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Stephen D. Gaimari, editor
Plant Pest Diagnostics Branch
California Department of Food & Agriculture
3294 Meadowview Road
Sacramento, California 95832, USA
Tel: (916) 738-6671
FAX: (916) 262-1190
Email: stephen.gaimari@cdfa.ca.gov

Welcome to the latest issue of *Fly Times*! This issue is brought to you during the Covid-19 pandemic, with many of you likely cooped up at home, with insect collections worldwide closed for business! Perhaps for this reason this issue is pretty heavy, not just with articles but with images. There were many submissions to the Flies are Amazing! section and the Dipterists Lairs! I hope you enjoy them!

Just to touch on an error I made in the Fall issue's introduction… In outlining the change to "Spring" and "Fall" issues, instead of April and October issues, I said "But rest assured, I WILL NOT produce Fall issues after 20 December! Nor Spring issues after 20 March!" But of course I meant no Spring issues after 20 June! Instead of hitting the end of spring, I used the beginning. Oh well…

Thank you to everyone for sending in such interesting articles! I encourage all of you to consider contributing articles that may be of interest to the Diptera community, or for larger manuscripts, the *Fly Times Supplement* series. *Fly Times* offers a great forum to report on research activities, to make specimen requests, to report interesting observations about flies or new and improved methods, to advertise opportunities for dipterists, to report on or announce meetings relevant to the community, etc., with all the 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 many thanks to Chris Borkent for assembling the list of Diptera works 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. Also note, the *Directory of North American Dipterists* is constantly being updated, so 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. 65 of the *Fly Times* will appear next Fall. Please send your contributions by email to the editor, aiming for the end of October 2020. I will send a reminder. And articles after October are OK too, as I can fit things in even up to the last minute!

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Issue 64, available online 8 June 2020

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NEWS

The 2020 dolichopodid survey of lowland and montane rain forests in Costa Rica (Diptera: Dolichopodidae)

Marc A.A. Pollet[1, 2] & Anja De Braekeleer[1]

[1] Research Institute for Nature and Forest (INBO), Herman Teirlinckgebouw, Havenlaan 88 bus 73, B-1000 Brussels, Belgium; marc.pollet@inbo.be

[2] Entomology Unit, Royal Belgian Institute of Natural Sciences (RBINS), Vautierstraat 29, B-1000 Brussels, Belgium; mpollet.doli@gmail.com

Summary
Costa Rica holds 4% of the world's biodiversity, despite its small surface (only 0.01% of the world), which is due to its position on the Isthmus of Panama, its topography and its elaborated conservation policy. Its invertebrate diversity, though, still remains the most poorly known.

During three weeks in March 2020 (7-28/3/2020[1]), the dolichopodid faunas (Diptera: Dolichopodidae) of several protected areas all around the country were investigated. This array included lowland tropical rain forests along both the Caribbean and Pacific coast and premontane and lower montane tropical rain forests in the centre, north and northwest of the country. Specimens were collected with sweep nets and pan traps. In 4 of these areas, at least 3 sampling sites were selected for sampling with pan traps and in each site, 10 yellow, 10 white and 10 blue pan traps were operational. Per sampling site, yields of 5 traps of the same type were pooled. Ultimately, 385 pan traps were employed, which produced 80 samples, next to 98 sweep net samples.

By investigating some sites for the first time the geographical and topographical framework on biodiversity patterns of Dolichopodidae in Costa Rica can be further extended. Moreover, data on dolichopodid faunas at three sites that have been sampled between 2 to 4 times since 2003 might provide first indications on the impact of climate change (drought mainly) in these areas.

1 General research framework

Study area

Costa Rica (Central America) is widely considered as one of the most prominent biodiversity hotspots of the world. Although it covers only 0.01% of the total land masses (51,100 km²), it houses about 4% of the world's biodiversity. This is due to a number a reasons:

- Costa Rica makes part of the Isthmus of Panama (age: ≈ 3 million years) that enabled the Great American Interchange, the migration of biota from North to South America and vice versa. This process still continues until today and does not only apply to large terrestrial mammals and birds.
- Costa Rica encompasses an unprecedented diversity of biomes on a relatively small surface due to its topography. It has both a Pacific and Caribbean coastal zone with swamps and mangroves, lowland rain forests, and a central mountain range with peaks up till 3,819m (Chirripó, Cordillera

[1] the expedition came to an end on March 27 due to the corona crisis, i.e., one day earlier than planned.

de Talamanca). This topography (including a substantial altitudinal range) created the conditions for no less than 12 different life zones (Holdridge, 1967), situated primarily in the humid and superhumid range (Hartshorn, 1983). Each of these life zones features a characteristic fauna and flora.
- Nearly 25% of the country has been declared National Parks (Parques Nacionales, PN) or Protection Zones (Zonas de Protección) by the government since the 1970s[2]. Eleven protection areas (Areas de Conservación) have been defined, which encompass the aforementioned National Parks, Biological Reserves (Reservas Biológicas), Wildlife Refuges (Refugios de Vida Silvestre) as well as a large number of smaller protected areas. A direct result of this large-scale protection strategy is the presence of still pristine habitats in most regions, housing a nearly undisturbed and tremendously rich biodiversity.

Costa Rica also remains one of the focal areas of invertebrate biodiversity research in the New World. Not only has the Instituto Nacional de Biodiversidad (INBio) long been regarded as exemplary for Central and South America, but also the Organisation for Tropical Studies (OTS) is still very active in this country and provides support to students and researchers in three biological stations dispersed over the country. Since 2015, the vast collections of INBio have been transferred to the Muséo Nacional de Costa Rica (MNCR).

Focal taxon

With over 7100 known species in more than 220 genera worldwide, long-legged flies (Diptera: Dolichopodidae) (Fig. 1) represent about 4.7% of all described fly species, which renders this family the fourth most species rich family in this insect order (Pape *et al.*, 2009). It is one of five major lineages within the superfamily Empidoidea (Diptera) and generally divided into 17 subfamilies (Pollet & Brooks, 2008). Adults range from 0.8-9.0 mm in length and are usually metallic green, bronze to blue in body colour, although yellow to dull brown forms occur as well. Other features of this family are the rather protruding mouthparts, the antenna that is positioned high on the head, and the secondarily reduced wing venation. In several genera, the male genitalia are large and folded underneath the abdomen. The Dolichopodidae are, however, most famous for their usually long and slender legs (hence the common name of the family) with an extraordinary array of shapes and vestitures in the male. These so-called Male Secondary Sexual Characters (MSSC) are specific and of considerable diagnostic value. Long-legged flies occupy all semi-aquatic and terrestrial habitats in every zoogeographical realm although most species seem to prefer humid habitats (Pollet, 2000). As such, moist, humid and wet rain forests are characterized by a very high dolichopodid species richness. Due to their strong habitat affinity,

[2] The Ministry of Environment and Energy (MINAE) played an important role in the creation of this system of National Parks, whereas the Department SINAC (Sistema Nacional de Areas de Conservación) is responsible for the ongoing monitoring of it.

however, dolichopodid faunas are not evenly distributed in their habitats and species richness and abundances differ greatly at a local scale. As a result, biodiversity assessments require the combined use of several sampling techniques.

As is the case in many other invertebrate taxa, the number of described dolichopodid species must be considered merely a fraction of the real diversity in the tropics. About 400 species have been recorded from Central America (Robinson, 1970) and 750 species is considered a conservative estimate of the real species richness (Bickel, 2009). I have every reason to believe, however, that the dolichopodid richness of Costa Rica is a multifold of this number.

Based on the number of described species, the subfamily Achalcinae represents less than 3% (33 sp.) of the dolichopodid fauna in the Neotropics, which makes it one of the species poorest subfamilies of Dolichopodidae. In sharp contrast with the extant literature, however, previous surveys in Ecuador, Colombia, Chile, Panama, French Guiana, Martinique and especially Costa Rica revealed an unprecedented achalcine species richness, with close to 200 undescribed species (one can only guess about the true species richness in the dominant Neotropical subfamilies like Sciapodinae and Diaphorinae!). These surveys also confirmed that high altitude life zones, and tropical premontane and lower montane rain forests in particular, are exceptionally rich in some genera of Achalcinae. In this respect, *Xanthina* Aldrich seems to reach its highest species richness in lowland tropical rainforest, whereas *Achalcus* Loew, *Australachalcus* Pollet and species of a yet undescribed new genus (Fig. 2) are most diverse between 1000m and 2000m.

2

Sampling strategy

During the past 34 years I have been sampling and studying long-legged flies, mainly from the Palaearctic realm and the Neotropics. Since 2003, I participated to several expeditions in the latter realm and have been otherwise involved in other surveys (Bolivia, Dominican Republic). My previous investigations in Costa Rica were conducted in 2003, 2005, 2007, 2010 and 2015.

Methodological research on Dolichopodidae (see e.g., Pollet & Grootaert, 1987, 1991, 1994), involving Malaise traps, pan traps of different colours and pitfall traps, clearly showed that Malaise traps and pan traps were the most effective for this purpose, but also proved highly complementary in assessing biodiversity. These studies also revealed that information on the ecology and behaviour of the different species could be retrieved with an accurate sampling design. In this respect, strong and frequent flyers could be separated from mainly soil-dwelling species by comparing the yields of Malaise traps and (non-interceptive) pan traps at soil surface level. Moreover, whereas most species proved most attracted to yellow or white coloured pan traps, arboreal species were collected in highest numbers in blue traps whereas distinctly epigaeic species were most abundant in red traps.


3


4

Though Malaise traps are by far the most widely used trapping device for flying insects, sometimes this method appears to be far less useful for short-term inventories of Dolichopodidae, especially in the tropics as I observed myself in Costa Rica in 2007 and 2015, and Ecuador in 2009. Moreover, it is surprising that pan traps (Fig. 3) have not been incorporated more frequently in large-scale surveys like ALAS and IBISCA nor in most other similar inventories in the Neotropics. To promote this method, I introduced it in two successive La Planète Revisitée surveys recently (French Guiana 2015, Corsica 2019) (see e.g., Pollet *et al*. 2018, Touroult *et al*. 2018). Their rather small size, light weight and easy employment make them an excellent device to gather information about the distribution patterns of species, even within sampling sites. Moreover, data gathered with a sufficient number of pan traps are suitable for statistical processing which enables the researcher to draw reliable conclusions about estimated numbers and differences.

As mentioned before, most dolichopodid species demonstrate a very specific habitat affinity, and are as such confined to particular habitat elements (e.g. springs, seeplings, banks of rivers and brooks). Other species seem to occur in very low densities and are hardly collected actively. As a result, samples collected with different methodologies show a surprisingly small overlap (only 30% for Malaise and pan trap samples; Pollet, 2002). In order to generate a representative estimate of the local species richness, different methods must be employed in combination. On the basis of my experience during the past 9 expeditions in the Neotropics, pan traps of different colours and sweep netting (Fig. 4) were selected as prime collecting methodologies.

2 Specific objectives of the mission

The primary aims of the 2020 survey were:

1. To further extend the lifezone array in the current data set, by adding two lowland and one upper montane rain forest sites. The collected data should at least include indications whether lowland rain forest communities are more similar (i.e., share more species) than montane communities;
2. To investigate the biodiversity patterns in dolichopodid communities over time by investigating three sites that have been sampled between 2 to 4 times before since 2003. These data might be a small but welcome contribution to "Climate Change Impacts on Biodiversity In Costa Rica" (provided to the Copernicus project, a Copernicus project initiated by the European Commission; and
3. To further test the usability of coloured pan traps as a standard technique for biodiversity surveys and to gather ecological information on the collected species.

3 Organisation, study area and sampling sites

Table 1, Figure 5 and Appendix I present an overview of surveys that add(ed) to the framework on biodiversity patterns of Dolichopodidae in Costa Rica. Grey cells (Table 1) correspond with sampling activities in a certain area and year, blue cells/circles sites that will be investigated in 2020 for the first time, and green cells/circles sites that have been visited before and will be investigated again in 2020. The latter sites will serve as benchmark sites for longer term monitoring.

In part due to the unexpected outbreak of the pandemic Covid19 and the time used for necessary information gathering about options to return home, some adjustments had to be made to the original planning and sampling strategy:

- **Parque Nacional (PN) Manuel Antonio**: could not be investigated due to the lack of the appropriate research permit, despite my timely application. In contrast, research permits for the thee following conservation areas were effectively awarded: La Amistad Caribe (incl. sampling sites nos. 11, 12), La Amistad Pacífico (incl. sampling sites nos. 7, 8, 13) and Arenal Tempisque (incl. sampling sites nos. 1, 2). By the end of our survey, however, National Parks were systematically closing for visitors and researchers.
- **Parque Nacional Chirippó**: we resided only three days in this region and time did not allow us to install pan trap sampling sites in the PN itself due to the underestimated distances to reach the PN itself. Instead, sampling sites were selected in second growth rain forest and the banks of Rio Chirippó adjacent to our accommodation at Canaán nr the PN.
- **Parque Nacional Volcán Tenorio**: likewise, as we had to take the plane one day earlier than planned, together with other Covid19 related issues, visiting the park became impossible. Instead, a few sweep net collections were made in a nearby private reserve (see Table 1).
- **Monteverde Cloud Forest Biological Preserve**: this conservation area appeared private instead of part of the national system of conservation areas (SINAC). As it was too late to apply for the necessary permit next to the fact that in this Preserve usually no animals were collected for research, we declined. As an excellent alternative, sampling sites at the Estación Biológica (EB) Monteverde were selected, an area that had been sampled with pan traps in 2007 and 2015 as well. Moreover, 2 extra series of 5 yellow pan traps were in operation in the latter area.
- **Caribbean coast**: next to the planned sampling in PN Cahuita, special collecting efforts were made in suitable habitats nr our accommodation in Cahuita as well as in the Wildlife Refugio Gandoca-Manzanilla.

Table 1. Overview of sampling sites in Costa Rica making part of the dolichopodid diversity research framework.

No.*	Geolocation[¥]	province	main area	Biome[§]	2003	2005	2007	2010	2015	2020
3	NE	Heredia	OTS - Estación Biológica La Selva	L						
11	SE	Limón	Parque Nacional Cahuita	L						
12	SE	Limón	Wildlife Refuge Gandoca-Manzanillo	L						
7	C	San José	Reserva Forestal Los Santos / Reserva Forestal Río Macho	UM						
8	C	San José	Canaán – San Gerardo de Rivas	LM						
4	NE	Heredia	Parque Nacional Braulio Carillo (+ Zurquí)	LM						
2	NW	Puntarenas	Estación Biológica Monteverde	LM						
9	S	Puntarenas	OTS – Estación Biológica Las Cruces	LM						
10	S	Puntarenas	La Amistad Biosphere Reserve	LM						
1	N	Alajuela / Guanacaste	Volcan Tenorio National Park (and/or Reserva Privada Volcán Tenorio)	PM						

[*] Sampling site no. 5 (Parque Nacional Manuel Antonio) ultimately could not be investigated; sampling site no. 6 (Parque Nacional Tapantí) has not been included in this list due to a request by the park manager

[¥] C: central, N: north, NE: northeast, NW: northwest, SE: southeast, and S: south of the country

[§] L: lowland rain forest, LM: lower montane rain forest, PM: premontane rain forest, and UM: upper montaine rain forest

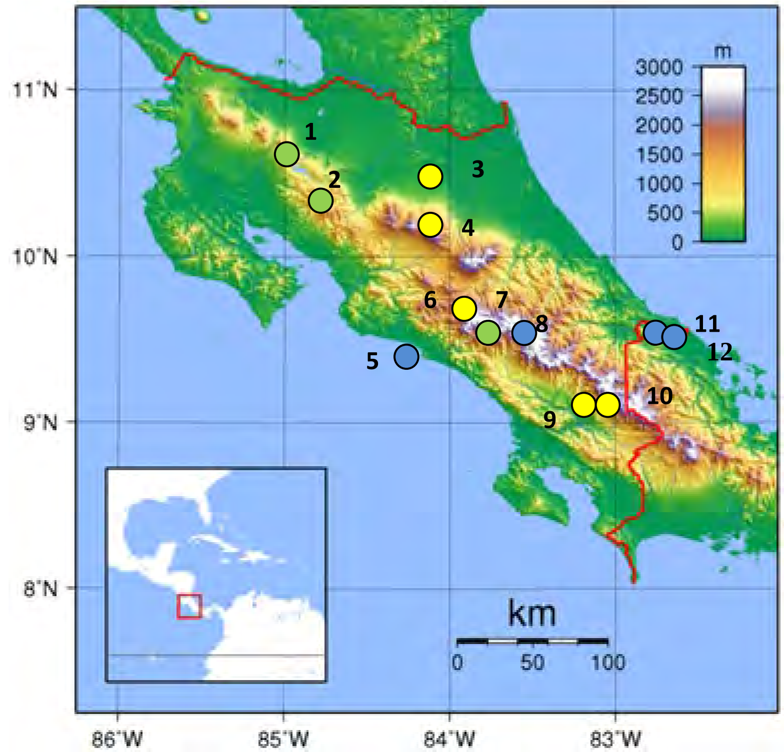


Figure 5. Past and new sampling sites in Costa Rica.
Circles/numbers refer to sampling sites. Yellow: sampled in previous surveys only; blue: site sampled for the first time in present survey; green: sampling site in previous and present survey. See also Table 1.

