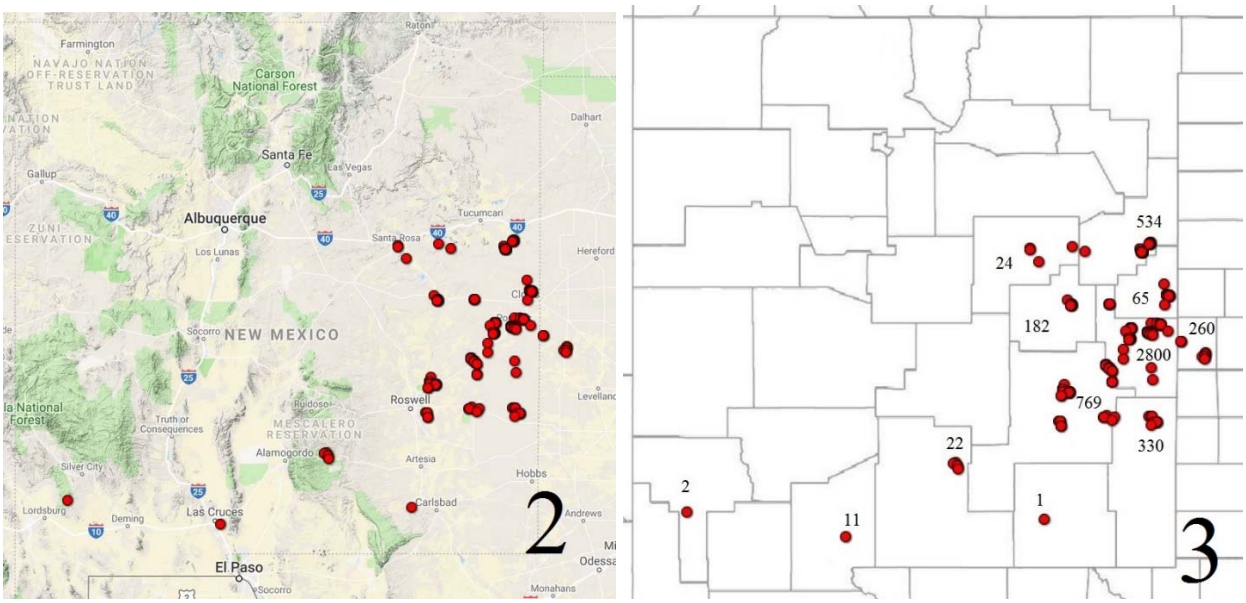
Due to a chance encounter in 2014 with an individual of the mydid fly *Phyllomydas phyllocerus* Bigot being consumed by a very large robber fly, *Proctacanthus micans* Schiner, I became interested in robber flies generally, and specifically, their prey preferences. This continues to the present, and has resulted in a sizeable collection of adult asilids pinned with their prey items. All of the 5,861 (as of 19 October 2018) predator-prey associations are housed in the insect collection of the Eastern New Mexico University Natural History Museum. In addition to these prey-associated asilids, general robber fly collecting has yielded another 10,000 or so specimens. The purpose of this paper is to present a preliminary analysis of the first 5,000 prey records and mention specific projects/studies underway, based on these data.

Figure 1. The 5,000th asilid-prey association: a female *Efferia varipes* (Williston) and *Polyphylla lanceolata* (Say) (Coleoptera: Scarabaeidae), Roosevelt Co., NM.

Geographic coverage and habitat types

The 5,000 predator-prey associations were collected "by hand", using a standard, 12" diameter insect net, at 153 discrete, GPS-documented localities (Figs. 1–2). All associations are mounted on the same pin, with standard entomological label and a four-digit code label (Fig. 1); all data have

been entered into an Excel spreadsheet and comprise the following "fields" (columns): Cat. Number, State, County, locality (lat), locality (long), locality nickname, day, month, year, predator subfamily, predator genus, predator species, predator sex, prey order, prey family, prey genus, prey species, sex of prey, and notes. Virtually all flies have been identified to species, using the most recent taxonomic revisions and/or consultation with other asilid workers. Species of certain genera, e.g. *Machimus*, remain difficult to identify. The identifications of many of the prey items have only been made to order level; the process of getting all prey items determined to species will be a long-term task. A concerted effort was made to sample localities within 2 hours of Portales (Roosevelt Co.), NM while specimens further afield were collected opportunistically. Individual localities were visited randomly (though usually once every 1-4 weeks), and no attempt was made to quantify collecting effort; predator-prey associations were collected (or were attempted to be collected!) wherever and whenever they were observed. Approximately 98% of records were obtained from five counties in eastern New Mexico [Roosevelt (56%), Chaves (15%), Quay (11%), Lea (7%), and De Baca (4%)] and one in west Texas: Bailey (5%). Fig. 3 displays the numbers of records for each of the included counties.



Figures 2–3. Distribution of the 5,000 asilid-prey associations in eastern NM and west TX. Each circle represents a discrete GPS locality; numerals indicate number of specimens for each county. Maps created with gpsvisualizer.com (fig. 2 option "Google terrain"; fig. 3 option "county outlines").

Almost all specimens were collected in open, grass-dominated semi-desert, or prairie-like habitats. No attempt has yet been made to analyze the botanical diversity at individual sites; some of the localities were treeless with scattered or uniform grass-diverse vegetation, with specimens collected from the ground (e.g., *Efferia* spp.) or swept from grasses (e.g., *Proctacanthus milbertii* Macquart) while others had taller shrubs, trees or cacti, on which were individuals of certain taxa of asilids (notably *Heteropogon* patruelis (Coquillett) and *H. cazieri* Wilcox, which were never seen on the ground).

Taxonomic representation of Asilidae

From 2014 to 2018, individuals representing 32 genera in seven subfamilies of Asilidae were collected in association with prey items. The top three subfamilies (numbers indicate specimen totals within each genus): Asilinae with 57% of all records (*Efferia* Coquillett, 1716; *Proctacanthus*

Macquart, 452; *Mallophora fautrix* Osten Sacken, 196), Stenopogoninae with 23% of all records (*Heteropogon* Loew, 814; genus nr. *Eucyrtopogon* Curran; 75, *Wilcoxia* James, 59), and Dasypogoninae with 15% of all records (*Diogmites* Loew, 385; *Saropogon* Loew, 330). Among Asilinae, individuals of all collected genera except for species of *Mallophora* Macquart and *Megaphorus* Bigot which were always collected on vegetation, are ground-resting, and therefore specimens with prey items are more easily seen and collected. *Efferia* is/was by far the dominant group of robber flies in the study area, with approximately 20 species collected in association with prey. The female: male sex ratio for the asilids representing the first 5,000 prey associations is 1.7:1. The complete taxonomic breakdown of the asilids involved in the 5,000 prey records is given in Table 1.

Prey selection

Spiders and insects form the bulk of robber fly diets (Wood 1981, Lavigne 2003, Dennis et al. 2012). The present study revealed that spiders and 13 orders of insects comprise the prey items; Table 1 shows the 5,000 associations, sorted to genus of Asilidae and order of prey items. Although analyses of these data are in their preliminary stages, some generalizations are possible. Over 98% of records were represented by six orders: Hymenoptera (30%), Hemiptera (24%), Diptera (22%), Coleoptera (10%), Lepidoptera (7%), and Orthoptera (6%). The rarest orders represented include Raphidioptera and Thysanoptera with one record each, Isoptera with two records, and Psocoptera and Odonata with seven and 11 records, respectively. In Londt's (2006) analysis of 2,000 Afrotropical asilid-prey associations, these same six orders comprised 96% of all records; however, the percentages represented by the specific orders were: Hymenoptera (26%), Diptera (23%), Coleoptera (15%), Orthoptera (14%), Hemiptera (10%), and Lepidoptera (8%).

At the generic level, predators such as *Efferia* spp. and other asilines seem to be generalists; however, *within* genera, individual species may show preferences for individual orders/families of prey. For example, we have approximately 20 species of *Efferia* with prey records; possible interspecies differences in prey preference are currently being analyzed. On the other hand, other genera seem to specialize on certain orders; this seems particularly true for Hymenoptera. For example, the Hymenoptera prey of *Mallophora* and *Megaphorus*, which seemingly are Hymenoptera mimics (refs?), represent 83% and 75% of all prey for these asilids, respectively. Two other genera of asilids whose species seem to prefer Hymenoptera are *Saropogon* and *Cerotainiops* Curran, with such prey representing 86% and 87% of all prey, respectively. *Cerotainiops abdominalis* (Brown) and two species of *Saropogon* have been discovered to be specialists on workers of *Pogonomyrmex* harvester ants, as mentioned below. As can be seen in Table 1, *Diogmites* spp. seem to prefer Hymenoptera (56%) and Diptera (26%). However, within *Diogmites*, one species – *D. pritchardi* – is potentially a specialist upon Coleoptera (Pollock, unpublished).

It is relatively straightforward to hypothesize on prey *preferences*, but given the large number of records obtained, the *absences* of prey orders also become obvious. For example, it is natural to assume that the absence of Orthoptera prey for species of *Atomosia* Macquart spp., with body lengths of about 10 mm, may be due to the prohibitively large size of orthopteran prey. However, for other groups of asilids, incompatibility in size cannot be relied upon as an explanation for the absence of specific groups of prey. Table 2 shows the percentages of the top six prey orders for the top five subfamilies of Asilidae, showing some trends. For example, Lepidoptera and Orthoptera comprise a significant component of prey for various genera of Asilinae (11% and 10%, respectively, of total prey associations) while in all other four subfamilies combined, they comprise only 2% and 3% of all prey. The Stenopogoninae and Stichopogoninae were associated with 58% and 48% hemipteran prey, respectively, while the overall percentage of these insects for the 5,000 asilids is only 24%.

Table 1. Details of 5,000 robber flies and their prey items, collected at various localities in eastern New Mexico and west Texas, from 2014 to mid-2018. Genera of asilid predators are listed alphabetically by, and within subfamily. Orders and suborders (for Hemiptera only) of prey items are given alphabetically, by 3- or 4-letter abbreviation: ARAN(eae), COL(eoptera), DIP(tera), EPH(emeroptera), HET(eroptera), "HOM"(optera), ISO(ptera), LEP(idoptera), NEU(roptera), ODO(nata), ORT(hoptera), PSO(coptera), RAP(hidioptera), and THY(sanoptera). Note: "HOM" represents the two orders Auchenorrhyncha and Sternorrhyncha.

subfamily	genus	records	% total	ARAN	COL	DIP	EPH	HET	"HOM"	HYM	ISO	LEP	NEU	ODO	ORT	PSO	RAP	THY
ASILINAE	*Efferia*	1716	34.32%	3	115	568	1	180	138	353	1	234	10	3	110			
	Machimus	61	1.22%	2	4	33		4	6	4		2	1		5			
	Mallophora	196	3.92%		10	6		12	5	**163**								
	Megaphorus	48	0.96%			9	1	1	1	**36**								
	Proctacanthella	185	3.70%	1	9	44		15	37	53		9	3		14			
	Proctacanthus	452	9.04%		50	124		4	1	108		61	1		103			
	Promachus	111	2.22%		10	36		9	3	39		3	1		10			
	Triorla	80	1.60%		**0**	26		1		**0**		11	3	4	35			
DASYPOGONINAE	*Cophura*	2	0.04%					1		1								
	Diogmites	385	7.70%	2	28	**100**		5	23	**217**		5	1	4	**0**			
	Hodophylax	17	0.34%		2	2				13								
	Lestomyia	17	0.34%		1	5		5	2	4								
	Omninabiautus	2	0.04%			2												
	Saropogon	330	6.60%		28	8		5	4	**285**								
LAPHRIINAE	*Atomosia*	27	0.54%		2	6		1	4	13								1
	Cerotainiops	119	2.38%		10	1		3	1	**104**								
	Lampria	4	0.08%		3					1								
	Laphria	2	0.04%		1					1								
	Pogonosoma	1	0.02%							1								
LAPHYSTIINAE	*Laphystia*	12	0.24%			9			2	1								
STENOPOGONINAE	*Ablautus*	57	1.14%			19		21	10	2	1				1	3		
	Backomyia	26	0.52%					14	12									
	Heteropogon	814	16.28%	25	190	20	9	307	195	51		**4**	9		**0**	4		
	Holopogon	11	0.22%			2		4	2	3								
	Microstylum	42	0.84%		1	4		14	4			**0**			19			
	nr. *Eucyrtopogon*	75	1.50%		4	10		35	10	12		3			1			
	Osprioceras	48	0.96%		18	13		7	2	3			2		3			
	Scleropogon	21	0.42%		3	4									13		1	
	Stenopogon	3	0.06%							1					2			
	Wilcoxia	59	1.18%		1	17		10	27	4								
STICHOPOGONINAE	*Stichopogon*	60	1.20%	6		18		1	28						7			
TRIGONOMIMINAE	*Holocephala*	17	0.34%	1		11	1	2		2								
Prey order totals				40	490	1097	12	661	517	1475	2	332	31	11	323	7	1	1
Prey order %				0.80%	9.80%	21.94%	0.24%	13.22%	10.34%	29.50%	0.04%	6.64%	0.62%	0.22%	6.46%	0.14%	0.02%	0.02%

Table 2. Breakdown of the top six orders of insect prey (COLeoptera, DIPtera, HEMiptera, HYMenoptera, LEPidoptera, and ORThoptera), based on the top five subfamilies (each of which comprised > 1% of total records). The overall percentages for each of the orders for all 5,000 records is given on the bottom row for comparison.

subfamily	**# genera**	**total records**	**COL**	%COL	**DIP**	%DIP	**HEM**	%HEM	**HYM**	%HYM	**LEP**	%LEP	**ORT**	%ORT
Asilinae	8	2849	198	7%	846	30%	417	15%	756	27%	320	11%	277	10%
Dasypogoninae	6	753	59	8%	117	16%	45	6%	520	69%	5	1%		
Laphriinae	5	153	16	10%	7	5%	9	6%	120	78%				
Stenopogoninae	10	1156	217	19%	89	8%	674	58%	76	7%	7	1%	39	3%
Stichopogoninae	1	60			18	30%	29	48%	4	7%				
overall order %			490	10%	1097	22%	1178	24%	1475	30%	332	7%	323	6%

Specific studies

Predation on Coleoptera.—Given my background as a coleopterist, this seemed a good first project; from 2014 to 2017, 293 Coleoptera were collected as prey of robber flies, representing 20 families. For three genera of Asilidae, beetles represented at least 10% of the total prey captures documented for each: *Ospriocerus* Loew (44%), *Heteropogon* (23%) and *Proctacanthus* (10%). The most popular beetle families as prey were Chrysomelidae, Scarabaeidae, Tenebrionidae, and Melyridae. The first manuscript (Pollock and Lavigne, in press) based on these asilid prey associations deals with 293 Coleoptera prey, representing 20 families; the Carabidae were not included in this paper and will be treated separately.

Predation on harvester ant workers.—Anecdotal evidence, and a few scattered literature records indicate that some species of Asilidae feed on workers of various species of *Pogonomyrmex*. We discovered this to be true in several species, notably in the genera *Cerotainiops* and *Saropogon*. In fact, of the 108 prey records known for *S. pritchardi* Bromley, 94% were harvester ant workers, despite the presence of a fairly rich pool of potential prey items from a variety of orders. For *C. abdominalis*, the bulk of the non-harvester ant prey items taken were done so on days where the temperatures were prohibitively high for the ants to be foraging (Pollock and Quinn, in prep.).

Predation of Asilidae by Asilidae.—Another interesting phenomenon made apparent by the collection of so many prey associations is the predation of robber flies on other robber flies. Of course, this should not be surprising given that many species are generalist predators and that robber flies can be abundant potential prey items. In fact, Londt (1993) found that Asilidae were the fourth most fed-upon group of prey, behind Acrididae, Formicidae and Scarabaeidae. Londt (1995) published data on 101 examples of asilid-asilid predation, with asilids identified only to genus. Our collections have produced 424 such associations, for all of which both asilids are identified to species (with a few rare exceptions), and their bulk indices (*sensu* Londt 1993) measured. These data will be used to answer questions on general prey selection in Asilidae (e.g., do larger predators select larger prey, and do females select larger prey than males?), and also intraspecific cannibalism. The same types of questions that Londt (1995) answered and also posed will be expanded upon, based on our larger data set.

Conclusion

As work continues on this collection, especially on identification of the prey items, it is expected that additional insights will be possible into ecology, behavior, and prey selection of robber flies in eastern New Mexico and western Texas. Not only will these specimens contribute to aspects of asilid biology mentioned above, but the large number of specimens will greatly add to knowledge (hitherto almost completely lacking in this geographic area) of seasonality, distribution, and basic taxonomy.

Acknowledgments

I thank various members of my family, especially my son George, who have accompanied me on many productive asilid-collecting field trips. For access to interesting collecting sites, I also am grateful to several enlightened land owners in Roosevelt County, NM (Jenny Clemmons, Marjorie Fraze, and Bill Roberts) and Bailey County, TX (Carlos Contreras and Greg Young). The unenlightened land owners shall remain nameless. For general encouragement and advice given to this neophyte dipterist, I acknowledge Eric Fisher, Rob Cannings, Torsten Dikow, Chris Cohen, Riley Nelson, and Jason Londt. Finally, I thank the many colleagues who have assisted with identifications of many of the 5,000 prey items.

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First record of the genus *Scythropochroa* Lengersdorf 1926 (Diptera: Sciaridae) from North America

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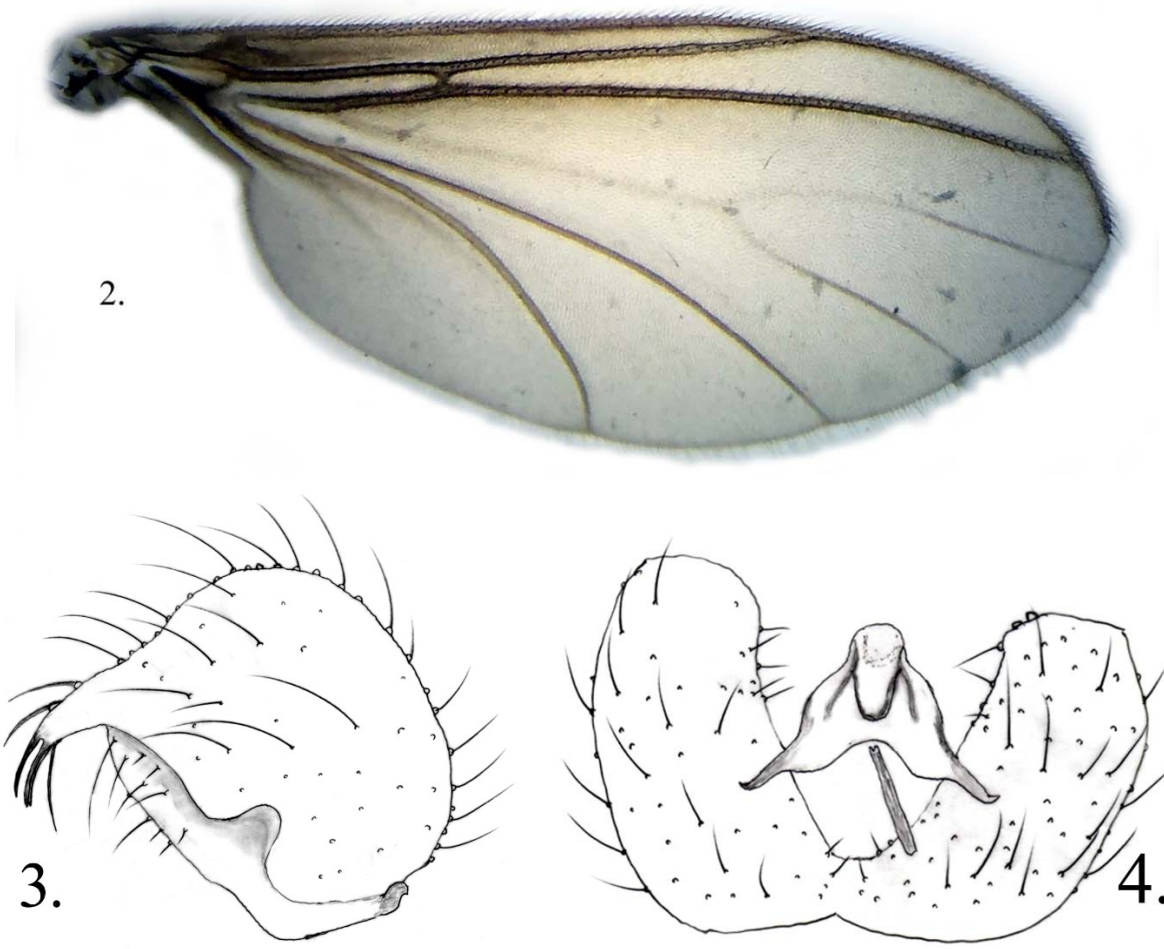
One of the most challenging and fascinating groups of Diptera which I collect and document is the Sciaridae (Diptera), better known as the black fungus gnats. In the most recent catalog of the North American black fungus gnats (Mohrig et al. 2012), 25 genera and 166 species are presented. However the genus *Scythropochroa* Lengersdorf 1926 was not included in that catalog simply because the genus was not represented in any museum material studied. On July 1, 2018 I collected one male and several females of what I believed to be a *Scythropochroa* sp. The collection site was in a mature oak-beech forest about 5 km North of Aspinwall in Allegheny County, Pennsylvania. Dr. Menzel verified the identification for me, confirming the fact that *Scythropochroa* is now a new North American record. Adults of this genus are large, dark bodied flies typically 4-6 mm in length, making them relatively easy targets for collectors. Adults are followers of decay and I collected my specimens while at rest on a heavily rotting oak log. Here I present two photographs and two illustrations of this *Scythropochroa* sp. Some of the morphological features which define the genus are the large 1-segmented palpus as seen in Fig. 1 of the female head; the long R1 vein which joins the C beyond the M "fork" (Fig. 2); the male gonostylus with the 2-3 strong spines at the inner apical margin (Fig. 3); and the tegmen with laterally splayed apodemes and well-defined aedeagus (Fig. 4, gonostyli removed). One male and one female will be deposited in the National Museum of Natural History, Washington, D. C. for future study.



I wish to express my appreciation to Dr. Frank Menzel, Senckenberg Deutsches Entomologisches Institut (SDEI), Eberswalder Strasse 90, 15374 Müncheberg Germany, for verifying the genus *Scythropochroa*.

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Pursuing mycetophilids in northern Nevada during 2018

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During 2018 I made an intensive effort to collect and rear Mycetophilidae from as many habitats as I could in Northern Central Nevada. I used Malaise, Emergence and Yellow Pan traps in this work. In addition I caught a considerable number of mycetophilids in EVS dry ice baited traps that I used for sampling mosquitoes as part of the mosquito abatement program that I am involved in. I put Malaise traps out in as large a variety of habitats as I was able. These included dry desert areas, riparian zones along the Humboldt River and a number of creeks, marshes in abandoned gravel pits, alkali flats (Fig. 1), willow thickets (Fig. 2), burned over areas, and islands of unburned vegetation in those areas, woodlands of juniper (Fig. 3) and of aspen (Fig. 4), and different sites on my own property, which sometimes yielded surprises. Elevations of these collecting sites ranged from 4200 to 9400 feet (Fig. 5). Some required taking a day off of work to hike into an area I was interested in, and do the same a week later to recover the trap. I tried to put these traps in remote and concealed locations where they would not be likely to be disturbed by humans. In fact, the only trap that was disturbed was the one I had set up on my own property, having been totally destroyed by cats (Fig. 6) who found it a wonderfully entertaining gymnasium. Both the emergence and the EVS traps made interesting contributions to the adults I collected during this past insect season. I tried to visit areas more than once during the season in the hope of being present when a short lived species was emerging.

Figures 1–2. Malaise traps set up on alkali flats (1, left), and in a willow thicket (2, right).

Figures 3–6. Malaise traps set up in a juniper grove (3, upper left), an aspen forest (4, upper right), and in the Santa Rosa Mountains at 9400 feet elevation (5, lower left). Figure 6 (lower right) was a trap on my property destroyed by cats.

In addition to this I attempted to rear adults out of every promising material I came across. These included mushrooms, various kinds of leaf litter, moldy cattail roots, decaying wood, material out of tree hollows and packrat nests. I put these into rearing chambers that I constructed (Fig. 7). They were of two types: one was a canning jar with the metal lid replaced by a square of cloth, the other a freezer container with ventilation holes lined with the same cloth so the interior could breathe. On the bottom of these containers I put about 2 centimeters of a 50/50 sand and peat moss mixture that I made myself. My rearing area was outside on the north side of a shed where it was shaded from the sun. As the season progressed and I got more and more containers I set up a table there and put the containers both on top of the table and beneath it.

Figure 7. My outdoor rearing chamber.

So far I have identified 177 adult specimens, collected mainly this year, to genus and I still have a considerable number to go. Of these 67% were taken in Malaise traps, most of the rest in EVS traps. I got no mycetophilids in Yellow Pan Traps. So far I have identified twelve genera among the adults. I am not sure how many species there are, but I plan on working on that this winter.

Of the twelve genera *Docosia* sp. made up 60% of the catch. It is present in a wide variety of habitats, including arid desert areas, from April through June. I caught two of these in an emergence trap I put over a rodent burrow. The edges of the trap were sealed over with dirt so that anything appearing in the killing jar had to have come from the burrow. After catching these two specimens I dug the burrow up, expecting to find nesting material that I could try rearing more adults of this genus out of. Instead I found that there was no nest in the burrow, just two droppings that I collect and put in a rearing chamber. The burrow dead ended and there were no branches coming off of it, it didn't appear to have been used by the animal that dug it. So I set the emergence trap over another animal burrow and caught a single specimen of *Megalopelma* sp. This burrow evidently had more than one entrance as large red spider wasps and a *Prionyx* wasp, among others, turned up in the trap. I caught one other mycetophilid, a *Rymosia* sp. in a partly flooded animal burrow in an abandoned gravel pit while dipping for mosquito larvae. This was very early in the season. I put a Malaise trap in this pit a number of times during succeeding months and caught no more *Rymosia* there. I caught one more adult mycetophilid with an emergence trap I put up over a patch of moss - a *Mycetophila* sp.

From the collecting I did this year I got the impression that the populations of some of these flies were very localized – I might catch several at one location and a hundred yards away in apparently identical habitat catch nothing. The adults of most of the genera I have seen don't seem to live very long - they will turn up in a trap one week, and not be seen again. Out of 19 *Exechia* sp. that I caught, only one was taken in a Malaise trap, the others were all collected in EVS dry ice baited traps. What is that telling me about them?

My efforts at rearing adult mycetophillids out of the various substrates I collected have so far not produced one adult fly, and I have seen no activity of any sort in any of the rearing chambers. I have no idea why my efforts on this have failed. Did I inadvertently kill whatever larvae might have been there while collecting the substrate? Did I collect the wrong substrate? But I collected everything that looked promising, neglecting nothing. It is a mystery to me where these flies are coming from. I've made a Berlese funnel and next year I am going to run prospective breeding material through it and see if I can't collect mycetophilid larvae. If I can, then I can target that material. But I haven't given up the breeding material I collected in 2018 - I will move the containers inside to a cool room over the winter and see if something comes out in spring.

This winter I will identify the rest of the adults I have collected to genus, and then move forward trying to get them to species. I will try to find keys and descriptions to do this. I don't think it will be an easy task. In the spring I will again start to collect adults and will run potential breeding material through my Berlese funnel. If I can find the time I will go out and search for adults with a net. I have not been able to get to every habitat in North Central Nevada that mycetophilids might be in, and I don't want to make assumptions about what those may or may not be because that just leads to blind spots. I think I may have missed some species because they emerge, live only a few days, and then are gone. I might pick those up if I kept a trap in one location for the entire insect season. I might try that in a promising location, and keep moving the other traps I have around.

This has been a very challenging, absorbing and interesting project and I feel I have learned a great deal about not only mycetophilids, but other insects as well. And the learning has been through direct engagement with the insects in the wild, trying to understand the clues they are giving me about their hidden, secret lives. I'm greatly looking forward to 2019.

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The Gnatwork

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The Gnatwork, directed by Dr Simon Carpenter (The Pirbright Institute) and Prof Mary Cameron (LSHTM), is one of four Global Challenges Research Fund (GCRF) Networks in vector-borne disease research. This project brings together workers on blackflies (Simulidae), sandflies (Psychodidae) and biting midges (Ceratopogonidae) from around the world to address technical issues that arise when working on small biting flies. As part of the project, we have funds available to pump-prime collaborative research projects that bring together researchers and techniques for working across the three vector groups (the next call will open late 2018). We will also be hosting a number of international training workshops aimed at early career researchers, and provide web-based resources, including re-releasing the information that was originally held at www.culicoides.net. For access to these resources and opportunities, join the Gnatwork at www.gnatwork.ac.uk.