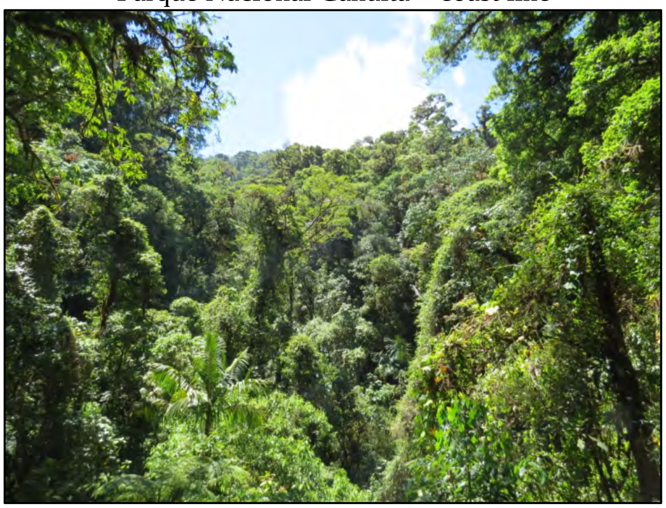
4 Material and methods - collecting techniques and strategy

Table 2 presents an overview of the **collected samples**.

- **Selection of sampling sites:** the standard pan trap sampling strategy at a given location is to select 3 different sampling sites, where 10 blue, 10 white and 10 yellow pan trap are employed. The traps are always arranged in units with one trap of each colour (see Fig. 6) in order to minimize the impact of environmental features on the insect yields. Traps are installed on soil surface level and fixed with metal pins. Yields of 5 traps of the same colour are pooled into one pan trap sample. For the latter practical reason, the above approach (i.e. 3 sampling sites with 30 traps) was only applied in PN Cahuita (see Table 3). In the other locations, at least 6 sampling sites were selected instead, where 5 blue, 5 white and 5 yellow traps were installed. In this way, overall yields per sampling site are lower, but information on more habitat types and sites could be collected.
- **Sampling time and servicing**. At the start of the survey, a fixative fluid for the pan traps was produced that consisted of 1-2% of formaline solution with detergent. Traps were always installed during the morning. They were filled for 2/3 with this mild solution and serviced in the afternoon of the last sampling day. As a result, the sampling duration of each trap was slightly over 2 days at most locations. Special attention was drawn to recycling this fixative fluid during servicing and salt was added to the collected liquid to retain its preservation capacity. As mentioned above, yields of 5 traps of the same colour were pooled per site. During the entire survey overall 125 blue, 125 white, and 135 yellow pan traps have been used.

Parque Nacional Cahuita – coast line

PN Cahuita – sampling site CR-2020-CA-02



San Gerardo de Dota – Reserva Natural Savegre

SgdDota – sampling site CR-2020-SG-01B

San Gerardo de Rivas/Canaán – Rio Chirippó

SgdRivas/Canaán – sampling site CR-2020-CH-03A

Figure 6. Some sampling locations and sites of the 2020 survey in Costa Rica.

- In addition, at each of the visited sites Dolichopodidae were also actively collected with **sweep nets** (see Table 2). Usually special attention is drawn to microhabitats with specialized dolichopodid communities like tree trunks, springs and waterfalls, and rocks in rivers, but during the 2020 survey not too many tree trunks have been investigated. Instead, we mainly focused on humid places e.g., river beds and banks with large boulders, seeps and low vegetation, beaches and cart wheel tracks. Both at random and on sight sweep net samples were collected (see further). Some of the former samples collected near our lodge in Cahuita easily contain over one thousand dolichopodid specimens (see Fig. 7)!

Table 2. Overview of samples collected during the 2020 Costa Rica survey.
HC: collected by hand, MSW: ad random sweep netting; SW: at sight sweep netting;
BPT: blue pan traps, WPT: white pan traps, and YPT: yellow pan traps.

Provinces - sampling localities	Sampling period	HC	MSW	SW	BPT	WPT	YPT	Total
Guanacaste			**1**	**4**				**5**
Nuevo Arenal	25/03/2020		1	4				5
Limón			**13**	**9**	**7**	**8**	**9**	**46**
Cahuita	9-11/3/2020		6	6	7	8	9	36
Manzanillo	10/03/2020		7	3				10
Puntarenas		**2**	**5**	**23**	**6**	**6**	**8**	**50**
4km S of Dominical	19-21/3/2020	1		1				2
ca. 2km NEE of Matapalo	20/03/2020		1	1				2
Santa Elena	22-24/3/2020	1	4	21	6	6	8	46
San José		**1**	**5**	**35**	**12**	**12**	**12**	**77**
Canaán (San Gerardo de Rivas)	17-18/3/2020	1	3	12	6	6	6	34
San Gerardo de Dota	13-15/3/2020		2	23	6	6	6	43
Total no. of samples	**9-25/3/2020**	**3**	**24**	**71**	**25**	**26**	**29**	**178**

5 Adjustments and encountered issues

The major issues encountered during the survey itself have been listed above (see **2 Organisation, study area and sampling sites**). Final results on number of sampling sites, pan traps and collected samples are given in Table 2. Overall, 80 instead of the planned 90 pan trap samples and 98 instead of an estimated 180 sweep net samples were collected. It soon became clear that 15 sweep net samples per day proved an overestimation, especially for those days that we moved from one location to the next (see Fig. 5), and days when pan traps were installed or serviced. Also, some of the pan trap sampling sites did not really evoke sweep netting due to dense vegetation, the apparent absence of dolichopodids in the field, etc. An overall average of 5-6 sweep net samples a day was ultimately accomplished.

During the entire survey, we enjoyed dry weather with one day of rain during its early start at Cahuita. For that reason, the pan trap campaign was not impacted by the weather at all, and only 5 traps (≈ 1%) were disturbed with yield losses.

Biodiversity research on this scale, on the other hand, does not get any easier in Costa Rica. In order to comply to the SINAC rules, the researcher must apply for collecting licences at the Ministerio de Ambiente y Energía (MINAE). A separate collecting licence is required for each of the 10 conservation areas, in case a national park in the respective area is included in the study. Next to that, a separate collecting licence must be acquired for private sites, also including Private Reserves.

Table 3. Overview of the sites in Costa Rica investigated with pan traps

Sampling site name	Sampling site description	sampling period	altitude	BPT	YPT	WPT
Cahuita PN sampling site 1	dark wet coastal forest	9-11/03/2020	9	10	10	10
Cahuita PN sampling site 2	well-lit moderately wat coastal forest	9-11/03/2020	4	10	10	10
Cahuita PN sampling site 3	dark rather dry coastal forest	9-11/03/2020	10	10	10	10
Cahuita Passion Fruit Lodge site 4	wet canopied ditch in park environment	9-11/03/2020	21	5	5	5
San Gerardo de Dota sampling site 1A	along seep nr stream in rather wet cloud forest	13-15/03/2020	2179	5	5	5
San Gerardo de Dota sampling site 1B	on stream bank in rather wetcloud forest	13-15/03/2020	2354	5	5	5
San Gerardo de Dota sampling site 2A	in dry cloud forest (right hand side)	13-15/03/2020	2442	5	5	5
San Gerardo de Dota sampling site 2B	in dry cloud forest (left hand side)	13-15/03/2020	2433	5	5	5
San Gerardo de Dota sampling site 3A	in rather dry cloud forest nr stream	13-15/03/2020	2260	5	5	5
San Gerardo de Dota sampling site 3B	on stream bank in rather dry cloud forest	13-15/03/2020	2259	5	5	5
San Gerardo de Rivas - Canaan site 1A	at wet spot in border of trail in cloud forest	17-18/03/2020	1179	5	5	5
San Gerardo de Rivas - Canaan site 1B	in rather dry border of trail in cloud forest	17-18/03/2020	1188	5	5	5
San Gerardo de Rivas - Canaan site 2A	in cloud forest	17-18/03/2020	1160	5	5	5
San Gerardo de Rivas - Canaan site 2B	in dried up stream bed in cloud forest	17-18/03/2020	1168	5	5	5
San Gerardo de Rivas - Canaan site 3A	near small waterfall and rock pool at Rio Chirippó	17-18/03/2020	1139	5	5	5
San Gerardo de Rivas - Canaan site 3B	near small pool on bank of Rio Chirippó	17-18/03/2020	1143	5	5	5
Santa Elena - EB Monteverde site 1A	in dried up stream bed (with low vegetation) in cloud forest	22-24/03/2020	1471	5	5	5
Santa Elena - EB Monteverde site 1B	nr small stream with pebbly soil in cloud forest	22-24/03/2020	1478	5	5	5
Santa Elena - EB Monteverde site 1C	on bank of stream in cloud forest (strongly vegetated)	22-24/03/2020	1487	5	5	5
Santa Elena - EB Monteverde site 2A	in bed of small stream in cloud forest	22-24/03/2020	1531	5	5	5
Santa Elena - EB Monteverde site 2B	on seepy slope in cloud forest	22-24/03/2020	1541	5	5	5
Santa Elena - EB Monteverde site 2C	in stream bed within small canyon in cloud forest	22-24/03/2020	1540	5	5	5
Santa Elena - EB Monteverde site 1D	on muddy spot on bank of stream in cloud forest	22-24/03/2020	1498	0	5	0
Santa Elena - EB Monteverde site 1E	on pebbly bank of stream in cloud forest	22-24/03/2020	1496	0	5	0
Total no. of employed pan traps				125	135	125

Finally, also an export permit is needed if the collected samples are transferred abroad for further examination. Thanks to the patient and kind help by Mr Enrique Alonso Castro Fonseca (Organisation of Tropical Studies, San José, CR) and the swift interaction by Mr Javier Guevara Sequeira (SINAC, San José, CR), we finally managed to obtain all the permits we needed, but only just! These administrative arrangements took most of the nearly 52 hours spent on this project phase (see Table 4).

Figure 7A. Entire sample collection of the survey with sorted dolichopodid samples (blue plates), non-dolichopodid taxa (white plates) and residue samples (whirl-paks)

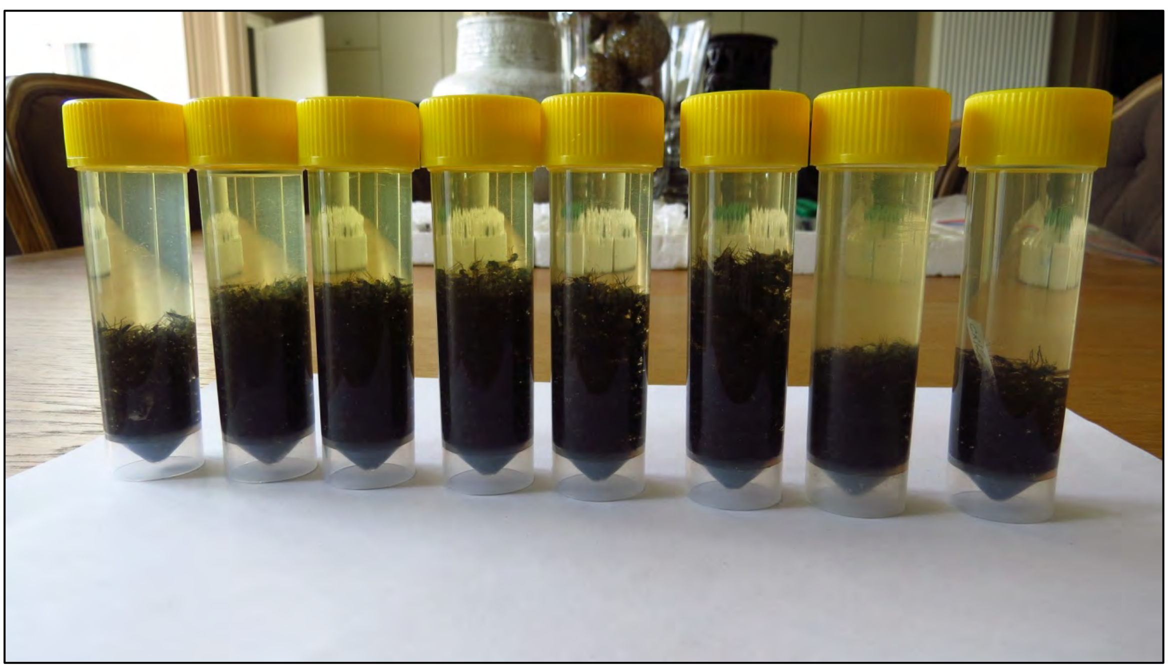


Figure 7B. Collected samples during the 2020 Costa Rica survey: Huge dolichopodid samples collected by at random sweep netting at Cahuita

Table 4. Overview of time spent to each of the past and current project phases.

Project phase *	time period	no. hours
Preparation (incl. research proposal, administration)	11/7/2019-31/3/2020	51,8
Fieldwork (incl. transport)	7-29/3/2020	276,0
Collection management	4/04/2020	0,8
Sample processing	4-25/4/2020	51,9
Reporting (incl. collection management)	4-25/4/2020	14,3
Total no. hours spent	11/7/2019-25/4/2020	394,8

6 Preliminary results - sample and data processing

During the expedition, time was dedicated primarily to the trapping campaign, the collection of specimens with sweep nets, and the preparation of the samples for export. This encompassed most of the time spent to this project thus far (see Table 4: identification phase not included).

Processing of the collected samples has been conducted in the Belgian lab, as this phase requires a microscope infrastructure; in fact, some of the collected species (in e.g., the genera *Enlinia* Aldrich, *Harmstonia* Robinson and *Micromorphus* Mik) are truly minute, with body sizes of about 1 mm! The results of the processing of samples collected by pan traps or at random sweep netting are summarized in Tables 4 and 5. This project phase has been started on 4/4/2020 and was accomplished in three weeks time. Dolichopodidae were sorted and stored separately. In addition, 6 and 8 other different beetle and fly (super)families were pulled from the samples (see Table 5) and taxonomic experts contacted. The residue samples (i.e. samples with the remainder of the invertebrates after extraction of the taxa mentioned above) will be temporarily stored at the Belgian lab and finally either be deposited at the Muséo Nacional de Costa Rica or at RBINS (Brussels, Belgium).

Table 5. Overview of the non-dolichopodid taxa systematically extracted from the samples.

Taxon	no. samples
Coleoptera: Carabidae	48
Coleoptera: Cerambycidae	1
Coleoptera: Chrysomelidae	5
Coleoptera: Cicindelidae	2
Coleoptera: Dytiscidae	7
Coleoptera: Scarabaeidae	8
Diptera: Asilidae	4
Diptera: Empidoidea	90
Diptera: Lygistorrhinidae	1
Diptera: Pipunculidae	4
Diptera: Sciomyzidae	5
Diptera: Stratiomyidae	20
Diptera: Syrphidae	15
Diptera: Tephritoidea	28
Total no. of samples	238

Dolichopodid specimens will ultimately be identified to morphospecies level and temporarily stored in my personal collection. Representatives of the subfamily Achalcinae and some selected genera will be examined in more detail and incorporated in ongoing personal projects. In addition, it is my firm intention to examine the dolichopodid specimens collected during earlier surveys in Costa Rica (at least from 2007, 2010 and 2015). As a matter of fact, this larger data set will allow us to answer some of the research questions more reliably.

Data on sampling sites, samples, species and specimens will be stored in a personal Microsoft ® Access database, NEOTROPICS, currently holding data on over 13,900 samples (excl. IBISCA) from 22 Neotropical countries.

7 Preliminary results – field observations

We can already conclude that, based on the sample processing results, the survey has been a great success. Not only did we collect a large number of species but, contrary to most previous surveys in Costa Rica, also large to very large numbers of specimens in 2020 (see Fig. 7).

We are further delighted to confirm the continued presence of some rare and/or stenotopic species at some of the previously visited sites (often, though, in apparently lower numbers than before). Moreover, I also discovered additional new achalcine species at sites that appeared not really promising for this fly family. And finally, also fair numbers of the elusive genus *Keirosoma* Van Duzee were observed in the pan trap samples collected at Cahuita.