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HISTORICAL DIPTEROLOGY

Revised dates of publication for Schiner's *"Fauna Austriaca. Die Fliegen (Diptera)"*

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Schiner's *Fauna Austriaca. Diptera* (Schiner 1860–1864) was published in two volumes, with the title page for having the dates "1862" (for Vol. I) and "1864" (for Vol. II). However, the work was actually published in 14 Hefte (including double Hefte) between 1860 and 1864. In Evenhuis (1997), I gave publication dates as researched at that time. Recently, I came across a recording journal of Austrian book publishers (the *Österreichische Buchhändler-Correspondenz*), which gives more accurate dates for the Hefte. Most of the dates are earlier than previously recorded, and in two cases (Hefte 3/4 and 9/10), involve publication in the year previous to what was known in 1997. I here present the breakdown of each Heft and earliest known publication dates based on current research.

Table 1. Dates of Publication of Schiner's *Fauna Austriaca. Die Fliegen (Diptera).*
(based on dates in the *Österreichische Buchhändler-Correspondenz* unless otherwise noted)

Vol.	Heft	Pages, plates	Date of publication	Source
I	1	1–72	10 Jun 1860	
	2	73–184, pl .1	20 Sep 1860	
	3/4	185–368	1 Dec 1860	
	5	369–440	10 Aug 1861	
	6/7	441–656	20 Nov 1861	
	8 (part)	657–674, prelims, pl. 2	2 Jul 1862	(Zool.-Bot. Ges. Wien)
II	8 (part)	1–80	2 Jul 1862	(Zool.-Bot. Ges. Wien)
	9/10	81–288	1 Dec 1862	
	11/12	289–480	1 Nov 1863	
	13/14	481–658, prelims	March 1864	(*Wien. Ent. Monatschr*.)

References

Evenhuis, N.L. (1997) *Litteratura Taxonomica Dipterorum (1758–1930) being a selected list of the books and prints of Diptera taxonomy from the beginning of Linnaean nomenclature to the end of the year 1930; containing information on the biographies, bibliographies, types, collections, and patronymic genera of the authors listed in this work; including detailed information on publication dates, original and subsequent editions, and other ancillary data concerning the publications listed herein*. 2 vols. Backhuys Publishers, Leiden, x + 871 pp.

Schiner, J.R. (1860–1864) *Fauna Austriaca. Die Fliegen. (Diptera). Nach der analytischen Methode bearbeitet von J. Rudolf Schiner. Mit der Charakteristik sämmtlicher europäischer Gattungen, der Beschreibung aller in Deutschland vorkommenden Arten und dem Verzeichnisse der beschriebenen europäischen Arten*. 2 vols in 14 Hefte. C. Gerold's Sohn, Wien [= Vienna].

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Gems from the H. Fischer collection: Diptera watercolors by E. H. Compton and a syntype of *Pegesimallus teratodes* (Hermann, 1906) (Asilidae)

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The SNSB Zoologische Staatssammlung München (ZSM) recently received the natural history collection of Dr. Heinrich ("Heinz") Fischer (* 5. iv 1911, Augsburg, Germany; † 15. iv 1991 ibid). Fischer was a natural history "all-arounder" interested in zoology and particularly entomology, but also ecology, geography, and archeology. He received a broad academic education in these topics at the Ludwig Maximilian University of Munich. After graduating in 1938 he was temporarily employed at the ZSM and later worked as a teacher and as a freelance scientist, all the time amassing an extensive natural history collection with a special focus on less studied groups such as Diptera. In 1983 Fischer founded a natural history museum in Königsbrunn and his collections were originally deposited there. Later most of the collection was placed into the temporary care of the Naturmuseum Augsburg. In 2016 the collection H. Fischer was finally transferred to the ZSM.

The received collection included 76 drawers of Diptera, mostly from Bavarian locations, but also with a few exotic specimens. Four of these drawers are particularly noteworthy, featuring some exceptional exemplars accompanied by beautiful illustrations in watercolor executed by E. Harrison Compton (* 11. x 1881, Feldafing, Germany; † 6. iii 1960 ibid). Compton is renowned for his alpine landscapes. The dipteran details demonstrate that he also excelled in this entirely different subject. The four drawers with Comptons watercolors are illustrated here with translations of the accompanying text labels.

One of the drawers contains a well-preserved specimen of *Pegesimallus teratodes* (Hermann, 1906) (Asilidae) whose hind legs are beautifully adorned with very long, laterally compressed, feather-like bristles along the anterior and posterior margins of the much elongated hind tarsi. The impressive specimen, which is labelled as "Type" is larger and much better preserved than the type specimen of *Pegesimallus teratodes* already present in the ZSM collection, which was previously considered the unique holotype (Londt 1980). By reference to the original description by Hermann (1906) it is established that the specimen form the H. Fischer collection is indeed a syntype. Some additional information on the provenience of the type material is provided.

Drawer "C 33 Fliegen (Compton 1)" (Fig. 1, ZSM Drawer-ID: ZSM-DIPT-40/o.Nr.)

Watercolors and respective exemplars as identified on the labels: on the left, top to bottom: *Haematopoda italica* (Tabanidae, head and thorax), *Laphria flava* (Asilidae, lateral aspect of head and prothorax, tarsi of right foreleg), *Sargus cuprarius* (Stratiomyidae, lateral aspect of head and prothorax, frontal aspect of head); on the right, top to bottom: *Ogcodes gibbosus* (Acroceridae, lateral aspect), *Bombylius major* (Bombyliidae, lateral aspect).

Text labels *[translation]*, top to bottom: "Die Bremsen saugen gerne Blut – und werden oft dafür erschlagen." *[The horse flies like to suck blood – and are often slain for it]*.

"Die Raubfliegen jagen andere Insekten und saugen sie aus." *[The robber flies hunt other insects and suck them dry]*.

"Die Waffenfliegen sind harmlose Tiere, obwohl sie mit zwei kräftigen Dornen am Schildchen bewehrt sind." *[The soldier flies are harmless animals, although they are adorned with two strong thorns on the scutellum]*.

"Die Buckelfliegen scheinen ohne Nahrungsaufnahme zu leben. Ihre Larven aber fressen Spinnen oder deren Eipakete auf." *[The hunch-back flies seem to live without food intake. Their larvae, however, devour spiders or their egg packets]*.

"Die Wollschweber sind äusserst gewandte Flieger. Wie Kolibris saugen sie – in der Luft stehend – den Blütenhonig. Ihre Larven schmarotzen bei der Seidenbiene (*Colletes*), fressen erst deren Blütenstaubvorrat und dann ihre Brut dazu." *[The bee flies are extremely swift fliers. Like colibri they suck – hovering in the air – the flower honey. Their larvae parasitize on the plasterer bee (Colletes), devouring first their pollen deposit then their brood to boot]*.

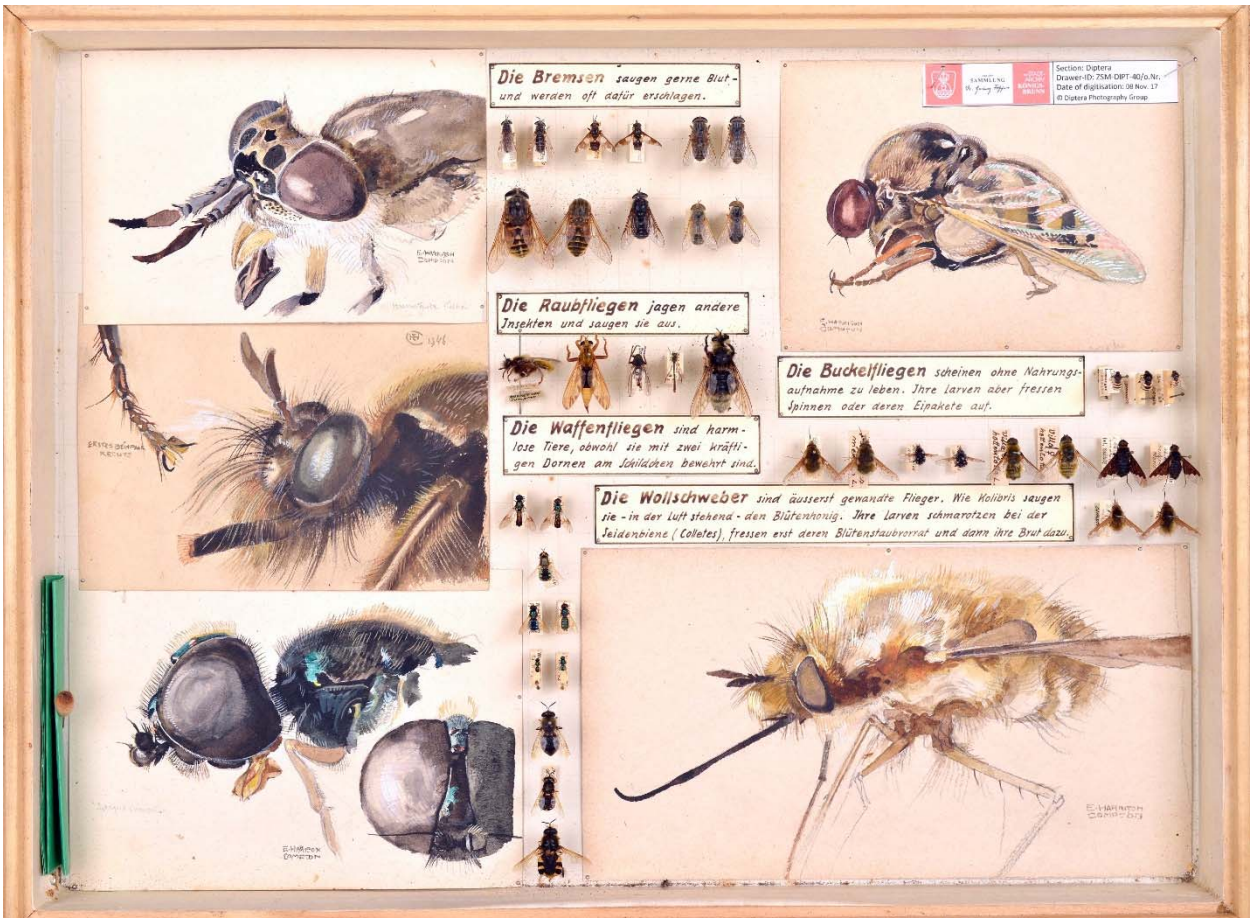

Figure 1. Drawer "C 33 Fliegen (Compton 1)" *[flies (Compton 1)]* from the H. Fischer collection.

Drawer "C 34 Harmlose, Licht u. Feuchtigkeit liebende Pflanzenbesucher" (Fig. 2, ZSM Drawer-ID: ZSM-DIPT-232/o.Nr.)

Watercolors and respective exemplars as identified on the labels: on the left, top to bottom: *Trypetoptera punctulata* (Sciomyzidae, dorsal aspect), *Stratiomyia chamaeleon* (Stratiomyidae, dorsal aspect of head and thorax); on the right: *Limnia unguicornis* (Sciomyzidae, lateral and dorsal aspect of head and thorax).

Text labels *[translation]*, top to bottom: “Die Hornfliegen sind meist auf Pflanzen in der Nähe von Wasser zu finden. Die Larven u. Puppen schwimmen auf der Oberfläche von stehenden oder langsam fliessenden Gewässern zwischen Wasserpflanzen, von denen sie leben. Die Puppen finden sich im Genist, frei oder in Schneckenschalen.” *[The horn flies are generally found on plants in the vicinity of water. The larvae and pupae float on the surface of standing or slow-flowing bodies of water between water plants, of which they live. The pupae are found in litter, free or in snail-shells]*.

“Eine Hornfliege.” *[A snail killing fly]*.

“Harmlose, Licht u. Feuchtigkeit liebende Pflanzenbesucher.” *[Harmless light and humidity loving visitors of plants]*.

“Die Waffenfliegen sind Honigsauger und Pollenfresser; sie lieben besonders Schirm- und Korbblüten und sitzen auch gerne auf sonnenbeschienenen Büschen in Wassernähe.“ *[The soldier flies are honey-suckers and pollen-eaters; the particularly love umbellifer and composite flowers and also like to sit on sunlit shrubbery in the vicinity of water]*.

“Eine Waffenfliege.“ *[A soldier fly]*

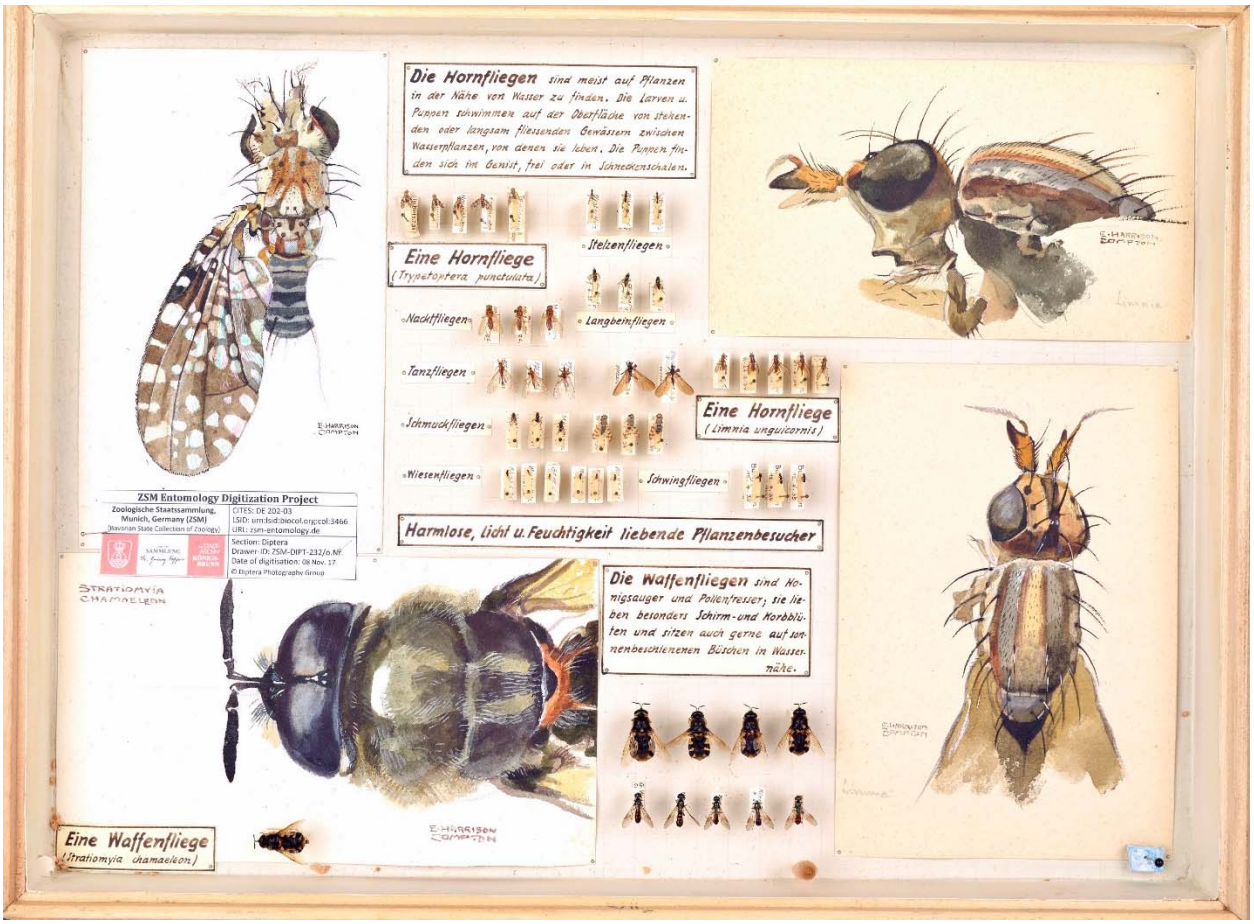

Figure 2. Drawer “C 34 Harmlose, Licht u. Feuchtigkeit liebende Pflanzenbesucher” *[Harmless light and humidity loving visitors of plants]* from the H. Fischer collection.

Drawer "C 35 Schmarotzerfliegen und ihre Opfer" (Fig. 3, ZSM Drawer-ID: ZSM-DIPT-27/o.Nr.)

Watercolors and respective exemplars as identified on the labels: on the left: *Gymnosoma rotundata* (Tachinidae, lateral and dorsal aspect); on the right: *Echinomyia fera* (Tachinidae, lateral aspect of the head).

Text labels *[translation]*, top to bottom:

"Schmarotzerfliegen und ihre Opfer." *[Parasitic flies and their victims]*

"Die Kugelfliege." *[The bullet fly]* (German vernacular name)

"Die Borstenfliege." *[The bristle fly]* (German vernacular name)

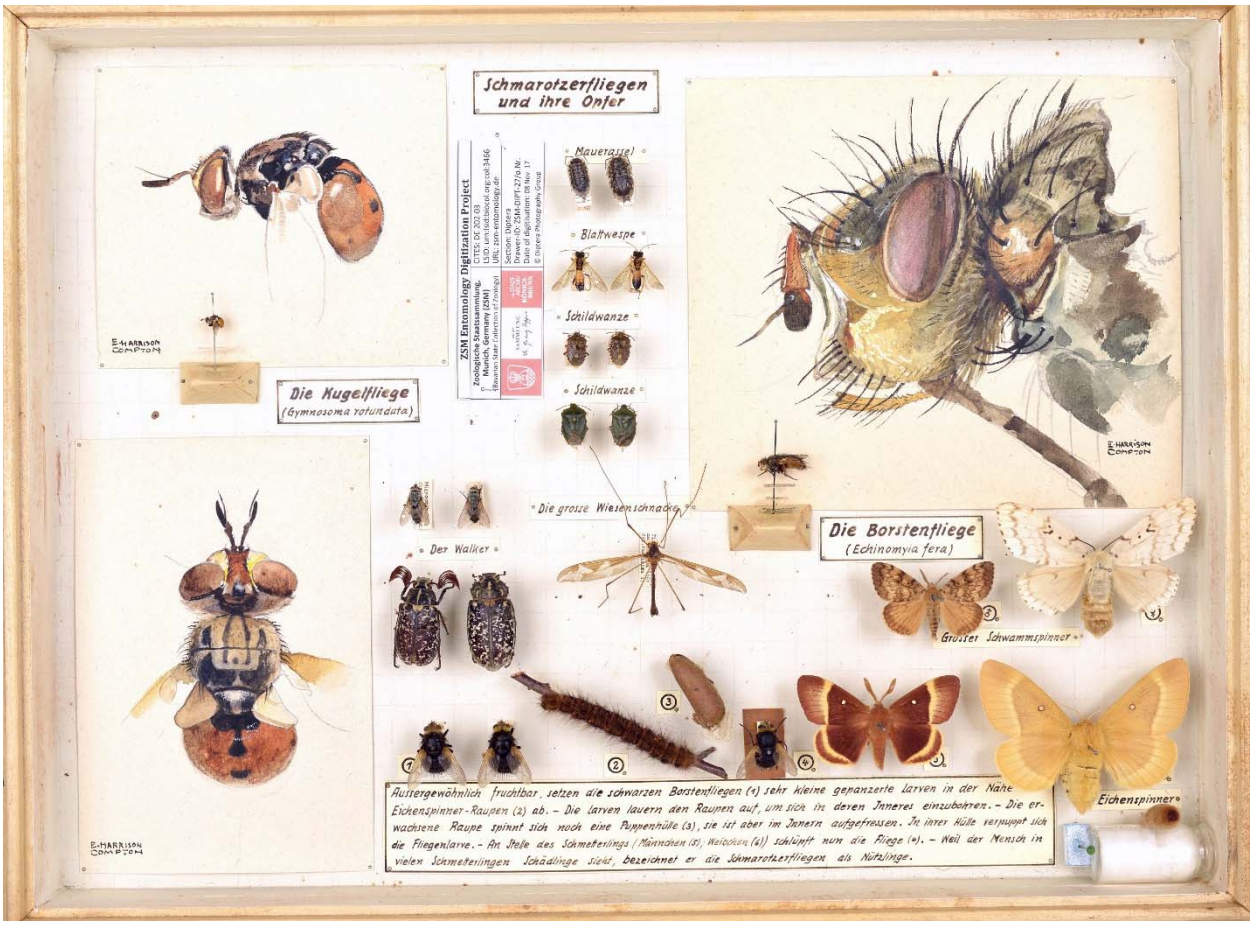

Figure 3. Drawer "C 35 Schmarotzerfliegen und ihre Opfer"*[Parasitic flies and their victims]* from the H. Fischer collection.

"Aussergewöhnlich fruchtbar, setzen die schwarzen Borstenfliegen (1) sehr kleine gepanzerte Larven in der Nähe der Eichenspinner-Raupen (2) ab. – Die Larven lauern den Raupen auf, um sich in deren Inneres einzubohren. – Die erwachsene Raupe spinnt sich noch eine Puppenhülle (3), sie ist aber im Innern aufgefressen. In ihrer Hülle verpuppt sich die Fliegenlarve. – An Stelle des Schmetterlings (Männchen (5); Weibchen (6)) schlüpft nun die Fliege (4). – Weil der Mensch in vielen

Schmetterlingen Schädlinge sieht, bezeichnet er die Schmarotzerfliegen als Nützlinge." *[Extraordinarily prolific, the black bristled flies deposit very small armor-clad larvae in the vicinity of oak eggar caterpillars. – The larvae ambuscade the caterpillars, in order to bore into their interior. – The mature caterpillar will still construct a cocoon for itself, but it is already eaten up inside. Within its shell the fly larvae pupates. – In place of the butterfly (male (5), female (6)) the fly (4) emerges. – Because man considers many butterflies as vermins, he calls the parasitic flies beneficial]*.

Drawer "C 37 Fliegen aus China und Afrika" (Fig. 4, ZSM Drawer-ID: ZSM-DIPT-37/233)

Watercolors and respective exemplars as identified on the labels: on the left, top to bottom: *Diopsis nigricollis* (Diopsidae, oblique aspect of head and thorax), *Diopsis thoracica* (Diopsidae, oblique aspect of head and thorax); on the right, top to bottom: *Hermyia diabolus* (Tachninidae, two aspects of the head), *Neolaparus (Lagodias) teratodes* (Asilidae, detail of the male right hind leg tarsi).

Text labels *[translation]*, top to bottom:

"Fliegen" – "aus China und Afrika" – "Aquarelle von E. H. Compton". *[Flies – from China and Africa –watercolors by E. H. Compton]*.

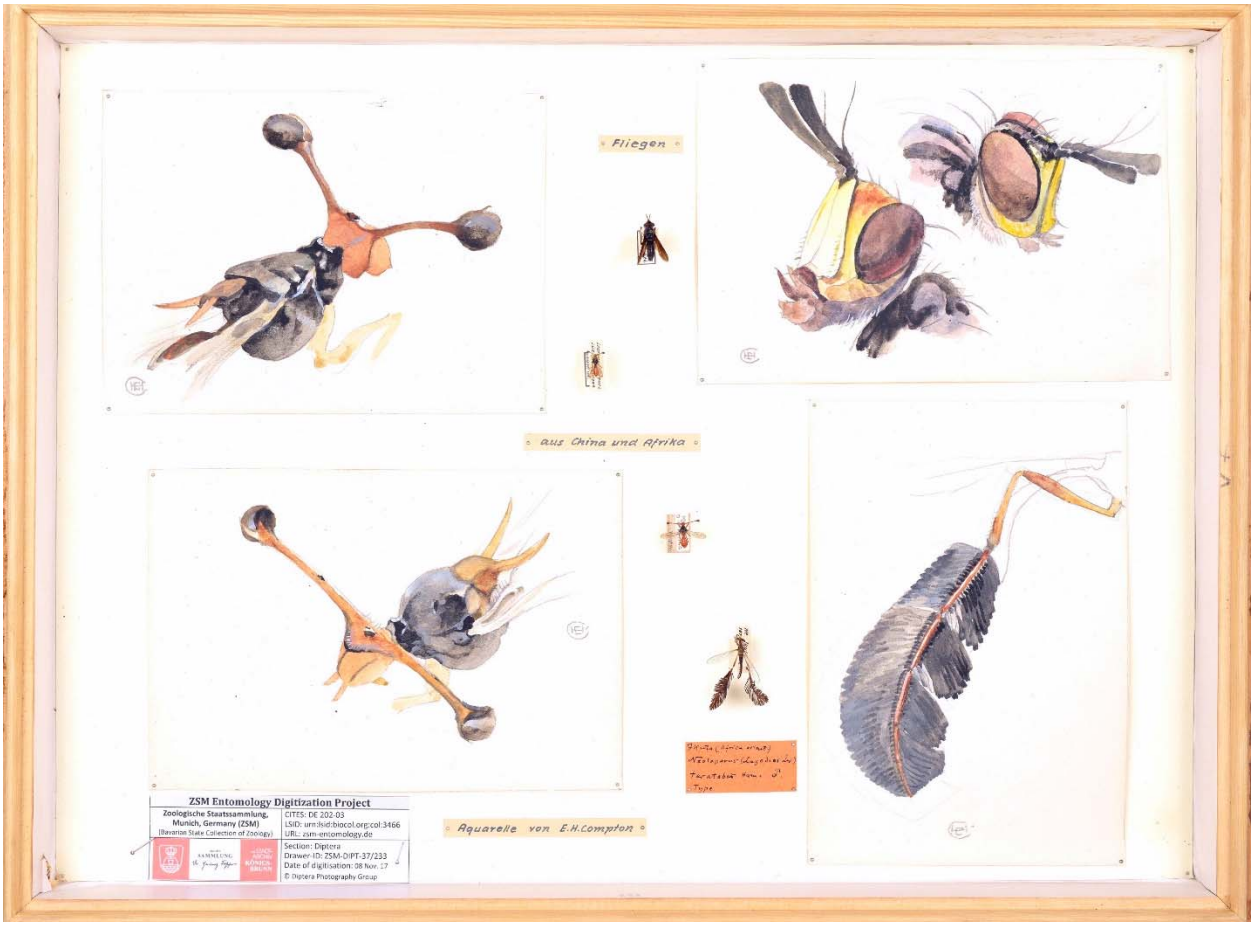

Figure 4. Drawer "C 37 Fliegen aus China und Afrika"*[Flies from China and Africa]* from the H. Fischer collection.

The red label pinned below the specimen of *Neolaparus (Lagodias) teratodes* reads "Ikuta (Africa orient.) / *Neolaparus* (*Lagodias* Lw) / *teratodes* Harm. ♂ / Type". The specimen itself is labelled "Ikuta / Ost-Afrika" and "*Neolaparus* ♂ / *teratodes* Harm."

Type material of *Pegesimallus teratodes* (Hermann, 1906)

The species was described in 1906 under the name *Lagodias teratodes* by Friedrich Hermann (* 07. iii 1859, Neapel, Italy; † 27.ii.1920, Erlangen, Germany), stating "Die Art ist durch die geradezu mönströse federartige Beschuppung an den Tarsen der Hinterbeine auf den ersten Blick kenntlich und wird dadurch zu einer der interessantesten und auffallendsten Asilidenformen, die bisher bekannt geworden sind." *[The species is discerned at first glance by the downright monstrous feather-like scales on the hind leg tarsi and thus becomes one of the most interesting and conspicuous forms of asilids so far recognized]*.

Londt (1980) rediscribed the species and included it in the genus *Pegesimallus*. Londt could study a single specimen of *teratodes* ("Holotype ♂, Kenya, Ikutha, vi.1906, Prof. Hauser, ZSM") which he received on loan from the ZSM and considered to be the unique holotype. He notes the meagre information about the provenience of the specimen: "I have not been able to trace the locality Ikutha or anything which looks similar. As Hermann states that it is in 'englisch Ostafrika' I must assume he was referring to present-day Kenya."