8 Perspectives

This sixth expedition in Costa Rica has clearly added new and significant data on the distribution of Dolichopodidae along different gradients in this megadiverse country. This effort most definitely contributes to build a fairly accurate idea about the distribution, ecology and diversity of this taxonomic group in several lifezones. It also enhances our knowledge on the faunas that inhabit the lowland rain forests that are generally expected to be more similar to each other than the montane sites.

During the 6 expeditions to Costa Rica carried out between 2003 and 2020, a good array of different lifezones has been investigated with a fair coverage of the country. However, as shown in Figure 5, certain regions (coastal, both Pacific and Caribbean) and lifezones e.g., dry lowland rainforest, mangrove still remain entirely unexplored. And without a single doubt do the latter harbour yet other new species that await discovery.

References

Bickel, D.J. (2009) 49. Dolichopodidae (Long-Legged Flies). In: Brown, B.V., Borkent, A., Cumming, J.M., Wood, D.M., Woodley, N.E. & Zumbado, M. (eds). *Manual of Central American Diptera*: 671-694. National Research Council Canada, Ottawa, Canada.

Hartshorn, G.S. (1983) Plants. Pp. 118-157. In: Janzen, D.H. (Ed.). *Costa Rican natural history*. University of Chicago Press, Chicago.

Holdridge, L.R. (1967) *Life zone ecology*. Tropical Science Center, San Jose, Costa Rica.

Pape, T., Bickel, D. & Meier, R. (Eds.) (2009) Appendix one. Species of Diptera per family for all regions. Pp. 430-435. In: Pape, T., Bickel, D. & Meier, R. (Eds.). *Diptera Diversity: Status, Challenges and Tools*. Koninklijke Brill NV.

Pollet, M.A.A. & Brooks, J.E. (2008) Long-legged Flies (Diptera: Dolichopodidae). Pages 2232-2241. In: Capinera, J. L. (Ed.), *Encyclopedia of Entomology*. 2nd Edition, Springer.

Pollet, M.A.A. (2000) A documented Red List of the dolichopodid flies (Diptera: Dolichopodidae) of Flanders [in Dutch with English summary]. *Communications of the Institute of Nature Conservation* 8: 1-190. Brussels.

Pollet, M. (2002) Biodiversity patterns in Neotropical dolichopodid faunas (Diptera: Dolichopodidae). P. 194. Abstracts of the 5th International Congress of Dipterology, Brisbane, Australia, 29 September - 4 October 2002.

Pollet, M. & Grootaert, P. (1987) Ecological data on Dolichopodidae (Diptera) from a woodland ecosystem. I. Colour preference, detailed distribution and comparison between different sampling techniques. *Bulletin de l'Institut royal des Sciences naturelles de Belgique, Entomologie* 57: 173-186.

Pollet, M. & Grootaert, P. (1991) Horizontal and vertical distribution of Dolichopodidae (Diptera) in a woodland ecosystem. *Journal of Natural History* 25: 1297-1312.

Pollet, M. & Grootaert, P. (1994) Optimizing the water trap technique to collect Empidoidea (Diptera). *Studia dipterologica* 1 (1): 33-48.

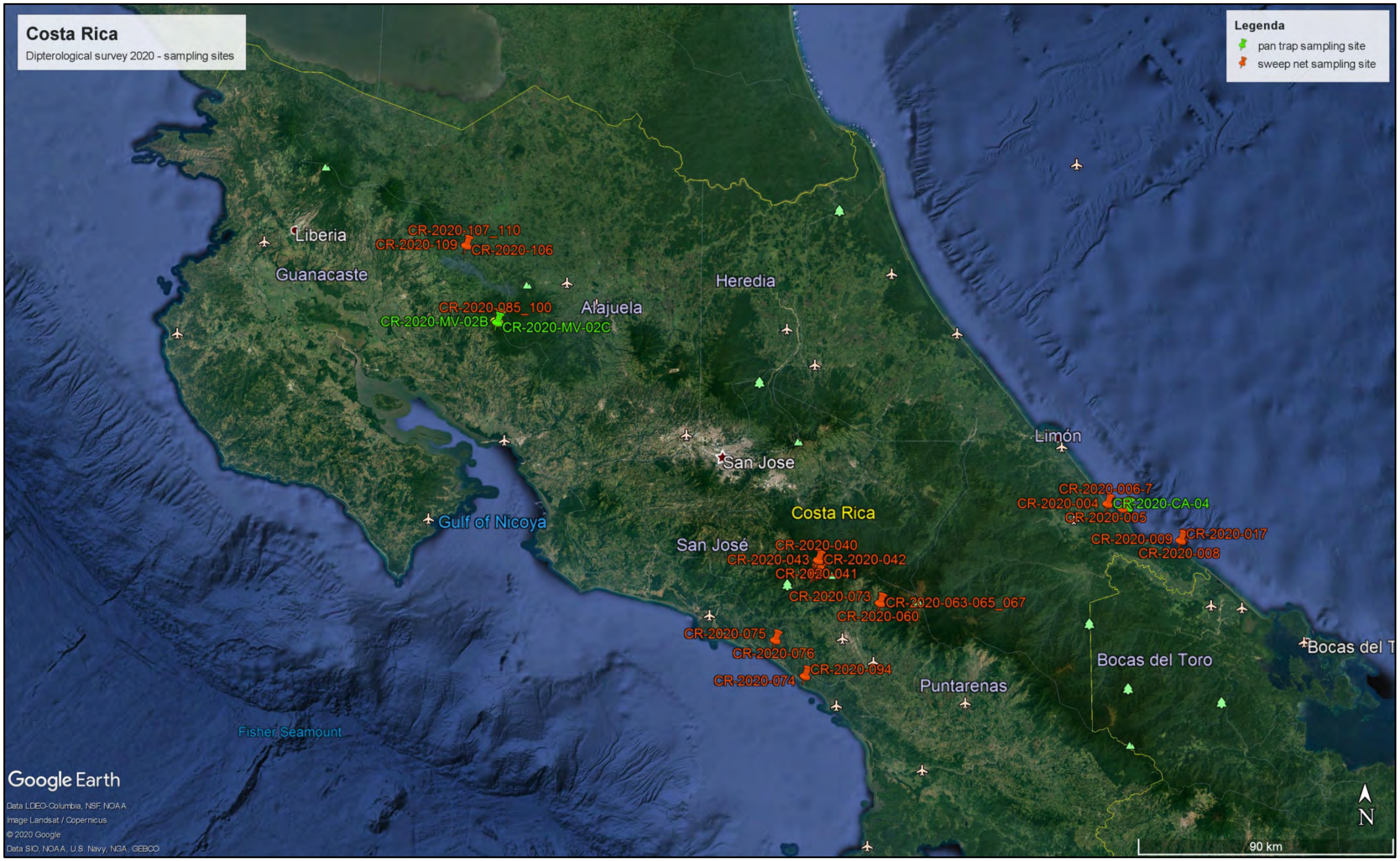
Pollet, M., Leponce, M., Pascal, O., Touroult, J. & Van Calster, H. (2018) Dipterological survey in Mitaraka Massif (French Guiana) reveals megadiverse dolichopodid fauna with an unprecedented species richness in *Paraclius* Loew, 1864 (Diptera: Dolichopodidae). In Touroult J. (Ed.). "Our Planet Reviewed" 2015 large-scale biotic survey in Mitaraka, French Guiana. *Zoosystema* 40 (21): 471-491. https://doi.org/10.5252/zoosystema2018/40/21.

Robinson, H. (1970) 40. Family Dolichopodidae. Pages 1-92. In: Papavero, N. (Ed.), *A catalogue of the Diptera of the Americas south of the United States*. 40. Universidade de São Paulo, Museu de Zoologia.

Touroult, J., Pollet, M. & Pascal, O. (2018) Overview of Mitaraka survey: research frame, study site and field protocols. In Touroult J. (Ed.) "Our Planet Reviewed" 2015 large-scale biotic survey in Mitaraka, French Guiana. In Touroult J. (Ed.). "Our Planet Reviewed" 2015 large-scale biotic survey in Mitaraka, French Guiana. *Zoosystema* 40 (13): 327-365. https://doi.org/10.5252/zoosystema2018/40/13.

Appendix I

Map of Costa Rica with sampling sites and samples indicated [not all of them are clearly displayed – sorry about that!]



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Australia Malaise trapping disaster update

Keith M Bayless & David K Yeates

Australian National Insect Collection, CSIRO National Research Collections Australia (NRCA), Acton, Canberra, Australian Capital Territory, Australia

Malaise traps are powerful tools for studying biodiversity and ecology, particularly in light of potential declines in the abundance of insect fauna. Studies that have tackled insect declines are primarily European and hinge on long term data, for instance Malaise traps running for a year or longer. No such data exist for Australian flies, so we need a baseline to accrue data sets that can address the trajectory of insect populations in Australia. Malaise traps are also extremely useful for discovering new species and obtaining fresh material of rare species for molecular analyses and fine dissection. Particularly in poorly known groups like Australian acalyptrate flies in which most species are undescribed, Malaise trapping will help us determine what taxa are here now and to gather vouchers for future comparisons.

However, experiments as they are run in Germany face new challenges in Australia. We set up Malaise traps in multiple locations in ACT and New South Wales with the intention of maintaining each for one year. Some of these traps were in parks where no similar insect trapping regime had ever taken place. By February 2020, seven trap emplacements had been destroyed by natural disasters various and sundry.

In March 2019, PhD student James Lumbers and I constructed a 2-meter Malaise trap over a slow muddy stream in Monga National Park in SE New South Wales. The trap's location (figure 1), Penance Grove, was one of the most humid sites I have visited in southern NSW. The vegetation consisted of sparse tree ferns and no understory vegetation, mainly moist loam. We collected and sorted samples for months, finding lists of curious taxa – aquatic scorpionflies in the Nannochoristidae, Piophilidae: *Piophilosoma*, Neminidae: *Nemo*, on and on. When the Clyde Mountain fire approached, we hoped soggy Penance Grove would be spared but it certainly was not. Miraculously, James recovered the sample, as the tree to which the collecting head was tied fell into the stream while the rest of the trap ignited or melted (figure 2). This material appears to contain rare canopy taxa that fled the fire front. No trace was left of another 6-meter Malaise in Badja Swamp in Deua NP in SE NSW, a location we had never previously sampled. Sadly, we will never know which fly species were in Badja Swamp in 2019 before the fire broke through.

We had placed three more traps in various habitats on Black Mountain in ACT in 2019, including a green wash, dense bushy vegetation, and open sclerophyll. It is quite easy to find undescribed acalyptrate flies in the Australian National Insect Collection's extensively surveyed backyard. The microhabitats also yielded stark different fly faunas. These traps, two 2-meter and one 6-meter traps, were productive for more than six months before they were suddenly thrust into a new experiment on January 20- what is the effect of fist-sized hail on Malaise traps? They were all completely destroyed, skeletonized with just the frame preserved (Figure 3). In some cases, the hail punched through the plastic Nalgene bottles themselves (Figure 4). Luckily, we were able to recover most of the samples.

Figure 1. Malaise trap in Monga National Park. Photo by James Lumbers.

Figure 2. Malaise trap sample saved by falling tree. Photo by James Lumbers

Figure 3. Hail destroyed traps.

Finally, I decided to head towards a region that was less likely to be affected by bushfires. Budderoo NP and Barren Grounds NR near Robertson NSW were hundreds of kilometers from the nearest bushfire in 2019, situated in the Illawarra escarpment which includes several rainforests nearby and comparatively high levels of precipitation. As a final sign of the unpredictability of fieldwork in Australia, a record rainfall occurred, dumping nearly 400mm of rain in a 24-hour period around February 10. A 6-meter Malaise trap was directly in the path of one of the newly scoured washes, with water, soil, and branches ripping it apart (Figure 5). Rain also washed out another 2-meter Malaise placed on Black Mountain after the hailstorm. Again, luck would have it that we were able to recover the samples.

Figure 4. A hailstone bullseyes a Malaise trap collecting head.

We have now taken down the Malaise traps replaced after the hailstorm due to the COVID-19 situation, as maintaining them might be too complicated or a risk to health and safety.

Due to the extraordinary series of weather events, this year would not serve as a particularly informative baseline anyway. We have not replaced any of the Malaise traps in the same localities to give the insects a chance to recover. The traps were not up long enough before the disasters to provide robust comparative data anyway. We are eager to push on discovering new species and improving our capacity to answer questions about insect decline and ecosystem resilience. I sincerely hope we're the only research group to lose Malaise traps to fire, hail, and flood in the same season.

Figure 5. Remnants of a Malaise trap after the flood.

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#CreepiestObject Yet

David Grimaldi

American Museum of Natural History, Central Park West at 79th St.,
New York, New York 10024-5192, USA; grimaldi@amnh.org

As a museum curator I'm interested in how museums are vying for on-line attention during the pandemic lockdown. A surprisingly popular contest was started by the Yorkshire Museum in England, #CreepiestObject. Proud custodians from museums around the world have posted pictures of their favorite candidates, some of them gross, many weird, and a few even creepy. Who would have thought that in such an anxious time as a virus pandemic people would *enjoy* being creeped out? For some it's like Halloween, only months long.

It started with the Yorkshire Museum posting a picture of the hair bun of a 3-4th c. AD Roman woman. Big deal; I've seen worse bed hair. There is a mask from the Black Plague, and collections of frostbitten fingertips and pulled teeth. Ho-hum. There are assorted weird toys (I've seen worse under my kids' beds). There is the bisected head of Peter Kurten, a vampirous psychopath from Dusseldorf (have you ever seen the *Bodies* exhibit?). Three entries of "Feejee" mermaids display what seems to have been a Victorian hobby, made by sewing the mummies of neonatal apes onto the tails of fish. OK, that's pretty creepy.

For some reason, curators at natural history museums are posting hardly any contestants, which is unusual because when it comes to visceral creepiness human artifacts have nothing on the natural world. While the worst of the contestants from history museums may be products of sick and disturbed minds, they are still contrived, involving familiar bits and pieces of human and near-human anatomy. In nature, the alien is completely natural.

Take flies -- specifically their maggots -- which do some things that are metaphorically and literally very creepy. As dipterists we can recite the familiar: subcutaneous and gastrointestinal bots; screw-worms; flesh-eating maggots; *Protocalliphora*, which creep under the naked skin of nestling birds; and the Congo floor maggot, *Auchmeromyia senegalensis*, another vampire. These are all *vertebrate* parasites, which are variations on a theme. Invertebrate parasitoids break the rules. Also, when are these creepy parasites ever preserved in action?

Allow me to present a fascinating exception.

Among the tens of thousands of insects I've seen in 17-myo amber from the Dominican Republic, ants are extremely common. Several years ago, however, a friend brought to the museum a unique piece, which contains a male (winged) *Dolichoderus* ant with a parasitoid fly larva squeezing out of it. The ant is approximately 3.5 mm long, the larva about 1.3 mm. The larva is emerging head first, ventral side up, out of a small hole in the membrane between the ants' pronotum and propleuron, its "neck". It's a tight squeeze.

The maggot appears to be parasitoidal, not a mere corpse scavenger. The ant is very well preserved, and backlighting reveals internal tissues in the head and "abdomen" (the metasoma). The "thorax" (mesosoma) is hollowed out, and about a third of the posterior end of the maggot is still in the ant. The ant obviously couldn't fly without thoracic flight muscles. Maybe it just clung to a tree trunk as resin slowly flowed over it. As the ant died the larva rasped its way out, almost.

Identity of the maggot is uncertain but likely to be in the Phoridae. Scuttle flies have extraordinarily diverse life histories; many are larval scavengers and parasitoids of injured and healthy terrestrial arthropods, including many ants (Disney, 2012). Structure of the larva is also phorid-like: a transverse row of small dorsal tubercles on each segment, and swollen creeping welts.

The most notorious of the parasitoid scuttle flies is the large Neotropical genus *Apocephalus*, intensively studied for decades by Brian Brown at the Los Angeles County Museum of Natural History (e.g., Brown 2012, 2014; Brown et al. 2010). The genus name, and common name "decapitating " flies, comes from a common habit where the mature larva or even teneral adult of some species emerges from its worker ant host through the occipital foramen, the hole connecting the head to the neck. While freeing itself the ant head falls off.

Unlike *Apocephalus*, the host of the amber maggot is a male ant, although attacks on male ants are not unknown in phorids: *Pseudacteon* scuttle flies are reported "attempting to parasitize emerging gynes" of *Solenopsis* fire ants in Brazil (Pesquero et al., 1993). Another difference with *Apocephalus* is that the amber maggot is so *big* compared to its host, which is precisely what makes it such a disturbingly creepy contestant.