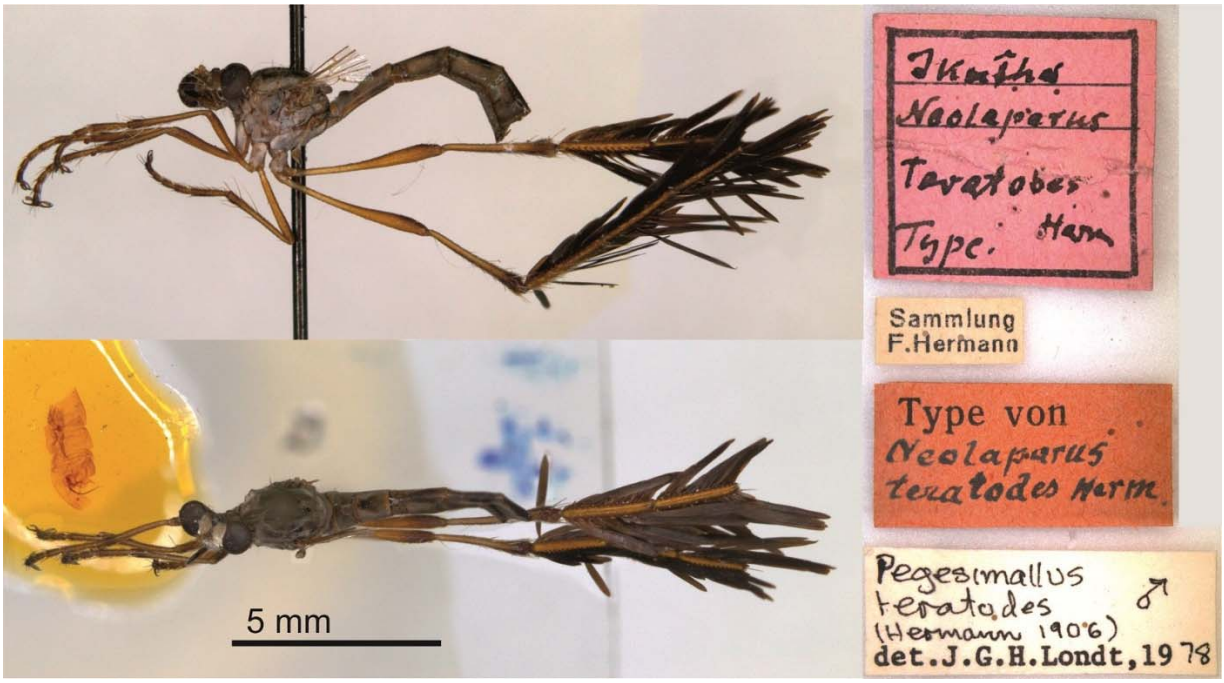

Figure 5. *Pegesimallus teratodes* (Hermann, 1906), syntype 1 (ZSM) previously considered the unique holotype. Lateral and dorsal aspect, labels.

Said specimen had been deposited at the ZSM with the collection of Friedrich Hermann in 1920. Today we find it in rather poor condition, lacking both wings, the terminal 3 tarsal segments of both hind legs and the terminal segments of both antennae (**Fig. 5)**. The pin bears a square of clear plastic with the cleared terminalia in a drop of yellowish medium and four labels reading top to bottom: [red label] "Ikuṯha/ *Neolaparus*/ *teratodes*/ Type. Ham", "Sammlung/ F. Hermann", [red label]

"Type von/ *Neolaparus teratodes* Herm", "*Pegesimallus*/ *teratodes* ♂/ (Hermann 1906)/ det. J. G. H. Londt, 1978."

Figures 6 and 7. *Pegesimallus teratodes* (Hermann, 1906), syntype 2 (H. Fischer collection). Dorsal (6A, top) and lateral (6B, middle) aspects, with labels, and illustration from Hermann (1906, "Fig. 8. *Lagodias teratodes* n. sp.") (7, bottom).

Considering the poor condition of this supposedly unique specimen it is particularly fortunate that the specimen so prominently featured in the Fischer collection (**Fig. 6**) turns out to be a syntype. Not only does the label next to it declare it as a "Type" and from the type location Ikutha. Also Hermanns (1906) species description specifies that he possessed two male specimens. ("Da ich von *Lagodias teratodes* nur zwei Männchen besitze, ..." *[as I only possess two males of Lagodias teratodes, ...]*). Most importantly, his illustration "Fig. 8. *Lagodias teratodes* n. sp." (our **Fig. 7**), drawn after a photograph, undeniably shows the specimen from the Fischer collection. It has to be noted, however, that the handwriting on the red type labels of the ZSM type and the red label pinned next to the specimen in the Fischer collection seem not to be from the same hand.

Some information can be added regarding the provenience of these specimens. The type locality "Ikutha, englisch Ostafrika" most likely refers to Ikutha (2°03'60"S 38°10'47"E), a semi-arid town in Kitui County, Kenia, ca. 150 km southwest of Nairobi. It is reported that the Leipzig Evangelical Lutheran Society opened a mission station at Ikutha in 1892.

Hermann (1906) states that the specimens were sent to him together with Coleoptera by a collector "Prof. Hauser" of whom, at the time of the description, he had not heard in years. In the Biographies of the Entomologists of the World Groll (2017) lists three entries for the name Hauser that fall into the appropriate time frame before Hermanns publication in 1906:

(1) Fritz Hauser (* 28. xii 1868, Vienna, Austria; † 26. viii 1910, Plomberg, Austria): An obituary by Rebel (1911)

addresses him as "Herr Fritz Hauser" *[Mr. Fritz Hauser]* and "Assistent" *[assitant]* at the physiological institute of the university. It can be ruled out that the academic title "Professor" was omitted in an obituary written in Austria at that time. This proves that Fritz Hauser never carried the title and Hermann would not have referred to him as "Professor". Moreover Fritz Hausers entomological activities were restricted to Lepidoptera. This renders it highly unlikely that Hermann received the type specimens from him.

(2) Friedrich Hauser (* 30. vi 1853 Nördlingen, Germany; † 00.00.1932, Erlangen, Germany), Colonel.

(3) Gustav Chr. F. Hauser (* 13. vii 1856, Nördlingen, Germany; † 30.vi.1935, Erlangen, Germany), Prof. Dr. of anatomy, "Geheimrat" *[privy councillor]*.

Friedrich and Gustav Hauser were brothers and both amateur entomologists mostly interested in Lepidoptera and Coleoptera (Roß 1935). Only for Gustav Hauser it is documented that he later diversified into other Insect groups, particularly Diptera (Roß 1935). Moreover only Gustav Hauser carried the academic title "Professor". No record was found documenting that either brother visited Africa. Groll (2017) only states that Friedrich Hauser collected in Turkestan and also occasionally dealt in insects.

In any case it appears most likely that Hermann received the specimens via "Professor" Gustav Hauser. How the one syntype finally ended up in Fischers collection is more mysterious. When Hermann died in 1920 Fischer was only 9 years old, a child unlikely to have received the precious specimen directly from the author. Also it appears quite unlikely that Hermann gave away the better one of only two type specimens he had of that species. Or that he returned it to the collector Professor Hauser, of whom he had not heard in years. It is therefore most conceivable that both syntypes were originally received by the ZSM with the Hermann collection in 1920. Fischer may have come across the spectacular specimen when he was employed at the ZSM, picked it for illustration by Compton, and kept it in the display drawer together with the watercolor. Happily, the two syntypes of what is today *Pegesimallus teratodes* are finally reunited and readily available for further scientific study in the ZSM collection.

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Reproduction of Loew's 1859 Instructions for Collecting Diptera

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In gathering information for a biography of Hermann Loew, the following was found among his many (over 270) publications I had gathered together years ago, and was initially overlooked, only because it did not contain any taxonomy. Although ~160 years old, many of the techniques are still used today — only the equipment has changed or become modernized. When rediscovering the article in his bibliography I was intrigued as to what he might have said about collecting since I had just finished writing about his 1841–1842 trip to "Asia Minor" [essentially just southwestern Turkey] where he was said to have collected thousands of specimens yet only had a few months collecting time (in between doing archeological work with his colleague August Schönborn) and these insects were all collected without traps that we use so commonly today.

This article is one of many articles on instructions for the collecting of various groups of plants and animals—each written by a specialist on the group—that were included in the *Annual Report of the Smithsonian Institution for 1858* (published 1859). The introduction to all the articles on insects (the first of the following 8 pages) is added here to explain Loew's article and put things in context for the time, i.e., the young fledgling Smithsonian Institution was just embarking on an ambitious goal of producing catalogues and inventories of the natural history of the United States. The first *Catalogue of the Diptera of North America* had just been published by Osten Sacken the year previous and the new series on the *Diptera of North America* to be headed by Loew was to begin shortly.

INSTRUCTIONS FOR COLLECTING INSECTS.

INTRODUCTORY REMARKS.

The Smithsonian Institution has undertaken the preparation of a series of reports on the insects of North America, with the view of attracting attention to and facilitating the study of a department of natural history, which, though so much neglected, is yet of great practical importance to the agriculturist and rural economist. These works will consist—first, of catalogues of all the known genera and species of each order, with reference to the places of publication ; and secondly, of monographs and detailed descriptions of both old and new species, so as to enable any one interested in the subject to identify the insects met with, and to prosecute investigations respecting them.

Towards the accomplishment of this object the Institution has already published a catalogue of the North American Coleoptera, by Dr. F. E. Melsheimer, and also one of the Diptera, by Baron Ostensacken, while similar catalogues of Neuroptera, Hymenoptera, Hemiptera, and Diurnal Lepidoptera are in an advanced state of preparation. It is now proposed to take up a very interesting and extensive group, that of the Moths or Night Butterflies, and contributions of materials towards a work on this subject are, therefore, respectfully solicited. There is no locality in the country where new species may not be readily obtained, and from which complete collections are not desirable, although novelties are most to be looked for from the regions of the west. From every region the most common and familiar species are equally desirable, with the rarest and most striking ; the object being not merely to collect all the species, but also to determine accurately their geographical distribution.

In the following pages will be found special instructions for collecting insects, furnished for this article by different entomologists, with some general remarks on the subject taken from Samouelle's Entomologist's Companion.

INSTRUCTIONS FOR COLLECTING DIPTERA.

BY H. LOEW, WITH ADDITIONS BY R. OSTENSACKEN.

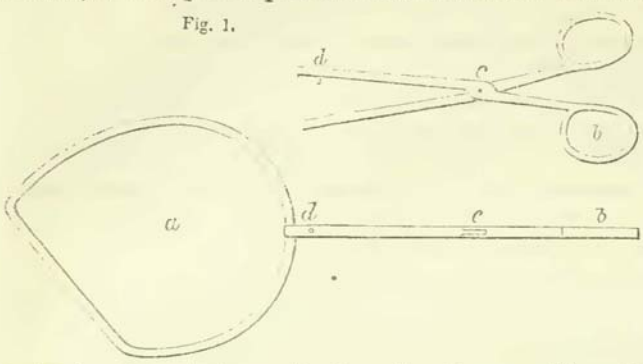
The first instrument I use in a locality, the fauna of which I am not well acquainted with, is a linen bag, fourteen inches in diameter and two and a half feet long, a little rounded at the top or apex, and attached to a strong iron ring, with a hollow metallic handle, in which, if necessary, a cane or other piece of wood may be inserted. With this bag I begin to sweep, and in a short time ascertain what insects abound in the grass, on the flowers, or in moist or dry places, &c. After the last sweep, by a dexterons twist of the handle I throw the apex of the sack over the ring, so as to prevent the escape of the insects, and give them time to compose themselves at the bottom. It is then opened, and I insert my head into it to see what I have captured. They immediately begin to move upwards. The common specimens I allow to pass; but if there is one which I desire to take, I let it advance to the middle of the bag, and then gently grasp it, from the outside of the bag, with the right hand. The other captives I drive down to the bottom by blowing moderately on them, and confine them there by letting the ring fall over the right hand, which holds the insect, which is now easily seized with the left hand. This operation is repeated until everything desirable is taken out, when the bag is emptied of its contents by inversion, and the sweeping recommenced.

This is the most important of all the implements used by the Dipterologist. Its employment prevents him from wasting his time in barren localities, promptly indicates the presence of rare species, and, by furnishing this information, enables him afterwards to have an abundance of specimens.

When I have, by the use of the bag, discovered the locality of rarities, I use another instrument, which is nothing more than an ordinary insect-forceps, of the form shown in fig. 1. Here, *b* is the place for the thumb, *c* is the joint placed near the handle in order that the

forceps may be closed rapidly; the remaining portion of the arms should be made so stout that they will not spring when closing the blades; *d* is a pin to prevent lateral motion when the blades are closed;

Fig. 1.



a the oval ring must be covered with a double cotton tape tightly sewed. If the forceps are not more than nine or ten inches long the ring need scarcely be bound with tape. Its angle and straight side are useful in capturing insects in particular situations. Then the space between the rings, on their internal side, must be covered with the best bobbinet, tightly drawn and securely sewed, so that a perfectly level surface be formed, in order to prevent the captured insect from struggling. The insect is pinned through the openings of the bobbinet, and is then easily transferred to the collecting box, or stuck into the sides or top of your hat, at pleasure. Two views of the instrument are given to illustrate its form more fully.

This instrument is not adapted for very small insects. For such, a forceps with finer bobbinet is used, but even this is superfluous, if you have become expert in employing the bag in sweeping, as well as in holding it under plants, bushes, and flowers, and, by gently striking or shaking them, allowing the insects to fall into it. Neither does it answer for the capture of very active species. It is, for the most part, useless to pursue such, and only betrays the intemperate zeal of the beginner. It is better to ascertain where such species pass the night, and thus you can easily capture that with your fingers which at other times would cost much labor. An excursion early in the morning, before the dew is off, is often very productive.

To carry more instruments with you than those just mentioned is an unnecessary burden.

Besides the capture, the *breeding* of Diptera, is of the greatest importance, and, for the most part, easy. The principal rule I follow, in order to secure the perfect insect, is, to be in no hurry about taking the imperfect one. If there is reason to presume that the larvæ will change into the pupa state at the place where it is found, I wait until then and gather the pupas. On a contrary presumption, I take the larvæ only when I observe that they are preparing for the pupa state. Decaying wood, mould in hollow trees, manure, and ground-earth under manure, stems of plants, grass, stalks of hollow weeds, dried flowers and their seed vessels, particularly of the *Compositæ*, furnish me the richest booty.

A bag full of the dried flowers of the *Compositæ*, or a bundle of dry burdocks and thistles, which I have had gathered for a few pennies, has always furnished me with something good. The pupæ of Diptera do

not require much care ; only do not let the place in which they are kept be too warm. Those I wish to separate are put in large glass jars, the tops of which are covered with paper. The others I place in a wooden box, which I keep in an unheated room, on the window-sill. When they are developed from the pupa towards spring, they naturally fly to the window, from which I take them with a glass vial, or, what is better, with a small chip-box furnished with a glass bottom.