The amber maggot reminds me of a scene from the 1982 movie, *The Thing*. In it, aliens assimilate into the bodies of humans and dogs in a remote Antarctic research station. The scientists first learn of their "parasitoidism" when the kennel erupts in chaos, and one dog acting weird lies down as large, slimy tentacles burst out of its body. For a pre-digital production it can still make you jump. The possibilities are now limitless with digital monsters, but if Hollywood producers really want to create a shockingly original, creepy monster I would like to suggest that it actually have *creeping welts*. Better yet: flash-freeze for millions of years a huge maggot squeezing itself out of a hole in the neck of its host. Is it still *ALIVE*? Maybe not, but still the Creepiest Object Yet.

Acknowledgments
I wish to thank Keith Luzzi for his generous donation of the creepiest fossil ever to the AMNH; to Brendan Boudinot for identifying the genus of the host ant; and to Brian Brown for feedback on the amber maggot and other phorids in Dominican amber.

References:

Brown, B.V., 2012. Revision of the *Apocephalus mucronatus* group of ant decapitating flies (Diptera: Phoridae). *Zootaxa*, *3413*(1), pp.19-28.

Brown, B.V., 2014. Revision of the *Apocephalus analis* group of ant-decapitating flies (Diptera: Phoridae). *Zootaxa*, *3857*(4), pp.551-570.

Brown, B.V., Disney, R.H.L., Elizalde, L. and Folgarait, P.J., 2010. New species and new records of *Apocephalus* Coquillett (Diptera: Phoridae) that parasitize ants (Hymenoptera: Formicidae) in America. *Sociobiology*, *55*(1), p.165.

Disney, H., 2012. *Scuttle flies: the Phoridae*. Springer Science & Business Media

Pesquero, M.A., S. Campiolo, H.G. Fowler. 1993. Phorids (Diptera: Phoridae) associated with mating swarms of *Solenopsis saevissima* (Hymenoptera: Formicidae). The Florida Entomologist 76(1): 179-181.

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Ant and flower flies: Two different groups

F. Chris Thompson

Ponte Vedra, Florida, USA; xelaalex@cox.net

Most people recognize flower flies as those common visitors to flowers, which are mimics of various hymenopterans. Few know ant flies, which have been long lumped among those flower flies. Yet they are quite different. Flower flies have various types of immature development ranges from predators of immature homopterans to saprophagous rat-tailed maggots. Ant flies are as far as known exclusively inquilines within the nest of ants as immatures. The adults are not normally flower visitors and usually remain close to the ant nest from which they emerge.

Microdon mutabilis (Linnaeus, 17658). Slovakia. Photo by Matej Schwarz, used under Creative Commons Attribution License 3.0, https://www.biolib.cz/en/taxonimage/id244327/?taxonid=123971

Phylogenetically the ant flies are the basal clade to the flower fly clade and in turn together they are the sister clade to Schizophora, the rest of higher Diptera. Schizophora is divided into 84 families (Pape *et alia* in 2011 *Zootaxa* 3148: 222-229). Given such ranking, should the ant flies be considered only a subfamily of the sister clade to all those families?

Yes, those workers, like Curtis Sabrosky and George Steyskal, who once told me that flower flies should not be split as everyone one knows what they are! But neither Curt nor George nor everyone else knew what ant flies were. So today I return to the position I held years ago (Thompson 1972, *Arquivos de Zoologia* 23: 85) and recognize two groups within the syrphid clade: Ant and flower flies.

The only remaining unknown is the biology of the Spheginobacchinae, the sister to the Microdontinae. These flies are limited to the Afrotropical and Oriental regions. Unfortunately their biology is completely unknown.

Spheginobaccha vandoesburgi Thompson, photographed by S.D. Gaimari in Sabah, Malaysia (Borneo)

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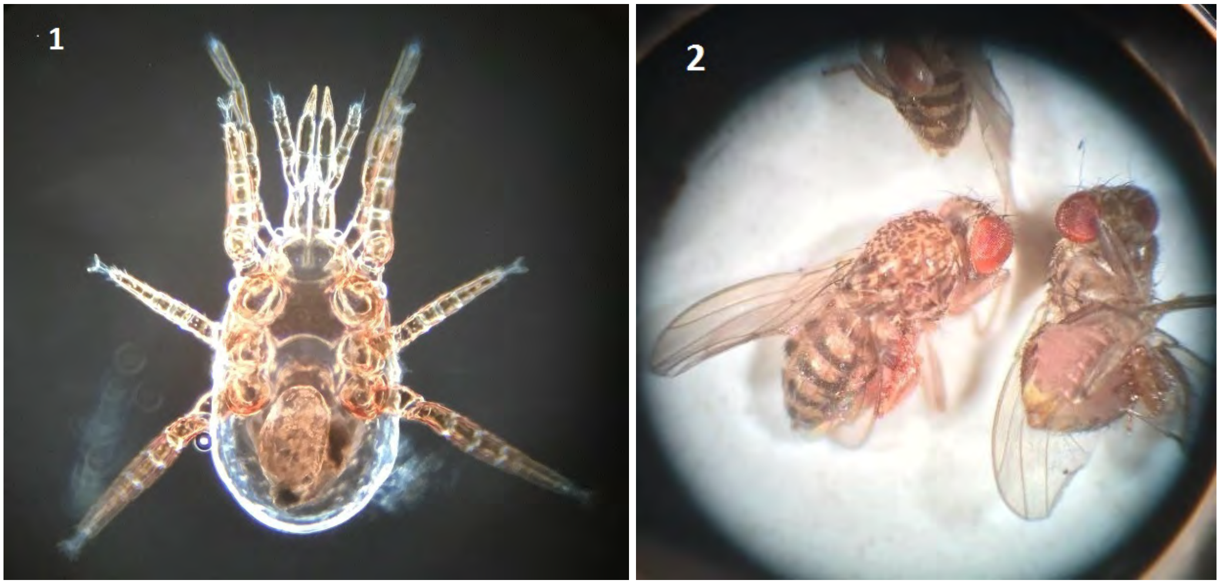
Macrochelid mites collected from *Drosophila repleta* group flies on Vaca Key, Florida

Lawrence J. Hribar

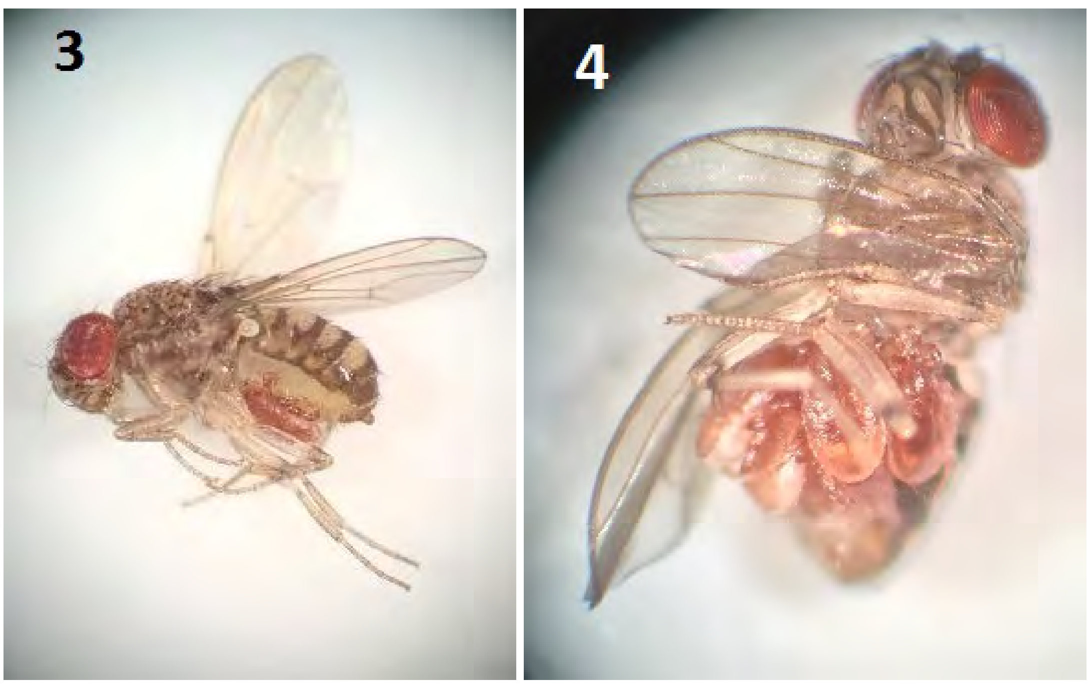
Florida Keys Mosquito Control District, 503 107th Street, Marathon, Florida 33050, USA

Recently the African Fig Fly, *Zaprionus indianus* Gupta (Drosophilidae), was reported from Monroe County, Florida (Hribar & Boehmler 2019). Intrigued by this record of an exotic fruit pest and curious to know if it occurred elsewhere in the Florida Keys, I decided to try to collect this fly in my backyard. I have a composter into which fruit- and vegetable-derived kitchen waste is deposited on a regular basis. I also have a fig tree and a tamarind tree in my backyard. There is ample food for Drosophilidae and other flies. Beginning on 15 April 2020 and continuing until the evening of 19 April 2020 I set traps fashioned from empty soft drink bottles (similar to those described by Hwang & Turner (2005)). The first two nights I set only one trap, baited with a mixture of red wine (Merlot) and apple cider vinegar (Epsky et al. 2014, Kremer et al. 2017). On the second night I collected one *Z. indianus*, and a couple of other species; 108 specimens of one species were collected (Table 1). Curious to know what species I had caught, I made an attempt to identify the specimens. The task was daunting because there are 69 species of Drosophilidae known from Florida, 33 of them alone in the genus *Drosophila* (Anonymous 2019-2020). The most current key I could locate was that of Miller et al. (2017). Perusing this publication I learned two things: 1, that there are no modern completely up to date keys to the *Drosophila* of the United States; and 2, the species collected in greatest numbers very closely resembled *Drosophila repleta* Wollaston (pale areas on tergites and dark spot on costal sector). However, further reading revealed that there are 106 species in the *repleta* group, and no less than four occur in Florida: *D. hydei* Sturtevant, *D. peninsularis* Patterson & Wheeler, *D. repleta* Wollaston, and *D. stalkeri* Wheeler (Markow & O'Grady 2006, O'Grady & DeSalle 2018). Species in the *repleta* group are difficult to distinguish morphologically (Perez-Leanos et al. 2017). Ergo, the identification stands at "*Drosophila repleta* group species." Other Drosophilidae were designated "*Drosophila* species 1 – 4." Without modern keys, clear illustrations, and a good reference collection at hand, I decided not to try to make specific identifications.
The *Drosophila repleta* group has been described both as "cosmopolitan" and "endemic to North America" (Sturtevant 1921, Etges et al. 2001). Knab (1912) reported *D. repleta* from Jacksonville and Key West, Florida, and mentioned that he collected some specimens in Mexico "about wine-bottle in tavern" – giving hints to both a collection method and how Knab may have spent his off hours while on collecting trips.

Most of the flies that I collected on the second night were captured in the upper chamber of the bottle trap, but some had died in the lower part and were floating on the surface of the wine-vinegar mixture. I strained these specimens through a paper towel and took them into the laboratory to examine them under a microscope. I saw several flies that were harboring mites on their bodies. I was able to recover 18 mites from the surface of the paper towel. I cleared them in a mixture of phenol, acetic acid and ethanol, and mounted them on microscope slides in Canada balsam (Figure 1). The mites were easily identified as *Macrocheles muscaedomesticae* (Scopoli) (Halliday 1990). This mite was first collected in Florida from the stable fly, *Stomoxys calcitrans* (L.) (Williams and Rogers 1976). Most flies were harboring one mite (Figures 2, 3, & 5) but two flies had four mites attached (Figure 4). Because so many mites became detached from the flies when the flies died in the bait, I did not attempt to count how many flies were parasitized. However, "a lot of them" is an accurate statement, although admittedly imprecise.



Figures 1–2. 1. *Macrocheles muscaedomesticae* (Scopoli). 2. *Drosophila* flies harboring mites.



Figures 3–4. 3. *Drosophila* fly with mite attached to abdomen. 4. *Drosophila* fly with four mites attached to abdomen.

Macrocheles muscaedomesticae is a well-known associate of flies (Halliday 1990). Opinions seem to differ whether the mites use flies as phoretic hosts (Rodrigueiro and Prado 2004) or if they are parasites (Perez-Leanos et al. 2017). Durkin et al. (2019) reported that mites weighed more after attaching to *Drosophila hydei* Sturtevant for four hours, but they were unable to show definitive evidence that the mites were feeding on the flies.

On the third night and following nights I set two traps, baited with white wine (Pinot Grigio), white wine plus apple cider vinegar, apple cider vinegar only, red wine plus apple cider vinegar, and red wine only (Table 1). More flies were collected consistently with baits containing red wine, whereas those baits containing white wine, apple cider vinegar only, or a combination of white wine and apple cider vinegar collected very few flies (Table 1). This is consistent with the report of Hottel et al. (2015) that apple cider vinegar was much less attractive to *D. repleta* than was red wine (Pinot Noir).

Figure 5. Two *Drosophila* flies each with one mite on the abdomen.

The difference in attractiveness to flies between red and white wines is interesting. Red wines are made from the skins, fruit flesh and sometimes seeds of the wine grapes, whereas white wines are made from the fruit flesh only; the red color of wines is due to anthocyanins (Robinson 2015). Anthocyanins and flavonoids are the major groups of phenolic compounds found in red wine; there are other chemicals as well, found in red wines but not in white wines (Xia et al. 2010). Most interestingly, some grape varieties can be used to produce both red and white wines, for example Pinot Noir and Pinot Grigio (Robinson 2015). Whereas Hottel et al. (2015) found Pinot Noir to be an excellent bait, I had little success using Pinot Grigio. Might some of the phenolic compounds in grape skins be attractive to *Drosophila repleta* group flies?

Surprisingly few nontarget organisms were collected. Three Calliphoridae, one Sciaridae, and one Phoridae were collected in bottles with red wine + vinegar, as was one unidentified beetle. A Sarcophagidae was collected in a bottle baited with white wine + vinegar (Table 1).
Finally, yes I did collect a whopping two (2) *Z. indianus* flies; success, I guess.

Table 1. Daily Trap Catch of Diptera in Soft Drink Bottle Traps Provided with Different Baits.

Date	Bait	Species	Number
15 April 2020	RW + ACV	*D. repleta* Group	3
		Drosophila sp. 2	4
		Total Drosophilidae	7
16 April 2020	RW + ACV	*D. repleta* Group	108
		Drosophila sp. 1	9
		Drosophila sp. 2	5
		Drosophila sp. 3	2
		Zaprionus indianus	1
		Total Drosophilidae	124
		Calliphoridae	1
17 April 2020	WW	*D. repleta* Group	3
		Drosophila sp. 2	4
		Total Drosophilidae	7
	RW + ACV	*D. repleta* Group	41
		Drosophila sp. 1	16
		Drosophila sp. 2	3
		Drosophila sp. 3	3
		Total Drosophilidae	63
		Calliphoridae	2
		Sciaridae	1
		Phoridae	1
		Coleoptera	1
18 April 2020	WW + ACV	*Drosophila* sp. 2	6
		Drosophila sp. 4	1
		Total Drosophilidae	7
		Sarcophagidae	1
	RW + ACV	*D. repleta* Group	13
		Drosophila sp. 1	9
		Drosophila sp. 2	5
		Drosophila sp. 3	1
		Z. indianus	1
		Total Drosophilidae	29
19 April 2020	ACV	*Drosophila* sp. 1	2
		Drosophila sp. 2	1
		Total Drosophilidae	3
		Coleoptera	1
	RW	*D. repleta* Group	12
		Total Drosophilidae	12
		Grand Total *D. repleta* Group	180
		Grand Total Drosophilidae	252

References

Anonymous. 2019-2020. A Checklist of the Drosophilidae of Florida. Florida Department of Agriculture and Consumer Services. https://www.fdacs.gov/Divisions-Offices/Plant-Industry/Florida-State-Collection-of-Arthropods/Explore-the-Collection/Insect-Collection/Diptera/Diptera-Families-of-Florida/A-Checklist-of-the-Drosophilidae-of-Florida. Accessed 17 April 2020.

Durkin, E.S., H. Proctor, and L.T. Luong. 2019. Life history of *Macrocheles muscaedomesticae* (Parasitiformes: Macrochelidae): new insights on life history and evidence of facultative parasitism on Drosophila. Experimental & Applied Acarology 79: 309-321.

Epsky, N.D., M.A. Gill, D.H. Cha, and P.J. Landolt. 2014. Trapping the African fig fly (Diptera: Drosophilidae) with combinations of vinegar and wine. Florida Entomologist 97: 85-89.

Etges, W.J., M.A. Armella, P.M. O'Grady, and W. B. Heed. 2001. Two new species of *Drosophila* (Diptera: Drrosophilidae) in the *repleta* group from Mexico. Annals of the Entomological Society of America 94: 16-20.

Halliday, R.B. 1990. Mites of the *Macrocheles muscaedomesticae* group in Australia (Acarina: Macrochelidae). Invertebrate Taxonomy 3: 407-430.

Hottel, B.A., J.L. Spencer, and S.T. Ratcliffe. 2015. Trapping *Drosophila repleta* (Diptera: Drosophilidae) using color and volatiles. Florida Entomologist 98: 272-275.

Hribar, L.J. and M. Boehmler. 2019. A Florida Keys record for the African Fig Fly, *Zaprionus indianus* Gupta (Drosophilidae). Fly Times, 63: 32.

Hwang, C. and B.D. Turner. 2005. Spatial and temporal variability of necrophagous Diptera from urban to rural areas. Medical and Veterinary Entomology 19: 379-391.

Knab, F. 1912. *Drosophila repleta* Wollaston. Psyche 19: 106-108.

Kremmer, L., J. David, N. Borowiec, M. Thaon, N. Ris, M. Poirie, and J.L. Gatti. 2017. The African fig fly *Zaprionus indianus*: A new invasive pest in France? Bulletin of Insectology 70: 57-62.

Markow, T.A. and P.M. O'Grady. 2006. *Drosophila*: A guide to species identification and use. Academic Press. London. UK. 258 pp.

Miller, M.E., S.A. Marshall, and D.A. Grimaldi. 2017. A review of the species of *Drosophila* (Diptera: Drosophilidae) and genera of Drosophilidae of northeastern North America. Canadian Journal of Arthropod Identification 31: 1-282.

O'Grady, P.M. and R. DeSalle. 2018. Phylogeny of the genus *Drosophila*. Genetics 209: 1-25.

Perez-Leanos, A., M.R. Loustalot-Laclette, N. Nazario-Yepiz, and T.A. Markow. 2017. Ectoparasitic mites and their *Drosophila* hosts. Fly 11: 10-18.

Robinson, J. (ed.). 2015. The Oxford Companion to Wine. Fourth Edition. Oxford University Press. Oxford. UK. 859 pp.

Rodrigueiro, T.S.C. and A. P. do Prado. 2004. *Macrocheles muscaedomesticae* (Acari, Macrochelidae) and a species of *Uroseius* (Acari, Polyaspididae) phoretic on *Musca domestica* (Diptera, Muscidae): effects on dispersal and colonization of poultry manure. Iheringia, Série Zoologia 94: 181-185.

Sturtevant, A.H. 1921. The North American species of *Drosophila*. Carnegie Institute of Washington. Publication 310. 150 pp. + 1 plate.

Williams, D.F. and A.J. Rogers. 1976. Stable flies infested with the mite *Macrocheles muscaedomesticae*. Florida Entomologist 59: 328.

Xia, E.-Q., G.-F.-Deng, Y.-J.-Guo, and H.-B. Li. 2010. Biological activities of polyphenols from grapes. International Journal of Molecular Sciences 11: 622-646.

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Mènage á Trois in crane flies, revisited

Leila Hashemi[1] & Arthur Forer[2]

[1] Biology Department, Bucknell University, Lewisburg, Pennsylvania 17837, USA

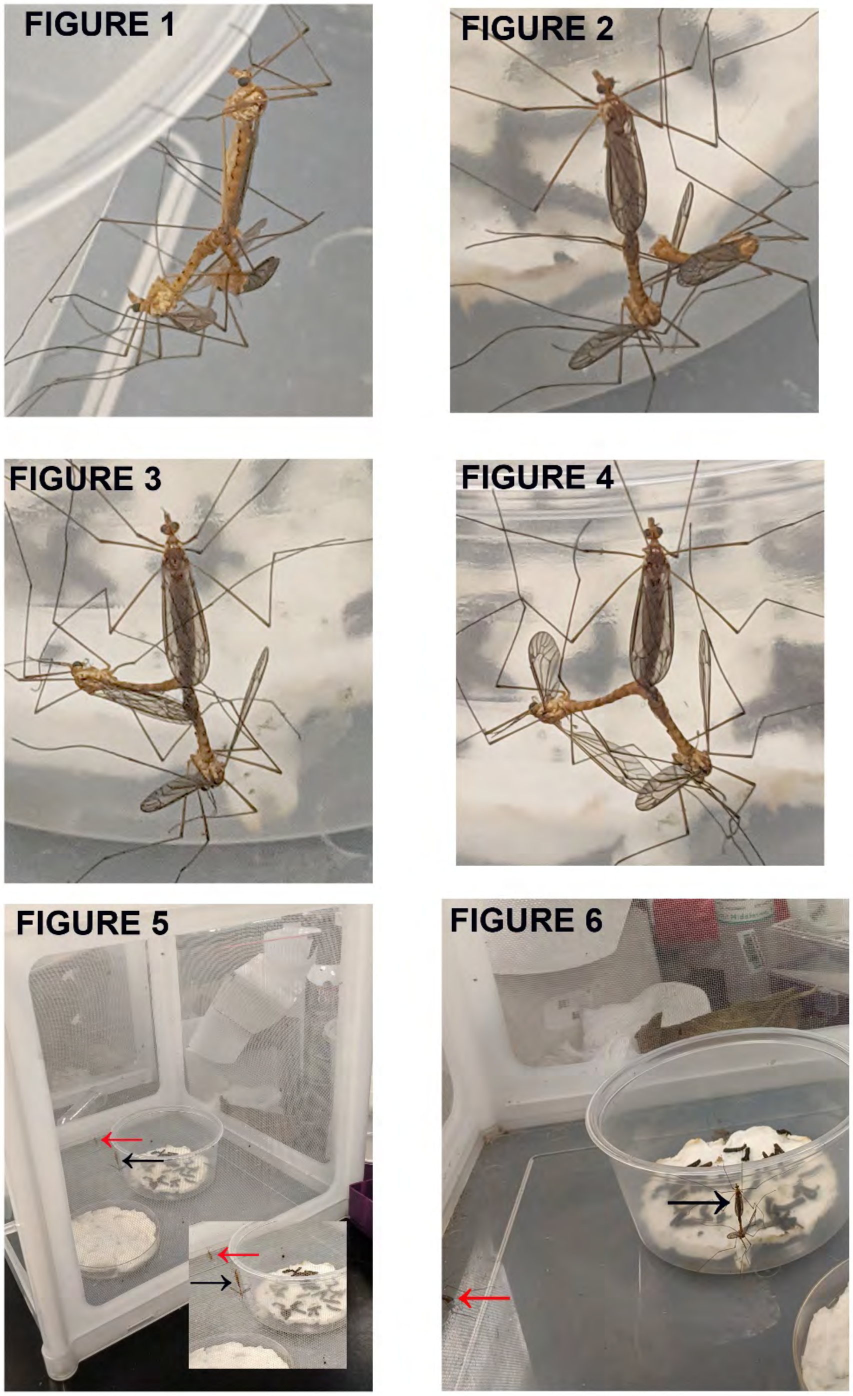
[2] Prof Emeritus, Biology Department, York University, 4700 Keele Street, Toronto, Ontario, M3J 1P3, Canada; aforer@yorku.ca

In a previous issue of *Fly Times* (issue 63, 2019) AF described mènage á trois in a laboratory culture of crane flies (*Nephrotoma suturalis* Loew), two males mating with the same female. He had not seen this previously in more than 50 years of raising the same colony of flies. When seen in that one instance, the flies were being housed in repurposed plastic boxes originally meant to hold pipette tips. Having not previously seen two males mating a single female, AF presumed that the mating trio, the mènage á trois, occurred because the matings started at the same time, i.e., that the two males approached the female simultaneously, and that the crowded conditions facilitated the two males arriving at a newly-emerged female at the same time. Recent observations by LH showed that AF was wrong on both counts: in a large insect cage in which there were only three adults, two males and one female, LH saw a male crane fly butting in on an already mating pair to form a group of three that mated as a trio for more than 90 minutes.

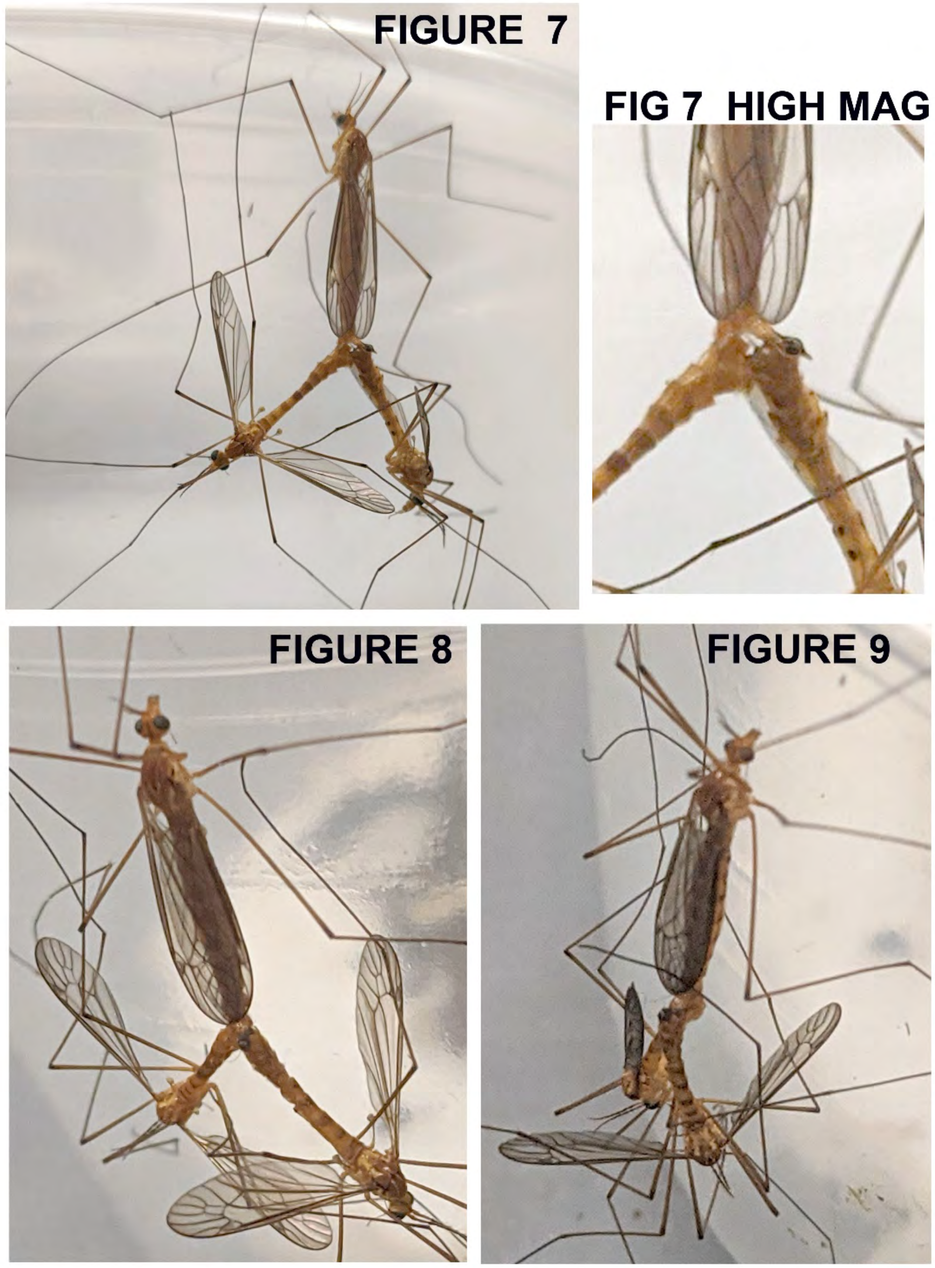
In the laboratory in Pennsylvania there were only three adults in the large, usual-sized cage: two males and one female, not at all crowded. When first looked at, there was one conventionally mating pair; the one other male in the cage was off to the side. Soon thereafter LH noticed that the two males were both attached to the female and copulating with her. Hence, the second male must have butted in on the first and was able to attach to the female without replacing the original partner. A picture was taken immediately (Fig. 1). When LH started to get set up for better imaging, about 20 minutes later, the 'new' male, the interloper, detached from the trio (Fig. 2). The male returned to the pair, again, about 15 minutes later (Fig. 3) and was successfully able to butt in, again, and to resume mating with the female while the first male remained attached as well (Fig. 4). About an hour later one male left the trio, and the female continued to mate with the other male in the conventional manner: we do not know whether the female remained paired with the original male or with the interloper (Figs 5,6). These observations show that the suggestions in the initial descriptions by AF were wrong: it is *not* necessary that both males arrive at the female at the same time, and crowdedness has nothing to do with attaining mènage á trois. The latter conclusion is consistent with inferences from other images of two males mating with single females under apparently sparsely populated conditions, such as this one.

In the mènage á trois reported here the physical connections attained by the two males are not weak and evanescent: both males made copulating movements, the attachments lasted for more than 90 minutes, and the attachments to the female were strong enough to survive various rapid shakes and movements. These points are demonstrated in a video taken by LH and posted on YouTube at https://youtu.be/j7gcU4C2KQc. We did not see the trio flying around as do two conventionally paired flies; it is yet to be seen if they can.

How are matings of two males to one female achieved? Images of this trio illustrate that two males are able to be attached at the same time because each is attached to a separate part of the opened-up ovipositor: one male attached to the lower (ventral) portion of the ovipositor and the other to the upper (dorsal), even bending it upwards, almost perpendicular to the back of the female (Figs 7-9).



Figs 1–6. 1: First sighting of the trio (1357 h), female on top, interloper male to the female's right. 2: Interloper male has broken away from female (1423 h). 3: Interloper just starting to butt in (1431 h). 4: Success (1441). 5: *overview* shows the cage with barely visible single pair mating hanging on the dish (black arrow) and the lone male skulking in the corner (red arrow); inset is at higher magnification. (1521 h). 6: same setting, but at an angle perpendicular to Figure 5, and without obstruction by the netting. (15:22 h).



Figs 7–9. 7: Overview and higher magnification of the trio, illustrating how each male is associated with one of the two parts of the ovipositor. The top ovipositor portion is more-or-less perpendicular to the female. 8 & 9: The ménage á trois shown at different angles, illustrating how the two males are associated with the two parts of the ovipositor and that the upper portion extends dorsally from the female. In Fig. 9, the front-most male clearly is seen to be associated with the top ovipositor piece.

Note: AF will retire in a few years and will be happy to send *Nephrotoma suturalis* from my stock to anyone who wants to study them.

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Continuing investigations on the Mycetophilidae of north-central Nevada, Spring 2020

Robin Gray

Seven Valleys LLC, Winnemucca, Nevada, USA; sevenvalleysent@gmail.com

I am continuing my investigations of mycetophilids that occur in northern Nevada. During the fall there were rains here that brought mushrooms – these were collected and put in rearing chambers, but no mycetophilids emerged. During the winter I worked on identification of the specimens I had collected during 2019. Many were species and genera I was familiar with, some were species of *Rymosia* and *Docosia* I had not seen before. But there were a few that would not key out to anything in the Manual of Nearctic Diptera mycetophilid chapter. What genera and species these specimens are remains unknown. And I still have unidentified specimens from 2019, and now from spring 2020, which I will get to as time permits.

During the winter of 2019-20 I began to seriously examine moss in the desert as a possible habitat for the development of mycetophilids. I began looking at these mosses as I caught a *Mycetophila* species in an emergence trap I put over a patch of moss in my yard, which is sometimes wet, and sometimes dry. There are places in the desert where moss is quite abundant, maybe, in some cases, from greater soil moisture in these spots. There are several species of moss in these areas. The one I chose to work with, probably a species of *Tortula* (Figure 1) often lives in the shelter of sagebrush or other woody plants, but sometimes more out in the open. When there is moisture this moss is green and looks alive, when things are dry, it is brown and brittle and looks dead, but it will quickly revive if it gets a little water. During the winter I collected some of this moss. I put some of it in rearing chambers (Figure 2), watering it with a spray bottle occasionally - to this day nothing has emerged from this moss, though it is still alive. I also dissected some of this moss under a dissecting scope, and saw no arthropods in it at all. But when I put clumps of this moss in a Berlese funnel I collected many arthropods - the fauna was dominated by podurid springtails, there were a few mites and a few insect larvae, none of which were mycetophilids. At the beginning of March I put an emergence trap over a patch of *Tortula* moss in the desert (Figure 3) and began collecting what emerged weekly. Up to the end of April I collected occasional ichneumonid wasps and various beetles, especially staphylinids. There was a big emergence of Sciaridae over a couple of weeks, but so far no mycetophylids. I plan on keeping the trap there the rest of the spring. I also plan to look at moss in wetter habitats in the mountains and along streams.