The third point of great importance is the preparation and pinning of the specimens for the cabinet. Sulphuric ether and chloroform are but inferior means of killing them. Specimens too long exposed to these agents are apt to spoil, and, if too little exposed to them, they revive. They answer only for certain tender minute species, of which I shall speak below. The best means of killing them are kreosote and the smoke of a strong cigar. The general rule is, to pin the flies whilst living, and thus to put them into the collecting box, which should have the bottom well moistened with kreosote, and be made tight. The captives will soon die, and thus, time after time, fresh subjects may be put in as they are caught. I have had boxes in which the largest Diptera were almost immediately killed, although the kreosote had not been renewed for six days, and which were still fatal to smaller species for six months afterwards. If you have no boxes thus prepared with kreosote, or, if you wish to avoid the odor of it, then prepare a box, so that, when it is full of pinned specimens, you may blow a few strong puffs of cigar-smoke into it, and all life will soon cease.

In the pinning of specimens, the long pins are greatly to be preferred to the short ones. Five-sixths of all the entomologists now use the long pins. *m n*, fig. 2, is the normal length of pins which are used for Diptera ; the finer kinds may be of the length *m d*. The insects must be pushed high enough up the pin to enable the surface of its back to be examined with an ordinary lens without being incommoded by the pin's head. The back of the insect must, of course, be a little nearer the pin's head than the length of the focus of the glass. As smaller insects must be examined by glasses of higher power, they must be brought nearer the pin's head than larger ones.

Fig. 2.

Large flies may be pushed up so that their backs come to *b*, which smaller ones should reach *a*. Since the beautiful magnifiers of Oberhauser, which allow the application of a lower power, have come into use, insects may be pinned at a greater distance from the head, but not much greater.

The minute and tender species, such as the *smallest Cecidomyiæ, Campylonyzæ*, and others, must be treated differently. They cannot be pinned in the ordinary way with safety. Van Heyden has proposed the most rational and elegant method. The smaller species are caught by the linen bag, and are then put into very porous chip pill boxes, and are killed with cigar smoke, if boxes moistened with kreosote are not preferred. When twenty or thirty are captured the box is turned up so that specimens fall into the cover. They are then transfixed from below on fine silver wire, but not so as to allow the wire to project beyond the thorax. The silver wire must previously

be cut with ordinary scissors into pieces of proper length and taken with you. The wire must be inserted into the insect by means of a very delicate pincers, and with the same instrument the other end of the wire must be stuck into a box, the bottom of which is covered smoothly with the pith of plants. Over the pith thin paper may be fastened in order to render the surface still more smooth. The top or cover of the pill box, in which the insects are placed while transfixing them, must not be too shallow, so that they may not be blown away by the wind, if the operation is performed in the field. The use of a glass vial for the capture of small insects is not to be recommend, as the moisture separates their parts and thus spoils them. The vial may be used on excursions, when you desire to take home a single living insect for the purpose of examining the organs of its mouth or its internal structure.

Those specimens which have been transfixed on the silver wire, as above indicated, are prepared for the collection in the following way: In the fall, stalks of weeds with pith not too porous, and before it is quite dry, must be collected. The best adapted for this purpose is the pith of *Artemisia*, and, still better, of *Verbascum*, (mullein.) It is cut into small pieces, which, seen from above, have the form and size of fig. 3, and seen from the side the thickness of fig. 4. Then insect pins of moderate size are inserted through these small pieces at the place indicated by the dot, (fig. 5,) and the pieces are pushed up nearly to the pin's head. As the pith is still moist it will adhere to the pin in drying, and by the slight coat of verdigris which will soon be developed, the insects, which have been previously attached to the silver wire are now inserted on the free end of the pith with the delicate pincers, where they will stick fast enough if the proper kind of pith has been used. Pith of *Sambucus*, or elder, *Helianthus*, or sunflower, and similar plants, do not answer the purpose, because it is too porous. The insect should stand a little higher than the head of the pin, so that it may be conveniently examined from all sides. The silver wire used for this purpose should be of the very best quality so as to prevent the development of verdigris.

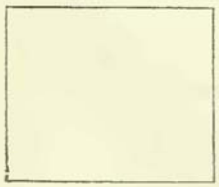
Fig. 3.

Fig. 4.

Fig. 5.

In regard to the *Tipularia*, and some others, whose legs easily break off, my method is the following: I capture them with the forceps and pin them as other large specimens. Before pinning, I press the thorax, so as to prevent all struggling; I then stick the pin through a piece of paper of this form, (fig. 6,) and push it up far enough to receive the legs of the insect neatly spread out or turned under it. When the insect is dead I remove the paper, which, however, might as well be suffered to remain.

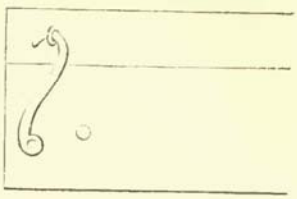
Fig. 6.



The boxes in which Diptera are kept should be about a foot square, the top should be glass, and made to fit tight to the other part by a double rab-

bet. Some persons, in addition, fasten the cover down by means of brass hooks, to prevent warping, (fig. 7.) The boxes may be made of any well seasoned wood. The bottom of the boxes should be made of wood cut *horizontally* from the trunk in plates one-fourth to one-third of an inch thick, and in this case we may use the harder kinds of wood from deciduous leaved trees, except when the rings making the last growth of the year are very hard, or else a very soft wood may be used, such as the partially decayed wood of dead linden or poplar trees; but the pieces are cut out lengthwise in the ordinary way. In both cases the finest pins can be easily inserted into the wood without risk of injuring their points and hold very well. But in the latter mentioned kind of bottom a fine pin readily takes a wrong direction, and after having been taken out it is difficult to insert it again in a perpendicular position. The use of soft material for lining the bottom of the boxes has been generally abandoned in the best collections. It is only when *perfectly* tight boxes cannot be procured that the lining is used, and then not so much with reference to the insertion of the pin as to facilitate the poisoning of the box and to exclude the *acari*, psoci, and other insects. The best material for this purpose is blotting paper spread over with mercurial ointment, and over this is laid a fine oiled silk of light color. The oiled silk may be faintly ruled with cross lines to facilitate the symmetrical arrangements of the specimens. If the oiled silk is fine enough it offers no perceptible resistance to the finest pin. But a more serious inconvenience is, that it prevents us from seeing the texture of the wood at the place where the pin is to be inserted, and hence the points of the very fine pins are liable to injury. On this account it is much better to use wooden boxes without any lining, and these when neatly made look well enough. But if it is deemed desirable to still further improve the appearance of the boxes, a sheet of thin paper may be spread over the bottom, provided the texture of the wood is very uniform or very fine pins are not to be used. This paper may be renewed from time to time, and should be fastened by glue and not by paste, which only furnishes a bait for destructive insects.

Fig. 7.

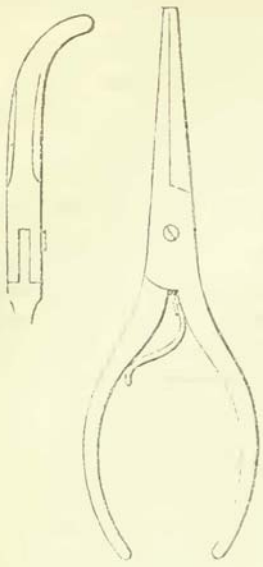


If it is deemed advisable to poison the boxes, it is most conveniently done by means of bits of felt smeared with mercurial ointment, which are fastened in the covers. During the examination of the insects the covers may be set aside, if any injury to the health is apprehended; but of this there is not the slightest danger.

In securing the insects in the collection there is one indispensable rule: nothing should touch the bottom. The labels of genera and species, as well as those on the pin, with each specimen, should be as high as possible; the first being nearly on a level in the specimen.

The labels are best made of stout paper, as they are then better kept in position on pins of moderate thickness.

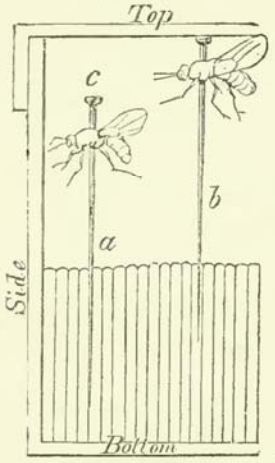
Fig. 9. Fig. 8.



The specimens should be placed at such a distance from each other that they may conveniently, and without risk, be removed and replaced—an operation which is performed with a steel pincers, having the shape indicated in the figure, (fig. 8.) The handle should be large enough to allow a firm grasp of the hand, and the branches should be kept constantly a little separated by means of a spring, as represented. The jaws of the pincers should be roughened like a file on the inside at the ends, and they may be either straight, or, still better, slightly curved, (fig. 9,) as in the figure, to admit of being passed more readily beneath the insect.

The cases used on excursions, or entomological trips, are differently constructed from those of the cabinet. The bottom must be lined with a material soft enough to allow every pin, even the finest, to be inserted easily without the aid of pincers. The best material for this end is pasteboard, which is cut in narrow strips glued against each other, so as to be in a position perpendicular to the bottom of the box.

Fig. 10.



The bottom of the box is lined with these strips, so that the pins move between the layers of the pasteboard. To prevent the pins so loosely inserted from dropping out, the lining should be sufficiently thick, and, at the same time, the box low enough to allow the head of the loosening pin to lean against the cover before dropping. (See fig. 10.)

Note by R. Ostensacken.—Collectors of Diptera should always endeavor to obtain *both sexes* of every species. The sexes in the families of the *Tipulidae* and of the *Asilidae* (for the greater part) are easily distinguished by the form of the abdomen, which is generally club-shaped or obtuse in the male, and more or less pointed in the female. In other families (*Tabani*, *Syrphi*, *Stratiomydae*, *Bombylii*, and in most of the true *Muscidae*) the eyes are close together in the male, and separated by the "front" in the female. Sometimes they are separated in both sexes, but then the front of the male is generally narrower than that of the female. If these characters fail to help in distinguishing the sexes, the size, and especially the shape, of the abdomen will be sufficient. The males are, for the most part, smaller than the females, and have the abdomen more slender.

It often happens that one of the sexes appears in great abundance, while not a single specimen of the other can be seen. In such cases

the following observations of Dr. Schiener (Wiener Entomol. Monatschrift, 1858, p. 175) may prove useful:

"From manifold and repeated experience I have arrived at the conclusion that whenever one sex of a Dipterous insect appears in great numbers, the other is always to be found somewhere in the immediate neighborhood.

"If the males soar in the air we can generally predict with certainty that the females are not far off quietly reposing on trunks of trees, as is the case with the *Anthomyzidæ*, or on the under side of leaves, as with the *Syrphidæ*.

"If every indication of the resting place fails, I then commence catching everything living and flying in the immediate vicinity, sweeping in the air and shaking or beating the leaves and grass, and in this way I have generally succeeded in obtaining, among one hundred specimens of the one sex, at least one of the other.

"The males soaring on the tops of mountains are generally isolated, but on descending several hundred feet we will seldom look in vain for the other sex resting on leaves or the heads of umbelliferous plants.

"I have even succeeded, by patient perseverance, in discovering single males among the numerous female horse-flies (*Tabani*) which attack cattle."

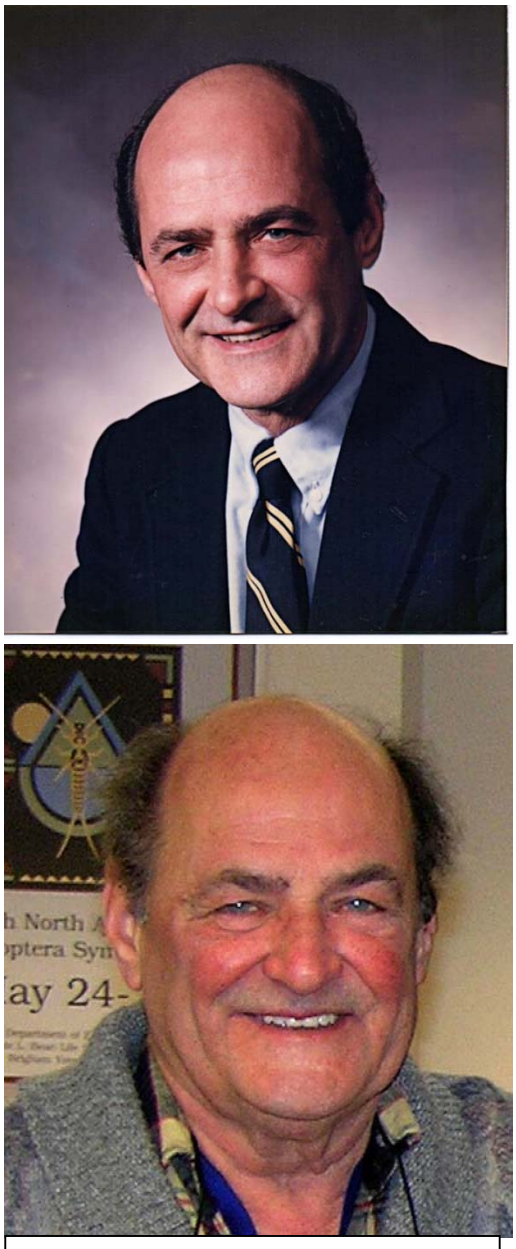
Those who wish more detailed information about the localities where rare species of Diptera have to be looked for will find them in Bremi's excellent paper on this subject, (Isis, 1846, p. 163,) as well as in an article of Mr. Hoffmeister, in the "Entomologische Zeitung" of Stettin, 1844, p. 360.

Lloyd Vernon Knutson
4 July 1934 – 10 January 2018

William L. Murphy

Fishers, Indiana, USA; murph3000@gmail.com

Lloyd Vernon Knutson passed away on 10 January at age 83 in Latina, Italy, about 25 miles from his home in Gaeta. The cause of death was heart failure following a stroke he had suffered at home three weeks earlier.



Lloyd, 1985 (top), 2012 (bottom)

Born in Ottawa, Illinois, Lloyd earned a B.A. in biology at Macalester College, St. Paul, Minnesota, and an M.S. in biology and a Ph.D. in limnology at Cornell University, Ithaca, New York. His Ph.D. dissertation was on the biology of European snail-killing flies (Diptera: Sciomyzidae), the group that would dominate his research for the next 55 years. He was employed for most of his career by the U.S. Department of Agriculture's (USDA) Agricultural Research Service (ARS). During his first five years, he worked as a research entomologist at the U.S. Museum of Natural History, Smithsonian Institution, eventually becoming Chief of the Systematic Entomology Laboratory. He subsequently served for almost 15 years as Chairman of the Insect Identification and Beneficial Insect Introduction Institute at the Beltsville (Maryland) Agricultural Research Center.

In 1988, Lloyd was appointed Director of the USDA/ARS Biological Control of Weeds Laboratory in Rome, Italy. Three years later, he was appointed Director of the USDA/ARS European Biological Control Laboratory in Montpellier, France, a position he held until he retired from federal service in 1997. Within a few years, he and his wife, Mara, had moved to their final home, in coastal Gaeta, Italy, about 65 miles north of Naples. There Lloyd continued to devote an enormous amount of time and energy to continuing his research, primarily on snail-killing flies but also on other organisms and on biological measurements of environmental quality. During his lifetime he authored, co-authored, edited, or co-edited at least 232 publications, with another seven manuscripts currently being completed by various coauthors. He mentored many young entomologists in the United States and in countries around the world, generously sharing his time and resources. His massive knowledge of and contributions to the knowledge of snail-killing flies likely will never be equaled.

Many of you will remember Lloyd because of his service to the entomological community. He was president of the Association of Registered Professional Entomologists (1985–1986), of the Eastern Branch of the Entomological Society of America (1978–1979), and of the Entomological Society of America (1988–1989). He was vice-president of the International Organization of Biological Control (1999–2000), secretary of the Association of Systematics Collections (1982–1983), and treasurer of the Society of Systematic Zoology (1971–1974). His extensive knowledge of a broad range of disciplines was a valuable asset in his service as editor for the Biological Society of Washington (1974–1978) and for the Entomological Society of America (1972–1976). In recognition of his vast contributions to entomology, in 1995 Lloyd was elected an honorary member of the Entomological Society of America and in 1996 of the Russian Entomological Society after a visit to St. Petersburg (then Leningrad).

Gifts in memory of Lloyd may be directed to the Cornell University Entomology Excellence Fund (075113) online at giving.cornell.edu/give, by calling (800) 279-3099, or by mail to Cornell University, P.O. Box 25842, Lehigh Valley, Pennsylvania 18003-9692. Please mention the Entomology Excellence Fund (075113) in all correspondence.

A detailed obituary will be published in *Proceedings of the Entomological Society of Washington*

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Bibliography of Papers on Crane Flies (Tipulidae s.l.) and other Diptera authored by George W. Byers

Jon Gelhaus

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This bibliography of the Diptera-focused papers (primarily crane flies) written by George W. Byers is a companion to the biography and memories of George which was published earlier this year (Gelhaus et al. in Fly Times April 2018). It does not include the extensive number of papers he authored on the Mecoptera, unless this intersected with Diptera (e.g. Byers, 1989 in list following). This list was compiled from a search of literature at Oosterbroek, P. 2018. Catalogue of the Crane flies of the World (Diptera, Tipuloidea: Pediciidae, Limoniidae, Cylindrotomidae, Tipulidae), http://ccw.naturalis.nl/index.php. Many of these papers are available as pdf downloads from this catalogue site. In addition a Web of Science search was carried out for 1980-2018 using "Byers GW" and on ProQuest using "Byers G W" and "Byers George W" resulting in finding additional non-crane fly Diptera papers he authored.

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Byers, G.W.; Rossman, D.A. 2003. A new *Dactylolabis* Osten Sacken (Diptera: Tipulidae) from North Carolina. Proceedings of the Entomological Society of Washington 105: 70-72.

Byers, G.W.; Rossman, D.A. 2004. Preliminary survey of the crane flies of Louisiana (Diptera: Tipulidae, Ptychopteridae). Proceedings of the Entomological Society of Washington 106: 884-890.

Byers, G.W.; Rossman, D.A. 2008. A new species of *Dicranomyia* (*Idiopyga*) from Wisconsin, U.S.A. (Diptera: Tipulida). Journal of the Kansas Entomological Society 81: 12-14.

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MEETING NEWS

The final countdown to ICD9!

Ashley Kirk-Spriggs, ICD9 chair

National Museum, 36 Aliwal Street
Bloemfontein, South Africa; Icd9@nasmus.co.za

We have now begun the final countdown to the opening of the 9th International Congress of Dipterology!

Our Organising Committee has done its level best to make this Congress an international scientific highlight for colleagues from around the world. As well as four excellent plenary speakers, the Congress will cover all major aspects of dipterology, including systematics and taxonomy, morphology, evolution, biodiversity, phylogenetics and conservation, ecology, disease vectors, forensic entomology, phytosanitary Diptera, *etc*. We are especially pleased to note that many of these have special relevance to Diptera researchers based in Africa, specifically symposia on the themes of disease vectors, Diptera pollinators, economically important fruit flies and forensic dipterology. The overall theme of the Congress is "Afrotropical dipterology", but all themes and regions will be represented.

A total of 273 full delegates and students from 51 countries, are attending the Congress, including 61 delegates from 13 African countries. This is the largest number of African delegates ever to attend ICD.

The scientific Programme is now finalised, which includes four plenary talks, 23 symposia, 258 oral presentations and 58 poster presentations. Due to the large number of oral presentations in the Congress, we will run four parallel symposia sessions on most days and the Organising Committee has done its best to minimise conflicts among them. The Abstracts Volume is also completed, which includes 320 abstracts of oral and poster presentations submitted to the Organising Committee of

ICD9. A printed versions of the book will also be included in delegates' packages and freely downloadable PDF versions of both are available on the ICD9 website.

ICD9 is dedicated to the memory of the late Roger Ward Crosskey (1930–2017), former Honorary Member of ICD, Editor of the *Catalogue of the Diptera of the Afrotropical Region* and author of numerous papers and books on the Simuliidae and Tachinidae, in recognition of his outstanding contributions to the study of dipterology in Africa and the world.

Some special features of the Congress include launch of the 2019 "Year of the Fly", the official launch of the *Manual of Afrotropical Diptera* and large symposia on "Tephritoidea – applied research and taxonomy", "Calyptrate evolution and diversity" and "Advances in Diptera phylogenomics". The Congress also highlights recent developments in "The importance of Diptera in plant-pollinator networks" and includes some novel specialised symposia, including "Diptera interactions with amphibians". A number of contentious issues will also be raised in the symposium "Too many species, too little time: fresh approaches to "open-ended" genera", which should lead to some lively debate.

Social events at the Congress comprise a Welcome reception and a separate evening reception for the official launch of the *Manual of Afrotropical Diptera* and happy hour sessions at the Hotel Safari and Safari Court bars. The Congress banquet will take place at the Safari Conference Centre, with a light after dinner speech by Dr Martin Hauser, entitled "Africa and me! – a dipterist's perspective".

ICD9 has organised a "Fly Photography Competition" with 14 entries and will award prizes and certificates for the "Best student presentation" and "Best student poster", with excellent academic books on Diptera as prizes. As part of our public outreach programme two public lectures, by Dr Mark Benecke and Prof. Stephen A. Marshall, will be held in collaboration with the Namibia Scientific Society.

We have received active assistance from our partnering institutions: the National Museum, Bloemfontein (South Africa), the Ministry of Environment and Tourism, Gobabeb Research and training Centre and the Namibia Scientific Society (all Namibia). We have also received generous direct financial support from the National Museum, Bloemfontein, the JRS Biodiversity Foundation and the KwaZulu-Natal Museum. Delegates were supported to attend ICD9 through grants provided by the S.W. Williston Diptera Research Fund and the Belgian Development Cooperation (*via* the Royal Museum for Central Africa, Belgium), as well as other sponsorship as indicated on the back covers of the Abstracts Volume and Programme and on our website.

We look forward to welcoming delates to Windhoek and hosting a great Congress.

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Organized Meeting: North American Dipterists Society (NADS), 2018 Joint Annual Meeting of the Entomological Societies of America / Canada / British Columbia

Matt Bertone

Plant Disease & Insect Clinic, North Carolina State University,
Campus Box 7613, Raleigh, NC 27695-7613; matt_bertone@ncsu.edu

As is tradition, we will be holding an informal organized meeting of the North American Dipterists Society at the 2018 Joint Annual Meeting of the ESA, ESC, and ESBC in Vancouver, British Columbia, Canada. The event will take place on Tuesday evening (November 13) from 7-9 pm, and be held in the Vancouver Convention Centre Meeting Room 215/216.

There will be introductions, announcements, and some business, along with the following presentations (only presenters listed):

- Identifying the freeloaders: Revision of nearctic *Paramyia* (Diptera: Milichiidae) - Julia Mlynarek
- Flies and flytraps: What, if any, are the relationships between Diptera and *Dionaea*? - Clyde E. Sorenson
- New adventures in ecology: Carrion-breeding Diptera associated bacteriophage discovery - Meaghan Pimsler
- Diptera of Palmyra Atoll: New survey, new discoveries - Matthew Bertone

If you are attending the annual meeting please consider joining us. For any questions please email me. Hope to see you there!

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North American Dipterists Society Code of Conduct

Matt Bertone

Plant Disease & Insect Clinic, North Carolina State University,
Campus Box 7613, Raleigh, NC 27695-7613; matt_bertone@ncsu.edu

The North American Dipterists Society (NADS) is an informal group that aims to bring together individuals with a common interest in the science and appreciation of true flies. As such, inclusivity, safety and a welcoming environment for all persons regardless of ethnicity, religion, disability, physical appearance, gender, gender identity, or sexual orientation is of utmost importance to us.

The Entomological Society of America (ESA) has tasked us with adopting or creating a code of conduct to formalize our expectations of members' behavior and interactions. We fully support this endeavor. Rather than create our own, we feel the code put forth by the ESA conveys our message and so have adopted it for all meetings and NADS functions. The ESA code of conduct can be found here: https://www.entsoc.org/conduct. Although the code describes several types of expectations, we are especially focused on the sections concerning Harassment and Safety, Expected Behavior, and Unaccepted Behavior.

As far as inclusivity, we accept anyone with an interest in Diptera, and anyone who wants to make a presentation focused on flies in our informal meeting at the Annual Meeting of the ESA can do so; scheduled presenters are solicited openly and there is no requirement except that their talk is related to the study or appreciation of Diptera. Unfortunately, because we are an informal society we have no official means or routes for recruiting diverse members, other than word of mouth from existing members and Diptera enthusiasts. We hope current members consider encouraging people with a diversity of backgrounds and identities to become part of our society. Anyone who would like to be included need only fill out the form at the back of the Fly Times, or provide the information as outlined on the form.

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

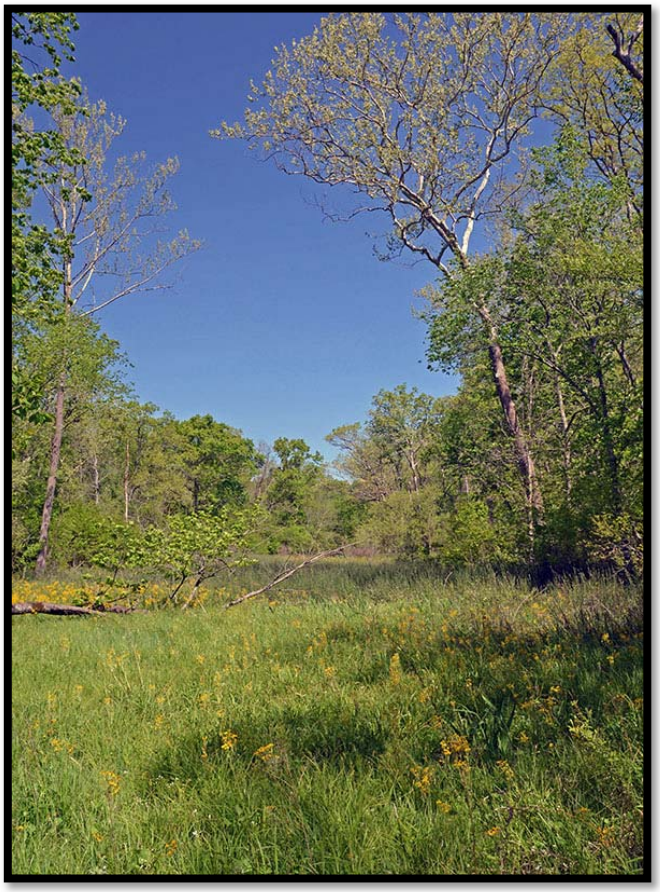
Greg Courtney[1] & David Bowles[2]

[1] Department of Entomology, Iowa State University,
401 Science II, Ames, Iowa 50011, USA; gwcourt@iastate.edu

[2] National Park Service, Heartland Inventory & Monitoring Network
c/o Department of Biology, Missouri State University
901 South National Avenue, Springfield, MO 65897; david_bowles@nps.gov

Invitation to Attend

On behalf of the NADS, we extend a warm invitation for you to attend the 2019 field meeting. This year's meeting, at Bull Shoals Field Station in Missouri, will bring together Dipterists from throughout North America to discuss and collect flies, focusing on taxa from the Ozark Plateau. The meeting will provide a unique environment for interaction in field, laboratory, and informal settings.



Weather during the meeting is likely to be hot (85-90ºF). Biting insects, ticks and chiggers, and poison ivy are abundant at the field station so use of personal protective measures is highly recommended.

Specific questions about BSFS or other accommodations can be directed to Dr. David Bowles at the email above, or at 417-836-4702.

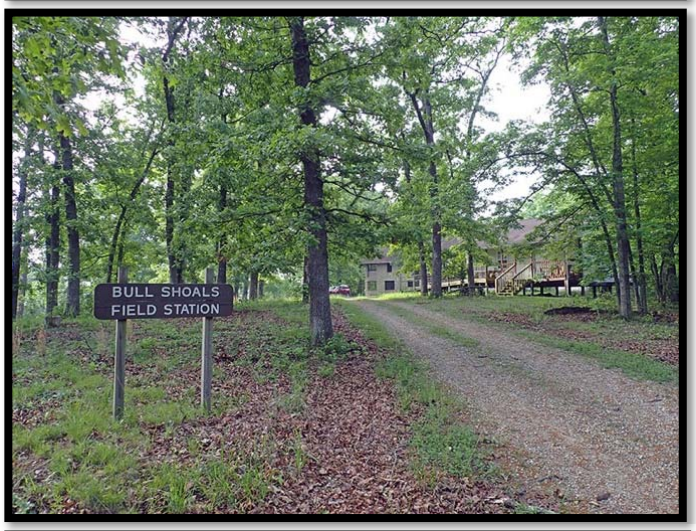
Bull Shoals Field Station

Bull Shoals Field Station (BSFS), administered by the Department of Biology, Missouri State University, is located in Taney County, Missouri, close to the Arkansas border. The station is just south of Kirbyville, Missouri (5 miles) and approximately 10 miles from Branson, Missouri. BSFS shares property with the Drury-Mincy Conservation Area managed by the Missouri Department of Conservation. The station occupies some 5,600 acres and is located in the heart of the Ozarks ecoregion.