Since starting this project in 2017 I have collected three genera of mycetophilids, including several species of the genera *Rymosia*, *Docosia* and *Megalopelma*, emerging from abandoned animal burrows. This spring I have been trying to dig up abandoned ground squirrel nests, the sorts mycetophilid adults have emerged from. I hoped to find nesting material that I could examine in various ways to see if these mycetophilids were breeding in these tunnels. But I have had no real success so far in my efforts to excavate these burrows – they have many branches and dead ends, and I find that I just lose the tunnels at some point. I have yet to find any nesting material in them. It must be there, because at one point these were inhabited by ground squirrels. So I think I have to try some new ideas to keep track of the tunnels I am digging up. I recently found nesting material of some sort on the surface of the ground (Figure 4), consisting of dry grass woven tightly together. It didn't look very promising, but I put it in a rearing chamber for observation.

This has been a dry winter and a dry spring here in northern Nevada, and I have thus far seen almost no mushrooms. But last year when there were a great variety of mushrooms, I was able to rear

Figure 1. Moss, *Tortula* sp.

Figure 2. *Tortula* sp. in rearing chamber.

Figure 3. Emergence trap over moss

mycetophilids out of only two species of fungi, and what came out of them was one species of *Rymosia*. This is very puzzling to me - where are all the other mycetophilids? And for this particular *Rymosia*, where is it when the mushrooms are not out - they are out from the end of March to the beginning of May, even in good years. This year I have not seen even one. I have never captured one of these *Rymosia* in a Malaise trap, even when it is set up in an area with the *Tricoloma* mushrooms. Can they, and other mycetophilids, find and live on mycelia in the soil? I have been told by a person working on mosquito abatement in Minnesota that they catch large numbers of mycetophilids in gravid traps. That seems to indicate that odor plays a role in the lives of these insects. This also seems consistent with the fact that I collect them in dry ice baited EVS traps. So this spring my intent has been to try to dig up the mycelium connected with the mushroom and see if any larvae are there, if I can rear any adults out. So far this spring I have seen only one patch of mushrooms - they were

Figure 4. Nesting material found on the ground.

Figure 5. Rotten poplar wood containing mycelium in rearing chamber.

growing out of a buried poplar stump - I forced pieces of wood off of this stump and put it in a rearing chamber (Figure 5). I have tried rearing mycetophilids out of this particular species of mushroom with no success - they melt down overnight into a black soup.

In the early spring of 2019 I found *Boletina* adults in leaf litter in one location. I set up a malaise trap in that spot and kept it there, now for over a year. I wanted to see when this particular species was active as an adult, to give me an idea of how many generations there were in a year. They faded away in mid April, and I saw no more of them until late January when large numbers of them began to emerge. This was still very much winter, night time temperatures went as low as 12 degrees Fahrenheit. I saw adults mating at this time. I gathered a bucket of the leaf litter and went through it by hand – I found half a dozen pupae – they were nearly black, naked with no cocoon, and looked like a piece of debris, easy to miss. Two of these were alive, I put them in a rearing chamber and a day later a male *Boletina* emerged. It lived a couple of days, then died. Is this the natural lifespan? There are no flowers out in the winter when these flies came out – do they take nourishment, if so what? In March I caught one adult male in my mosquito dipper when I was sampling for mosquito larvae in a marsh. I took an insect net and swept it over this marsh and a couple of similar ones, but caught nothing. What this adult was doing there I don't know. I also found larvae in the leaf litter at the same time as the pupae. They could have been this species of *Boletina*, but I was not able to key them out because they had no visible spiracles, a feature that is part of the key in the Manual of Nearctic Diptera. During most of the year these flies are not out, and they are not in leaf litter. It seems possible they are down in the soil somewhere and if I sift through it I might find the larvae. So that is also in my plans for this spring. The last adults of this species were seen during the first week of April.

So my plans for the spring are to keep trapping the adults, putting traps up in new locations and habitats to see what I can find. If I can find mycelia in any place I will look at it. I will keep looking at moss in different habitats. I will keep trying to dig up animal burrows. I am going to sift through soil in pursuit of *Boletina* immatures. I am also going to look at abandoned bird nests - in some ways they might not be so different than nests in abandoned ground squirrel burrows. My plan to visit a university library to find mycetophilid literature that I could copy did not happen because of personal life getting in the way. So that is still to come. And it would be good to talk with someone who has worked with these insects if they would be willing to talk to me. The more I study these little flies the stranger, the more secretive and more mysterious they seem to me, and the more questions that come up in my mind about them.

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Differential collections of *Drosophila* flies in traps baited with two different styles of beer

Lawrence J. Hribar

Florida Keys Mosquito Control District, 503 107th Street, Marathon, Florida 33050, USA

Drosophilidae are known to be pests in breweries, and some species even use discarded beer bottles as oviposition sites (Oguma et al. 1992). Some drosophilid species can be collected with beer-baited traps (Calabria et al. 2012, Máca et al. 2015, Dvořák et al. 2017, Oboňa et al. 2017, Renkema et al. 2018). After a week spent collecting drosophilid flies in my backyard I decided to see what I could collect using beer as bait, in the same traps modified from Hwang and Turner (2005) (Figure 1).

Traps were baited with two styles of beer produced by the same brewery. One beer was an American Adjunct Lager (AAL) (4.45% alcohol by volume) and the other was a Vienna Lager (VL) (4.7% alcohol by volume). Adjunct lagers contain grains other than barley, such as rice or maize (Bamforth 2003). Traps were baited with beer, hung in the backyard in the late afternoon, and retrieved the following morning from the 25th to the 29th of April 2020. Baits were rotated between trap locations to avoid bias due to trap site.

Figures 1–2. 1. Beer-baited soft drink bottle trap modified from Hwang and Turner (2005). 2. *Drosophila suzukii* collected in the trap.

Results of the collections are presented in Table 1. Over four times (4.43X) as many flies were collected in traps baited with Vienna lager-style beer (248) than in traps baited with American adjunct lager-style beer (56). Most of the flies collected appeared to be a species in the *Drosophila repleta* group, and some of these flies had attached *Macrocheles* mites. More African fig flies, *Zaprionus indianus*, were collected, most of them in the Vienna Lager-baited traps. Most interestingly, one male *Drosophila suzukii* Matsumura (Figure 2) was collected in a trap baited with the Vienna lager-style beer; this appears to be a new county record (Monroe County, Florida) for this species.

The next question appears to be, “which is the better bait, red wine or Vienna lager-style beer?” Trapping is already underway.

Table 1. Daily Trap Catch of Diptera in Soft Drink Bottle Traps Provided with Different Beer Baits.

Date	Bait	Species			
		Z. indianus	*D. repleta* gr.	Other *Drosophila*	Row Total
25 April 2020	AAL	0	1	1	2
	VL	1	5	7	13
26 April 2020	AAL	0	0	5	5
	VL	0	16	5	21
27 April 2020	AAL	0	0	13	13
	VL	0	0	0	0
28 April 2020	AAL	0	1	8	9
	VL	1	1	1	3
29 April 2020	AAL	3	4	20	27
	VL	4	187	120	211
Column Total		9	215	80	304

References

Bamforth, C. 2003. Beer: Tap into the Art and Science of Brewing, Second Edition. Oxford University Press. Oxford, UK.

Calabria, G., J. Máca, G. Bächli, L. Serra, and M. Pascual. 2012. First records of the potential pest species *Drosophila suzukii* (Diptera: Drosophilidae) in Europe. Journal of Applied Entomology 126: 139-147.

Dvořák, L., J.-P. Haenni, J. Máca, R. Mariychuk, and J. Oboňa. 2017. Some insects (Dermaptera, Diptera, Mecoptera) from beer traps in Uzhhorod City (Ukraine). Acta Universitatis Prešoviensis, Folia Oecologica 9(2): 11-17.

Hwang, C. and B.D. Turner. 2005. Spatial and temporal variability of necrophagous Diptera from urban to rural areas. Medical and Veterinary Entomology 19: 379-391.

Máca, J. 2015. New and interesting records of Drosophilidae (Diptera) from the Czech Republic and Slovakia. Acta Musei Silesiae, Scientiae Naturales 64: 101-106.

Oboňa, J., L. Demková, M. Kohútová, J. Máca, and P. Manko. 2017. On the occurrence of *Drosophila suzukii* (Matsumura, 1931) in Slovakia. Acta Universitatis Prešoviensis, Folia Oecologica 9(2): 5-10.

Oguma, Y., T. Nemoto, and Y. Kuwahara. 1992. A sex pheromone study of a fruit fly *Drosophila virilis* Sturtevant (Diptera: Drosophilidae): additive effect of cuticular alkadienes to the major sex pheromone. Applied Entomology and Zoology 27: 499-505.

Renkema, J.M., L.E. Iglesias, P. Bonneau, and O.E. Liburd. 2018. Trapping system comparisons for and factors affecting populations of *Drosophila suzukii* and *Zaprionus indianus* in winter-grown strawberry. Pest Management Science 74: 2076-2088.

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The unresolved question of whether red wine or Vienna lager-style beer is the better bait for *Drosophila repleta* group flies

Lawrence J. Hribar

Florida Keys Mosquito Control District, 503 107th Street, Marathon, Florida 33050, USA

After determining that red wine and Vienna lager-style beer were both suitable baits for *Drosophila repleta* group flies, I wanted to determine which was the better bait. Traps modified from Hwang and Turner (2005) were baited with Vienna lager beer or Merlot wine. Traps were hung near the backyard composter in the late afternoon, and retrieved the following morning from the 3rd to the 8th of May 2020. Baits were rotated between trap locations to avoid bias due to trap site.

Results of the collections are presented in Table 1. Results from the beer-baited trap on May 6 are omitted because during the night that trap became disassembled and most of the catch was lost. On three occasions more *D. repleta* group flies were collected in the trap baited with wine. On the last day over ten times (10.2) as many *D. repleta* group flies were collected in the beer-baited trap. The first day's collections were too small to worry about and numbers of *D. repleta* group flies were essentially equal. The 6th was a bust. Leaving the last day's catches out and retotaling numbers of *D. repleta* group flies only reveals that almost 12 times (11.9) as many *D. repleta* group flies were collected in wine-baited traps than in beer-baited traps. If it hadn't been for the last day I'd say red wine was the better bait but right now I'm not 100% sure about that.

Table 1. Daily Trap Catch of Drosophilidae in Soft Drink Bottle Traps Baited with Beer or Wine.

Date	Bait	Species			
		Z. indianus	*D. repleta* gr.	Other *Drosophila*	Row Total
3 May 2020	Beer	0	3	0	3
	Wine	0	2	7	9
4 May 2020	Beer	0	1	0	1
	Wine	0	86	3	89
5 May 2020	Beer	1	10	10	21
	Wine	4	24	3	31
6 May 2020	Beer	-	-	-	-
	Wine	1	24	5	30
7 May 2020	Beer	0	35	27	62
	Wine	3	387	24	414
8 May 2020	Beer	3	867	34	904
	Wine	0	85	3	88
Column Total		12	1524	116	1652

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Oviposition behaviour of a native New Zealand *Pollenia* (Polleniidae)

Stephen Marshall

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

The cluster fly genus *Pollenia* has over 30 endemic species in New Zealand, but all are rarely encountered and almost nothing is known of their biology. Therefore, when I visited New Zealand in late 2019 I was pleased to not only get some first photographs of a native *Pollenia* species in the field, but also to obtain some first observations of oviposition behaviour in the genus.

On November 22, 2019 I spotted several *Pollenia* females landing in sunspots along a track in the Ruahine Forest Park near Rangiwahia, New Zealand (39°53'33"S176° 0'41"E, ca. 1000m). After an hour or so of watching I managed to keep a lens on one female throughout her entire short period of oviposition. The resulting series of photos showed the female exploring loose soil surface mixed with leaf fragments and other organic debris before repeatedly extending her telescoping ovipositor and then working her whole abdominal tip into the surface material. Some selected photos from that series are compiled here, in the order in which they were taken, to show the female searching the substrate (1), extending her ovipositor (2), working her abdomen into the substrate (3-6).

Thanks to Thomas Pape and Silvia Gisondi for commenting on the photos, and to Silvia for confirming that the photos are of a New Zealand endemic *Pollenia*, unidentifiable to species based on photos alone. It was not possible to take voucher specimens in the Park at that time.

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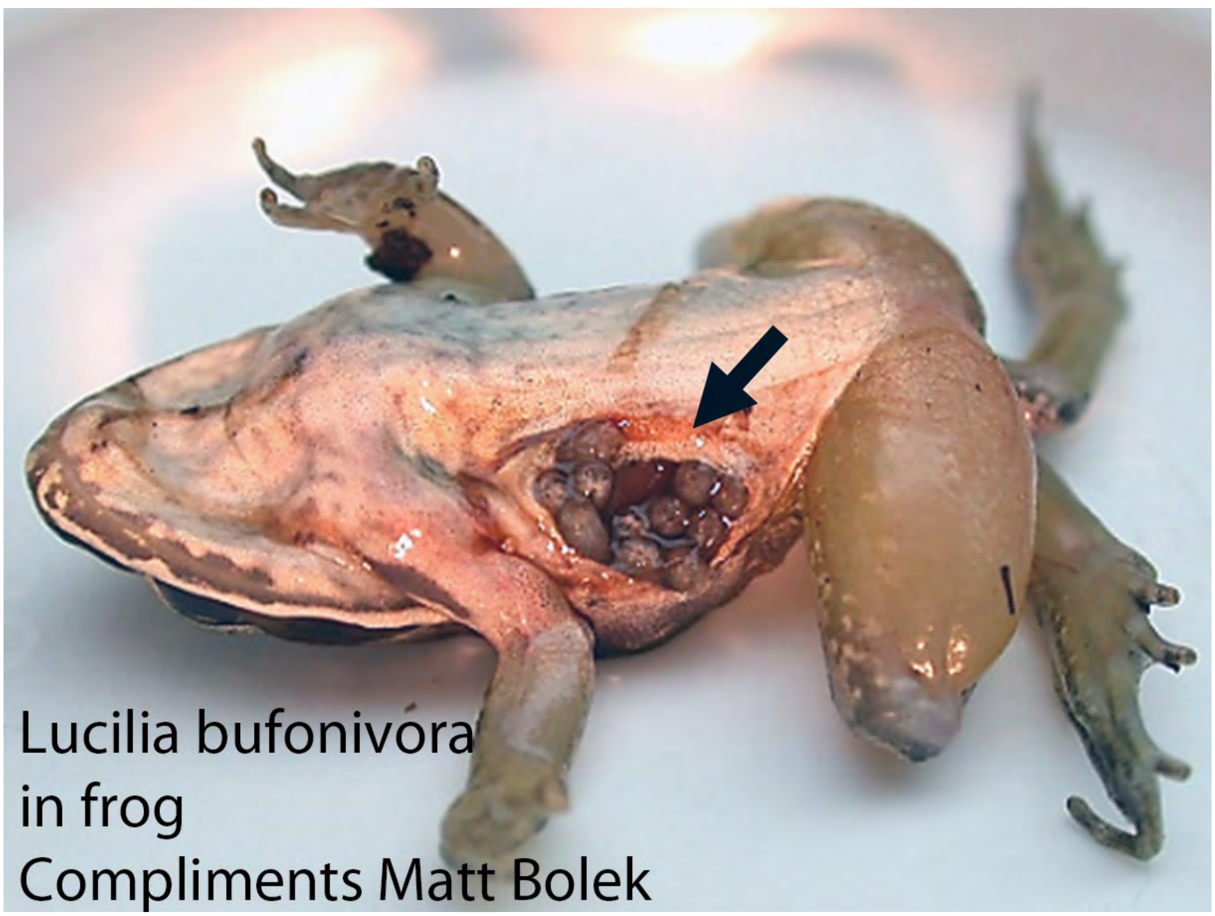
Looking for blow fly parasites causing myiasis in frogs and toads

Terry Whitworth

Department of Entomology, Washington State University, Pullman, Washington 99164, USA;
(adjunct) blowfly@twhitworth.com, twhitworth@wsu.edu, www.blowflies.net

A few years ago we discovered that *Lucilia bufonivora* Moniez (Calliphoridae) is established in North America (Tantawi & Whitworth 2014). Until then, it was thought to be Palearctic only. We now suspect all anuran myiasis attributed to *L. silvarum* (Meigen) in North America is actually this species. However, the very rare *L. elongata* Shannon (a North American species) may have similar habits as it is closely related to *L. bufonivora* based on molecular analysis (Arias-Robledo, et al. 2019). We also are interested in learning about the life history of *L. thatuna* Shannon which is found in wetland areas in the west, but its habits are unknown. We have a paper coming out shortly on this subject (Whitworth, Bolek & Arias-Robledo, in Press), but would like to examine more larvae or adults that were taken from anuran myiasis collected in North America. *Lucilia bufonivora* is very similar to *L. silvarum* and some specimens collected in the northern US and Canada may be misidentified. For anyone with specimens in the *silvarum*, *elongata*, *bufonivora* group I would be happy to identify species they have. Please contact the author, noting that shipping specimens may be to a different address.