BSFS has modern, air conditioned, accommodations located in two residential buildings. Residences are outfitted with bunk beds, full kitchens and bathrooms. There is an education classroom with microscopes and table space that can be used for presentations and other activities, as well as a wet lab and large outdoor pavilion. Primitive on-site camping is also permitted. In addition, motor boats can be rented from a local marina, and canoes are available on-site at no cost.

For those not wishing to stay at BSFS, the city of Branson, Missouri has many reasonably priced hotels and restaurants. The following website lists available hotels in the Branson area: https://members.bransonchamber.com/list/ql/lodging-76.

Please see the BSFS website for additional information: https://bullshoals.missouristate.edu/.



Bull Shoals Field 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.

The Ozark Plateau is known for its unusual plant and animal communities, including many endemic and disjunct species. The area's diverse habitats will provide many interesting flies! Note that several malaise traps will be set at BSFS a week before the meeting, so we should have plenty of fresh material to examine and identify at the start of the meeting.

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 approx. 65 miles from BSFS (1-1.5 hours). There is also a small airport just south of Branson, but it serves only Frontier Airlines.

Tentative schedule

Monday, 3 June (late afternoon / evening)
- Check-in at BSFS
- Collecting near BSFS
- Dinner on your own
- Welcome and introduction to area

Tuesday, 4 June
- Breakfast on your own
- Field excursions
- Dinner on your own
- Presentations and sorting the day's catch

Wednesday, 5 June
- Breakfast on your own
- Field excursions
- Dinner on your own
- Presentations and sorting the day's catch

Thursday, 6 June
- Breakfast on your own
- Field excursions
- Dinner (barbeque) @ BSFS
- Presentations and sorting the day's catch

Friday, 7 June
- Breakfast on your own
- Check-out

Cost

There will be a small registration fee (≈$30) to cover the cost of using the BSFS classroom & laboratory, a Thursday night barbeque at the Drury house, and incidentals. Except for the group dinner and evening refreshments, food costs will be the responsibility of the registrant. Accommodation costs include the following options.

1) $10/day/person for participants staying in either of the BSFS houses. Note again that this includes shared rooms and bunk beds, with a total of 24 beds. To make reservations, please contact Dr. 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.

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Eagle Hill Institute in Maine, USA will be holding a Workshop on Chironomidae Taxonomy, June 9-15, 2019

Armin Namayandeh

TAXANAMA Corp.
Toronto, Ontario, Canada; a.namayan@taxanama.com

Natural History Science Programs on the Eastern Maine Coast – Seminar and Workshop: Chironomids: Classification, Morphology, Identification, and Lifecycles

Chironomidae midges are diverse and abundant family of freshwater insects with worldwide distribution and occurrence in variety of habitats. These attributes have proved them to be a good utility tool for environmental biomonitoring and ecological investigation of freshwaters. In most part the taxonomic and biogeographical investigation of this family emerged as a discipline to improve upon this utility. However, difficulty in identification of these taxa and lack of proper association between life stages has prevented their proper use in freshwater investigations. In this seminar I will address some of the issues involved with identification of chironomid. We will learn the morphology of different life stages and their use in taxonomy. We will explore both macroscopic and microscopic morphological characters to sort and identify Chironomidae to different level and using different life stages. Additionally, we will learn methods such as rearing, collecting, preserving and mounting of immatures and adults.

Please follow the link below for further information:
https://www.eaglehill.us

About the instructor

Armin is an aquatic entomologist, focusing mainly on taxonomy and ecology of family Chironomidae (Diptera: Insecta). Armin has worked on various graduate and post graduate freshwater ecology research for over 15 years. His focus for these has been to developed ways to integrate the knowledge of taxonomy and phylogeny into the ecological investigations. Armin main research interest lies on Chironomidae of Northern Canada, especially the subpolar and polar regions. He has conducted taxonomic research on Chironomidae of Eastern Arctic, Chironomidae of Athabasca River and its tributaries and Chironomidae of Precambrian Shield in Canada. Currently, he is conducting research on taxonomy of Chironomidae in far northern Ontario and Chironomidae from Fosheim Peninsula in Ellesmere Island, Nunavut, Canada.

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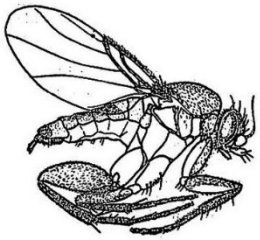
Fly School
23 June–6 July 2019

Brian V. Brown

Natural History Museum of Los Angeles County, 900 Exposition Boulevard,
Los Angeles, California, 90007, USA; bbrown@nhm.org

The second offering of our fantastic Diptera course is now posted at http://dipteracourse.com/. Please tell your students, friends and colleagues to register early, There is a great set of instructors, special guests, and a fabulous location on the Central Coast of California. It will take place 23 June–6 July 2019. The collecting is superb at this time of the year,and we will have access to a tremendous variety of habitats from ocean shore to mountains. Please join us for two weeks of fly immersion: morphology, identification, field techniques, and more!



FLY SCHOOL

A course for Dipterists

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OPPORTUNITIES

S.W. Williston Diptera Research Fund

Torsten Dikow

Department of Entomology, National Museum of Natural History, Smithsonian Institution
PO Box 37012, MRC 169, Washington, DC 20013-7012, USA; DikowT@si.edu

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*. To this day, the fund has supported the travel of graduate students and dipterists to the International Congresses of Dipterology and to the USNM for collections-based research, field work, and attendance at FlySchool.

The deadline for the 2018 award round is December 15, 2018.

E-mail the following information to Torsten Dikow as a representative of the Williston Fund committee:

1. summarize your research goals into a short proposal in PDF format (1–2 pages maximum)
2. itemize your budget (anticipated transportation costs, per diem costs for lodging and food, and any other items)
3. attach a current CV

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.

The Williston Fund is administered by a committee of at least three members, two of whom (the majority) must be systematists actively working on Diptera, and one who must be a scientist affiliated with, but not necessarily employed by, the Smithsonian Institution (for example, a dipterist of the U.S. Department of Agriculture Systematic Entomology Laboratory (SEL)). The current committee consists of: Allen Norrbom, Woogie Kim, and Torsten Dikow.

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DIPTERA ARE AMAZING!

The two syrphid photographs were submitted by Andrew Young, who recently finished his PhD with Jeff Skevington at Carleton University, and is currently a postdoc in the lab of the Fly Times editor.

Episyrphus viridaureus (Wiedemann).

Pelecocera (*Chamaesyrphus*) *scaevoides* (Fallén).

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BOOKS AND PUBLICATIONS

Once again, we offer below a rundown of recent publications on Diptera. 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. We also apologize for the missing diacritics in some author's names, unfortunately this is a product of searching in Zoological Record and Web of Science, where they are removed.

Adler P.H. 2018. Roger Ward Crosskey-The Life and Contributions of an Entomologist par Excellence (1930-2017). Zootaxa **4455(1)**: 35-67.

Arillo, A., Blagoderov, V. and Penalver, E. 2018. Early Cretaceous parasitism in amber: A new species of *Burmazelmira* fly (Diptera: Archizelmiridae) parasitized by a *Leptus* sp mite (Acari, Erythraeidae). Cretaceous Research **86**: 24-32.

Barraclough, D.A., Colville, J.F., Karolyi, F. and Krenn, H.W. 2018. A striking new species of *Prosoeca* Schiner, 1867 (Diptera: Nemestrinidae): An important pollinator from the Bokkeveld Plateau, Northern Cape Province, South Africa. Zootaxa **4497(3)**: 411-421. doi:10.11646/zootaxa.4497.3.5.

Barriault, S., A.O. Soares, S.D. Gaimari & E. Lucas. 2018. *Leucopis glyphinivora* Tanasijtshuk (Diptera: Chamaemyiidae), a new aphidophagous biocontrol agent; Development, survival and comparison with *Aphidoletes aphidimyza* Rondani (Diptera: Cecidomyiidae). Bulletin of Entomological Research, 1–7, doi:10.1017/S0007485318000767

Belqat, B., Adler, P.H., Cherairia, M. and Boudghane-Bendiouis, C.C. 2018. Inventory of the Black Flies (Diptera: Simuliidae) of North Africa. Zootaxa **4442(2)**: 201-220. doi:10.11646/zootaxa.4442.2.1.

Bickel, D.J. and Kerr, D.S. 2018. *Scorpiurus aramoana* (Diptera: Dolichopodidae), a new species from New Zealand. Zootaxa **4422(1)**: 78-84. doi:10.11646/zootaxa.4422.1.4.

Bost, A., Martinson, V.G., Franzenburg, S., Adair, K.L., Albasi, A., Wells, M.T. and Douglas Angela, E. 2018. Functional variation in the gut microbiome of wild *Drosophila* populations. Molecular Ecology **27(13)**: 2834-2845.

Briem, F., Zeisler, C., Guenay, Y., Staudacher, K., Vogt, H. and Traugott, M. 2018. Identifying plant DNA in the sponging-feeding insect pest *Drosophila suzukii*. Journal of Pest Science **91(3)**: 985-994. doi:10.1007/s10340-018-0963-3.

Broadley, A., Kauschke, E. and Mohrig, W. 2018. Black fungus gnats (Diptera: Sciaridae) found in association with cultivated plants and mushrooms in Australia, with notes on cosmopolitan pest species and biosecurity interceptions. Zootaxa **4415(2)**: 201-242. doi:10.11646/zootaxa.4415.2.1.

Brooks, S.E., Cumming, J.M., Limeira-De-Oliveira, F. and Pollet, M. 2018. New species and records of *Cheiromyia* Dyte from Brazil and French Guiana (Diptera: Dolichopodidae). Zootaxa **4444(3)**: 267-282. doi:10.11646/zootaxa.4444.3.3.

Buenaventura, E. and Pape, T. 2018. Phylogeny, evolution and male terminalia functionality of Sarcophaginae (Diptera: Sarcophagidae). Zoological Journal of the Linnean Society **183(4)**: 808-906. doi:10.1093/zoolinnean/zlx070.

Burt Trevor, O. and Mengual, X. 2018. New records of *Melanostoma fumivenosum* Doesburg (Diptera: Syrphidae) with the description of the male. Australian Entomologist **45(2)**: 209-216.

Busso, J.P. and Blanckenhorn Wolf, U. 2018. Disruptive sexual selection on male body size in the polyphenic black scavenger fly *Sepsis thoracica*. Behavioral Ecology **29(3)**: 769-777.

Busso, J.P. and Blanckenhorn, W.U. 2018. Viability selection by invertebrate predators in the polyphenic black scavenger fly *Sepsis thoracica*. Behavioral Ecology **29(4)**: 992-1000. doi:10.1093/beheco/ary039.

Caetano, R.L., Carrico, C., Freitas, D.M.D. and Pinto, Z.T. 2018. Ultrastructure of sensilla on antennae and maxillary palps in three Mesembrinellidae species. Revista Chilena De Historia Natural **91**: 9. doi:10.1186/s40693-018-0077-6.

Camp, J.V., Bakonyi, T., Soltesz, Z., Zechmeister, T. and Nowotny, N. 2018. *Uranotaenia unguiculata* Edwards, 1913 are attracted to sound, feed on amphibians, and are infected with multiple viruses. Parasites & Vectors **11**: 10. doi:10.1186/s13071-018-3030-2.

Chatelain, P., Plant, A., Soulier-Perkins, A. and Daugeron, C. 2018. Diversity increases with elevation: empidine dance flies (Diptera, Empididae) challenge a predominant pattern. Biotropica **50(4)**: 633-640.

Chathuranga, W.G.D., Karunaratne, S.H.P.P., Fernando, B.R. and De Silva, W.A.P.P. 2018. Diversity, distribution, abundance, and feeding pattern of tropical ornithophilic mosquitoes. Journal of Vector Ecology **43(1)**: 158-167.

Chuncai, Y., Liu, T., Cao, W., Zhao, G. and Liu, W. 2018. A review of the Japanese *Cryptochironomus* Kieffer, 1918 (Diptera, Chironomidae). Zookeys **771**: 139-155.

Chursina, M.A. and Negrobov, O.P. 2018. Phylogenetic signal in wing shape in the subfamily Dolichopodinae (Diptera, Dolichopodidae) Zoologichesky Zhurnal **97(6)**: 688-700. doi:10.7868/s0044513418060041.

Coleman, J.M., Benowitz, K.M., Jost, A.G. and Matzkin Luciano, M. 2018. Behavioral evolution accompanying host shifts in cactophilic *Drosophila* larvae. Ecology and Evolution **8(14)**: 6921-6931.

Craig Douglas, A., Currie, D.C. and Moulton, J.K. 2018. *Nothogreniera* new genus, for two species of Australian '*Paracnephia*' (Diptera: Simuliidae). Zootaxa **4444(4)**: 351-380.

Cranston Peter, S. and Tang, H. 2018. *Skusella* Freeman (Diptera: Chironomidae): new species, immature stages from Africa, Asia and Australia, and expanded distributions. Zootaxa **4450(1)**: 41-65.

da Silva, F.L. and Ferrington, L.C. 2018. Systematics of the new world genus *Pentaneura* Phillip (Diptera: Chironomidae: Tanypodinae): Historical review, new species and phylogeny. Zoologischer Anzeiger **274**: 60-89. doi:10.1016/j.jcz.2017.11.010.

Daniels, G. 2018. Designation of a neotype for the Australian robber fly *Ommatius dimidiatus* Macquart, a new senior synonym of *Ommatius pilosus* White and *Ommatius levis* White (Diptera: Asilidae: Ommatiinae). Zootaxa **4450(2)**: 196-202.

Danitza Penafiel-Vinueza, A. and Violeta, R. 2018. Five new species of *Drosophila guarani* group from the Andes of southern Ecuador (Diptera, Drosophilidae). Zookeys **781**: 141-163.

Dantas, G.P.S. and Hamada, N. 2018. Immature stages of *Laurotanyus travassosi* Oliveira, Messias & Silva-Vasconcelos, 1992 reveal a new synonymy in Tanypodinae (Diptera: Chironomidae). Zootaxa **4444(4)**: 462-470. doi:10.11646/zootaxa.4444.4.6.

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