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Checklist of world Tachinidae (Diptera): an online resource

James E. O'Hara, Shannon J. Henderson & D. Monty Wood

Canadian National Collection of Insects, Agriculture and Agri-Food Canada,
960 Carling Avenue, Ottawa, Ontario, K1A 0C6, Canada;
james.ohara@canada.ca, shannon.henderson@canada.ca

We would like to tell you about a resource on the Tachinidae that is easy to miss because it is only available online on the Tachinidae Resources website (Fig. 1):

O'Hara, J.E., Henderson, S.J. & Wood, D.M. 2020a. Preliminary checklist of the Tachinidae (Diptera) of the world. Version 2.1. PDF document, 1039 pp. Available at: http://www.nadsdiptera.org/Tach/WorldTachs/Checklist/Tachchlist_ver2.1.pdf

The checklist is a product of a project that began in 2007 as a FileMaker Pro database of world Tachinidae. We have been slowly populating this database with tachinid names, type information and distributions ever since. The unabridged history of the project and the intricacies of the database were given in O'Hara *et al.* (2019) along with an introduction to the contents of version 1 of the *Preliminary Checklist*. Version 1.0 (released 7 March 2019) contained a complete list of the valid names of the subfamilies, tribes, genera and species of world Tachinidae and the known distributions of the species. Version 2.1 (released 5 March 2020 [replacing a short-lived version 2.0 that contained an error we could not live with]) was expanded to include generic synonyms, date and page numbers for generic and specific names, references, and taxonomic updates. The next version of the checklist will contain all synonyms for valid species names and we will drop "preliminary" from the title.

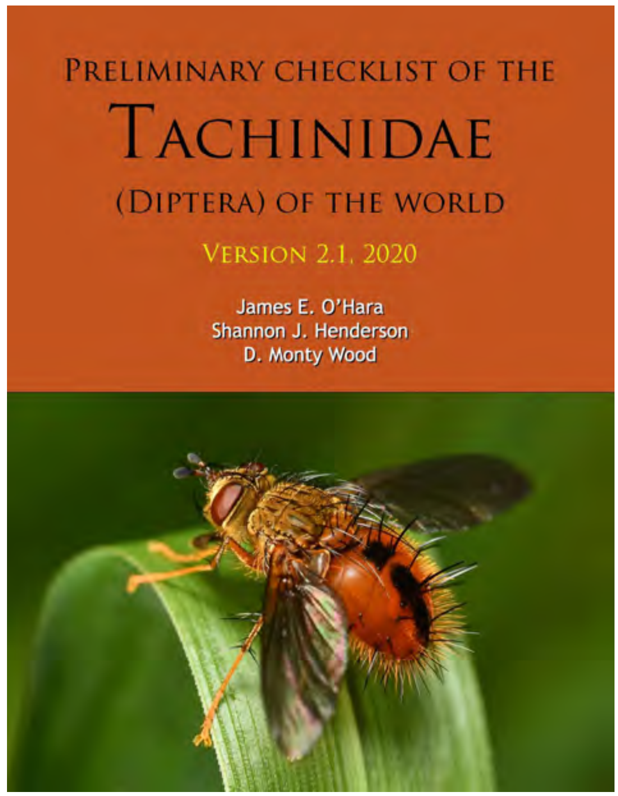

Figure 1. Cover of version 2.1 of the Preliminary Checklist of the Tachinidae, released in March 2020.

Our cataloguing and checklist efforts were borne out of a need to pull together the names, type data, distributions and references pertaining to the Tachinidae so we would be better positioned to look at the classification of the family from a world perspective. The Tachinidae pose a particular problem in this respect because there are a lot of names "out there" and the family is at the top of the list of Diptera families when it comes to names:

Family-group names: 429 (from Sabrosky 1999, "far in the lead"; the next highest family has 123)
Genus-group available names: ca. 3520 (unpub. database data)
Current number of recognized genera: 1477 (O'Hara & Henderson 2020)
Species-group available names: ca. 12,060 (unpub. database data)
Current number of recognized species: 8592 (O'Hara & Henderson 2020, O'Hara *et al.* 2020a)

The Tachinidae are no slouch either when it comes to literature. We do not have a complete accounting of all the taxonomic works containing information on tachinid names and distributions but our EndNote library of tachinid literature currently stands at over 7100 entries (this including papers on hosts and other non-taxonomic topics since 1980).

The references in the *Preliminary Checklist* total a little over 3000. A casual perusal of them, and of the citations to them appearing in the checklist, will reveal something out of the ordinary: we do not use the usual suffixes of a, b, c, etc. to distinguish papers published in the same year by the same author. That system vexed us for years. It is great for a final publication where the order of publication dates can be matched by suffices progressing from *a* to *z* through the Roman alphabet, but it is awful for a high number of references undergoing perpetual change, or when subsets of references are desired. The admirable work of Neal Evenhuis has shown us that accurate publication dating is both the cornerstone of nomenclatural priority and a work in progress. In Tachinidae, for example, we need to know the order of publication of the 1830 works of Meigen, Robineau-Desvoidy and Wiedemann, the dates of publication of Brauer & Bergenstamm's four parts of *Vorarbeiten zu einer Monographie der Muscaria schizometopa (exclusive Anthomyidae)* in the late 1800s (and which came first, the periodical or separate of each; see Evenhuis 2014 for revised dating), and the order of the 18 taxonomic papers on Tachinidae published by Townsend in 1915 (and thanks again to Neal for sorting this out; Evenhuis *et al.* 2015). We have relegated Roman alphabet suffices to the dustbin for now and use the Greek alphabet for date suffixes in our *Preliminary Checklist*:

> "This was chosen because the characters are easy to recognize, they are cross-platform compatible (FileMaker Pro, EndNote, MS Word, Adobe Acrobat, etc.), and they are not apt to appear in our products except as a suffix to a date. We treat the order of these as "unordered" when associated with a date; *no offense to the classically trained intended!*" (O'Hara *et al.* 2020b: 3).

Of possible interest to some *Fly Times* readers is the introductory section of the *Preliminary Checklist* in which the geographic divisions of the world, as used for our species distributions, are listed and then shown in a series of nine maps. We were constrained by previous catalogues and a lack of knowledge about the distribution of tachinids in Mexico into accepting the border between the United States and Mexico as our boundary between the Nearctic and Neotropical regions. We had more data on the distribution of tachinids in China and proposed a division between Palaearctic and Oriental China that best reflects our perception of this transition zone. We followed *The Times Comprehensive Atlas of the World* (Times Books 2007) for the spelling of the names of countries and other divisions, if given therein. (If you do not like to see Java spelled as Jawa, Perú spelled as Peru, or Kamchatka Krai as Kamchatskiy Kray, then please complain to Time Books and not us!)

Our most immediate goals for the Tachinidae database include checking invalid species names (i.e., synonyms) to see if we are missing any, and adding information about name-bearing types. Species names and distributions are done and will continue to be updated on a regular basis thus allowing us to produce revised checklists at opportune times in the future. We can also assist other researchers who wish to know what species are known from a country or countries, or what literature is available by taxon or region.

Two graphs (Figs. 2, 3) are included here to show some statistics generated from our database that pertain to tachinid species and authors since the time of Linnaeus.

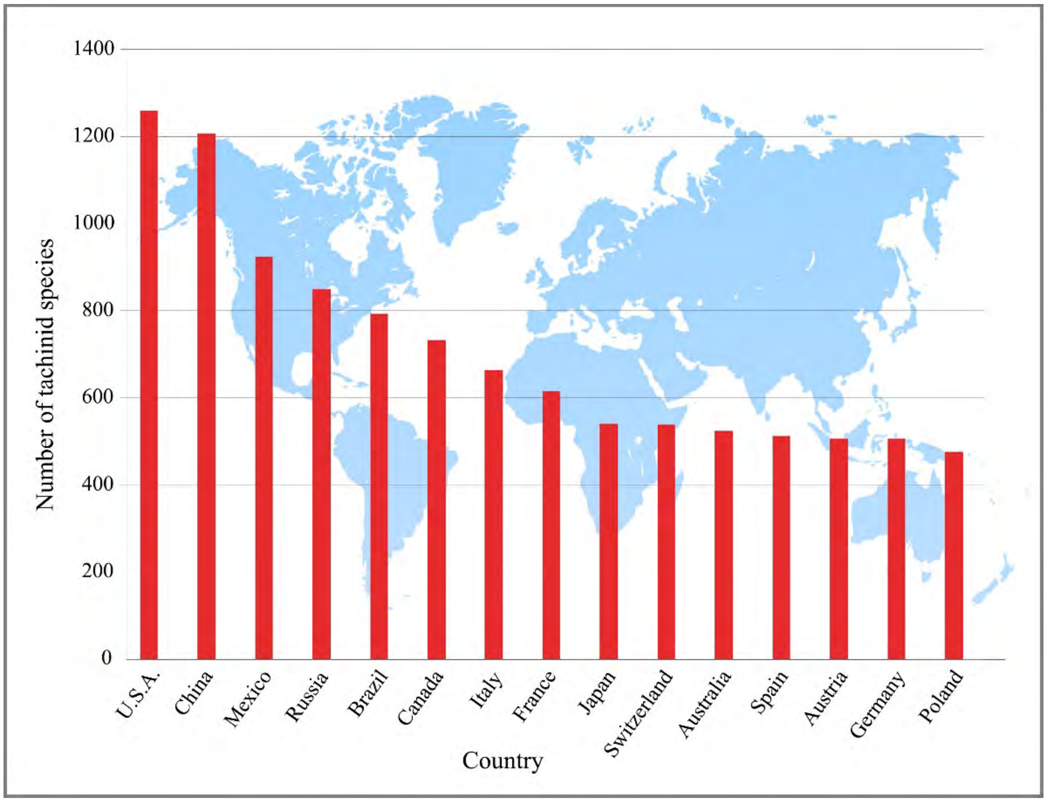

Figure 2. The 15 countries with the most currently valid names of tachinid species.

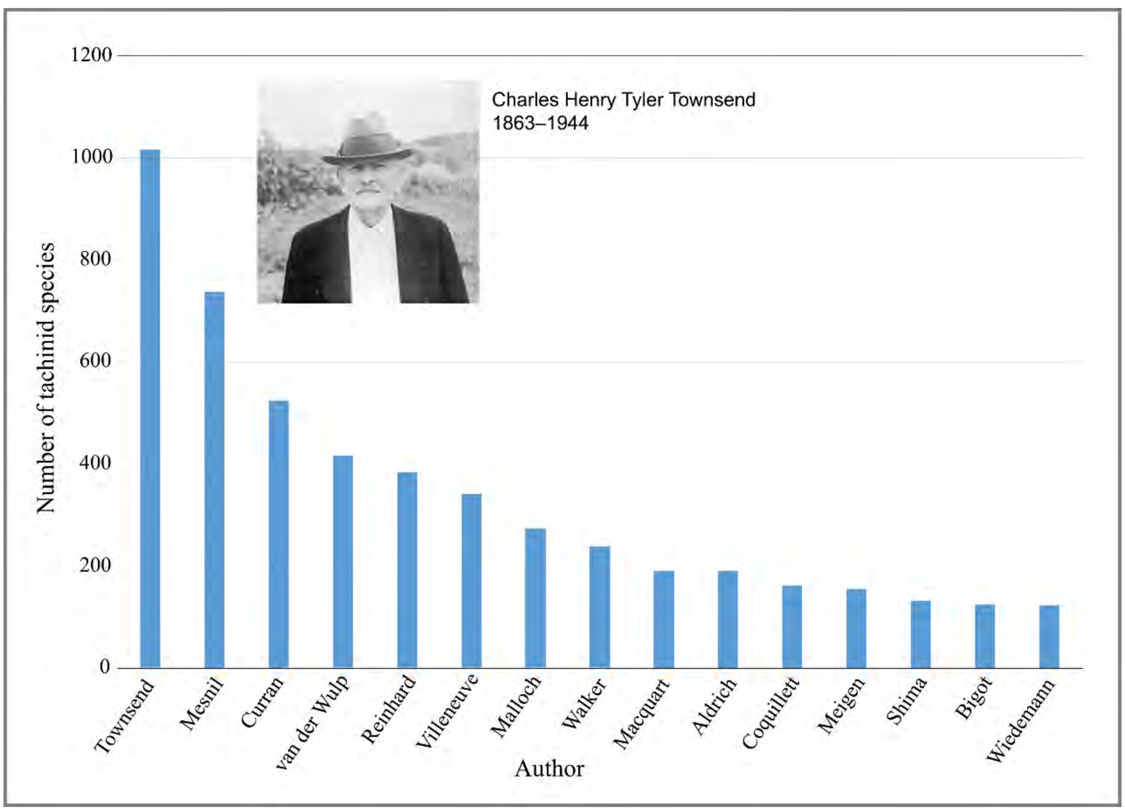

Figure 3. The 15 authors who have proposed the most currently valid names of tachinid

References

Evenhuis, N.L. 2014. Publication and dating of parts IV–VII of Brauer & Bergenstamm's *Die Zweiflügler des Kaiserlichen Museums zu Wien* (1889–1894). Zootaxa 3790: 495-499.

Evenhuis, N.L., Pont, A.C. & Whitmore, D. 2015. Nomenclatural studies toward a world list of Diptera genus-group names. Part IV: Charles Henry Tyler Townsend. Zootaxa 3978: 1-362.

O'Hara, J.E. & Henderson, S.J. 2020. World genera of the Tachinidae (Diptera) and their regional occurrence. Version 11.0. PDF document, 90 pp. Available from: http://www.nadsdiptera.org/Tach/WorldTachs/Genera/Gentach_ver11.pdf.

O'Hara, J.E., Henderson, S.J. & Wood, D.M. 2019. Introducing the ... *Preliminary checklist of the Tachinidae (Diptera) of the world*. The Tachinid Times 32: 20-36.

O'Hara, J.E., Henderson, S.J. & Wood, D.M. 2020a. Preliminary checklist of the Tachinidae (Diptera) of the world. Version 2.1. PDF document, 1039 pp. Available from: http://www.nadsdiptera.org/Tach/WorldTachs/Checklist/Tachchlist_ver2.1.pdf (accessed [insert date accessed]).

O'Hara, J.E., Henderson, S.J. & Wood, D.M. 2020b. Announcing Version 2 of the … *Preliminary checklist of the Tachinidae (Diptera) of the world*. The Tachinid Times 33: 41-44.

Sabrosky, C.W. 1999. Family-group names in Diptera. An annotated catalog. Myia 10: 1-360.

Times Books. 2007. The Times comprehensive atlas of the world. 12th edition. Times Books, London. 67 + [2] pp. + 125 pls. + 223 (Glossary and Index) + [1 (Acknowledgements)] pp.

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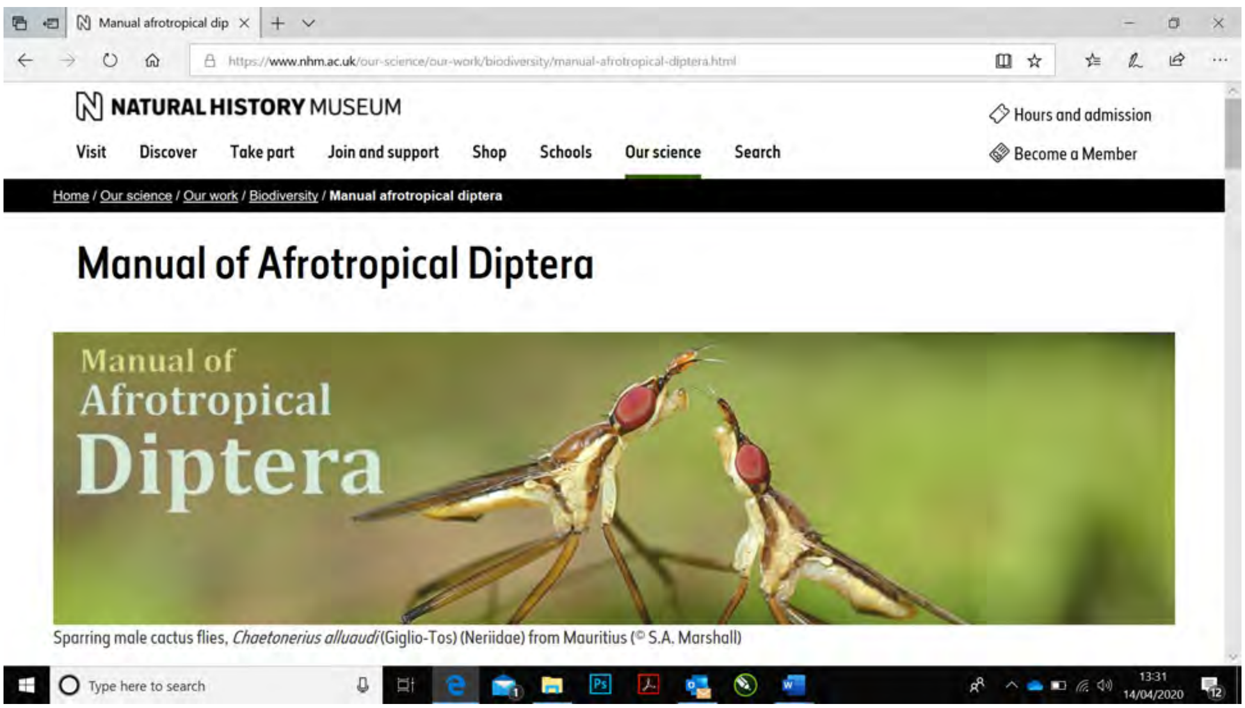
The *Manual of Afrotropical Diptera* has a new website!

Ashley H. Kirk-Spriggs

Department of Life Sciences, Natural History Museum,
Cromwell Road, London SW7 5BD, United Kingdom; a.kirk-spriggs@nhm.ac.uk

The *Manual of Afrotropical Diptera* project launched a new official website in March 2020, which is now being hosted by the Natural History Museum, London. The site was entirely re-designed to make information easily accessible and we now have a new web address:

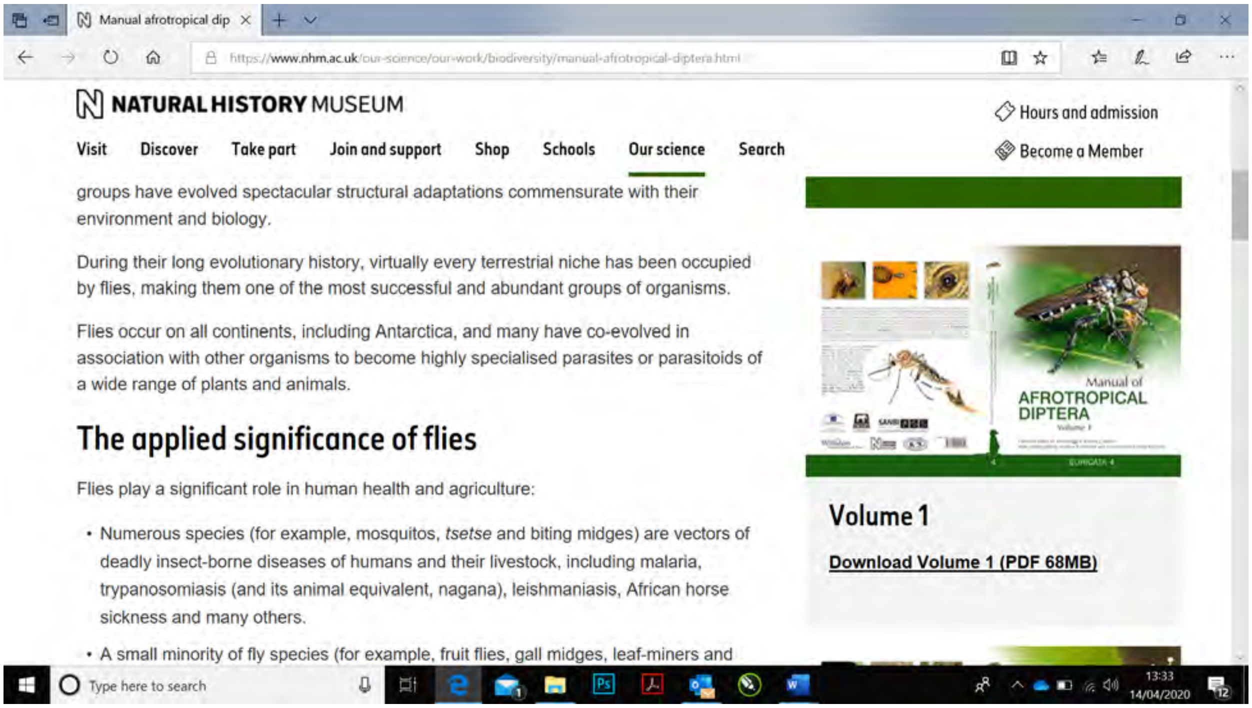
https://www.nhm.ac.uk/our-science/our-work/biodiversity/manual-afrotropical-diptera.html



The new site enables free downloads of the full versions of published volumes 1 and 2; provides information on how to order hard copies and the use of images; gives sponsor details; outlines the geographical scope of the project; and lists contributing authors for all four volumes. The site also includes the newly designed covers of volumes 3 and 4. Some information, such as Instructions for Authors, Collections and other content is now omitted, as tis is now either redundant, or is included in the published Introduction to volume 1.

The project is also pleased to announce two substantial sponsorships to cover production costs of volume 3 and 4: a Dr E.C. Zimmerman Bursary (administered by the Natural History Museum, London) and sponsorship from the African Biodiversity Trust. The project is still seeking additional sponsorship for production costs of volume 4.

It is not yet clear what effect the Covid-19 outbreak will have on the final publication date of volume 3, which is currently scheduled for late 2020, with volume 4 in 2021.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groups have evolved spectacular structural adaptations commensurate with their environment and biology.
During their long evolutionary history, virtually every terrestrial niche has been occupied by flies, making them one of the most successful and abundant groups of organisms.
Flies occur on all continents, including Antarctica, and many have co-evolved in association with other organisms to become highly specialised parasites or parasitoids of a wide range of plants and animals.
The applied significance of flies
Flies play a significant role in human health and agriculture:
• Numerous species (for example, mosquitos, tsetse and biting midges) are vectors of deadly insect-borne diseases of humans and their livestock, including malaria, trypanosomiasis (and its animal equivalent, nagana), leishmaniasis, African horse sickness and many others.
• A small minority of fly species (for example, fruit flies, gall midges, leaf-miners and
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Systema Dipterorum 2.6—The Phoenix edition

Neal L. Evenhuis[1] & Thomas Pape[2]

[1] J. Linsley Gressitt Center for Research in Entomology, Bernie Pauahi Bishop Museum, 1525 Bernice Street, Honolulu, Hawaii 96817-2704, USA; NealE@bishopmuseum.org

[2] Natural History Museum of Denmark, Zoological Museum, Universitetsparken 15, 2100 Copenhagen, Denmark; TPape@snm.ku.dk

In the last *Fly Times*, we announced that *Systema Dipterorum* (SD) was back online and doing well with additions, updates, improvements. But, as Murphy's Law would have it, the server hosting the SD website was affected by a museum-wide ransomware attack a few days after the *Fly Times* article came out (it turns out that at least three institutions in the U.S. were hit the same day). The attack knocked out the entire Bishop Museum's electronic operations (internet, web, email, servers, and even our desktop computers—anything that was connected via our LAN). We were offline for two months before email service was restored. The servers were toast, but much of the data on them was saved and is slowly being trickled out as our museum IT-unit checked and verified each file before allowing it to be put back online. The database behind the *Systema Dipterorum* website was totally unaffected as it is saved up on three separate computers and in the cloud. But we could not serve up the data to the public until we got a server back online.

That brings us to the second part of danged Murphy and his Law. We had to purchase new servers and, after a short while, found a generous donor, and we arranged for the purchase of new servers to replace the ones attacked by the ransomware. Then, the SARS-CoV-2 virus hit and the purchase grounded to a halt — because the servers were being made in China and China had shut down.

That brings us to May 2020, almost 6 months since the announcement in Fly Times that SD was back up and running. We finally have the servers and they have been reformatted to allow for the website and search strings to be coded onto them. After installing and checking and fixing a few inevitable bugs, *Systema Dipterorum* is finally back online.

And the good news is we now have the **diptera.org** domain back and it will be from now on the host for the database. Just go to **http://diptera.org** for all your *Systema Dipterorum* needs. Version 2.6 should be online as you read this.

Despite the downtime online, the database itself continues to be updated and edited by us, and with the help of a number of users who have pointed out duplicate entries, misspellings, etc. Additionally, an effort has recently been made to begin entering data from new articles and we have finally broken through the 200,000 nominal species entries number (200,288 as of 21 May). Other ongoing tasks include improving and expanding the references database. We are slowly making corrections to the original entries—many of the legacy entries were taken straight from the bibliographies of the regional catalogs, and as a result there were duplicate entries, and any errors in the published reference from those catalogs were entered without the vetting of titles. Many of these have been cleaned up (and are continually via checking the original literature), the journal titles are being spelled out in full, and dating (where we have accurate dates) is being added to the references where this was missing—or corrected with more accurate information on hand. We have more than 34,000 references databased and more are being added daily. Also, we have improved the database by linking more entries to the original publication. For example, when we took over the database in July

2018, there were 132,656 nominal species entries linked to the reference of the original description (= 66.7 % of the total nominal species entries linked). As of 21 May 2020 there are 147,732 nominal species entries linked (= 73.8%). We continue to add links to the references to make the database as complete as possible.

We sincerely thank you all for your patience. You have no idea how frustrating it has been for us. We have gotten numerous requests from colleagues and users around the world wondering if SD will be back online. A few months ago, we had no timeline, but now, that Phoenix has indeed arisen from the ashes and flying high. Also, when using SD, please use the “error” button if you find an error. We always fix those as fast as we can, and the plan still holds that we will deliver updates of SD every two months.

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New Website: Robber Flies of the World

Chris Cohen

Department of Biology, East Carolina University, Greenville, North Carolina 27158, USA; myelaphus@gmail.com

I am very pleased to announce the launch of my new website, titled "Robber Flies of the World." This website (https://www.robberfliesoftheworld.com) is dedicated to the taxonomy, identification, and natural history of these charismatic assassins, and takes heavy inspiration from Frank M. Hull's seminal work of the same name.

Robber Flies of the World currently has three main features:

- Taxon Pages: Browse through every accepted subfamily, tribe, genus, and species. Over time each taxon page will be updated with diagnostic photographs and information pertaining to its identification and natural history.
- Species Catalog: Search by subfamily, tribe, genus, zoogeographic region, country and state to generate a catalog of species that match those criteria. Only accepted taxa are included, with junior synonyms listed for the relevant taxa.
- Taxon Database: Search for a subfamily, tribe, genus, or species from a database of every known name used in Asilidae (over 12,000 records).

These all leverage a MySQL database to dynamically generate content. This server-side database will allow me to quickly and easily modify classifications or add taxa as new taxonomic and phylogenetic studies are published.

The next big feature to be added to the website is the literature database, which will be incorporated into the taxon pages, species catalog, and taxon database as well as have a dedicated query page. Other major planned features include a predator-prey database, dichotomous keys, and matrix-based keys.

Fritz Geller-Grimm has generously donated his photo collection for use in the site. Most of these have not yet been included but will be added over time. If you have any photos or content that you would like to contribute to the site, please contact me. All photos will have proper attribution.

Robber Flies of the World is intended as a long-term project. There will be frequent updates to fix errors, add new content and features, or improve the site's appearance and performance. I hope you will find Robber Flies of the World to be a useful addition to your toolkit, and I look forward to any feedback you might have!

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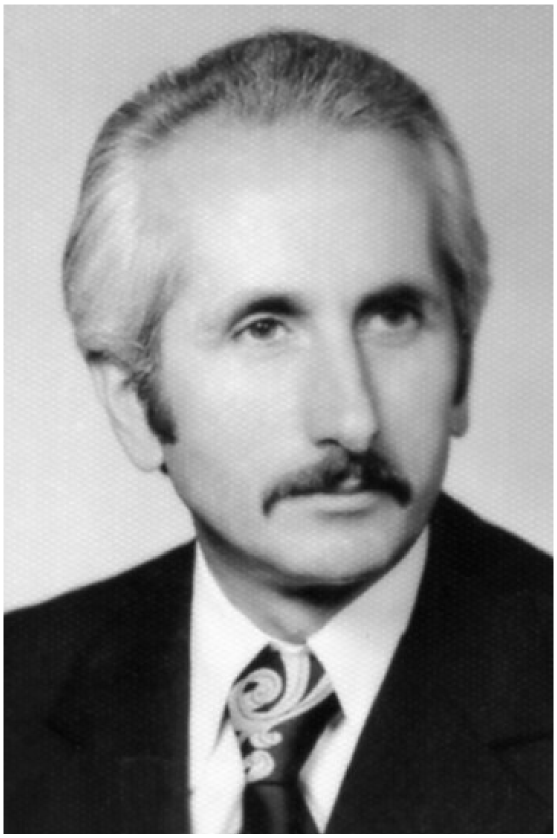
HISTORICAL DIPTEROLOGY

In Memoriam: Prof. Venelin Lazarov Beschovski (1933–2019)

Toshko Ljubomirov

Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences
1, Tzar Ossvoboditel Boulevard, Sofia, 1000, Bulgaria; toshkoljubomirov@gmail.com


Portrait of Venelin Beschovski, 1984.

Our dear and respected colleague and friend, Dr. Venelin Lazarov Beschovski, passed away on 3 December 2019, in Sofia, Bulgaria, at the age of 86. Dr. Beschovski was a professor at the Institute of Zoology, Bulgarian Academy of Sciences in the city of Sofia. He was a renowned entomologist and systematic zoologist, who was instrumental in advancing the study and our understanding of dipterology and odonatology in Bulgaria and Europe.

Venelin was born in the village of Knezha, northwest Bulgaria, on 3 April 1933, the third child of Ivanka and Lazar Beschovski. Venelin grew up in Knezha where he completed primary and secondary (in 1952) education. In the same year he attended the Biology, Geology, and Geography Faculty of Sofia University "St. Kliment Ohridski" and graduated in 1957 attaining the qualifications biologist-zoologist and biology & chemistry teacher. By the time of his graduation, Venelin was attracted to the working team of Hydrobiology by associate professor Georgi Kozarov, where he became a student of the natural history and diversity of dragonfly larvae under the supervision of Professor Alexander Valkanov. Venelin completed his master`s thesis on dragonfly larvae and earned a MSc degree; since then Odonata remained a beloved group of research throughout his lifetime.

Before moving into science, Venelin had a short-time career as a teacher in the high school at the village of Kozloduy (September to November 1957) and in the Agricultural College "Obtaztsov Tchifflik" at Rousse (December 1957 to August 1958), where he briefly taught biology and chemistry in both institutions. In September 1958 Beschovski subsequently became a curator in the Department "Nature" of the State History Museum at Rousse. At the latter institution, he became a co-organizer of the first exhibition at the Department "Nature", opened in 1959 based mainly on materials kept at that time in the Museum. At that time appeared in print the very first scientific labour of Beschovski, dedicated to the dragonflies from the high-mountain lakes and marshes in Bulgaria. In Rousse, Venelin met his wife, Vasilka, whom he married in 1960.

In the spring of 1960, Venelin was assigned as a technologist in the Research Institute of Fishing and Fishing Industry at Varna (now Institute of Fishery Resources – Varna) where he was appointed later as a research assistant in the Department of Hydrobiology (January 1962 – January 1967). It was Valkanov who suggested that he study Diptera, a group of insects, which remained the secondary (besides the dragonflies) focus of all his scientific activities for a lifetime. Venelin pursued research on seashore dipteran fauna, where he focused on the members of the group occurring in littoral (rocky and sandy supralittoral) and dune habitats. At the same time, he continued his research on dragonflies and soon became a recognized expert both on Odonata and Diptera. Despite plenty of obstacles (including the lack of literature and complete absence of any previous investigations), Beschovski pioneered the researches on Black Sea coast Diptera-Brachycera and doing his intensive field work while collecting material for his own studies he was able to produce a row of scientific papers dealing with ecology and habitat preferences of that insect group. His scientific activities as a member of the Institute of Fishery Resources resulted in publications of more than twenty articles between 1964 and 1975.

Figure 2. Beschovski (first at left) with Dimo Bozhkov (a front in right) and Boris Russev (at the bottom) on a field trip in Rhodopi Mountains at the area of Wonderful Bridges (Erkyupriya) in May 1961.

In February 1967 Venelin assumed full-time duties as an assistant professor of zoology at the Institute of Zoology in Sofia but actually moved with his family to Sofia in the summer of 1971. Prior to his true participation in the Institute of Zoology, Beschovski remained employed in the Institute of Fishery Resources where he continued his research activity at that time switched back to studying Odonata. Already a member of the Institute of Zoology at Sofia, with a rapidly expanding publication record and range of collaborations and project ideas, Venelin was successful to undertake

Figure 3. Sampling Diptera from seaweed piles at a sandy beach south of Shabla (northern Black sea coast) in May 1968.

Figure 4. During presentation at a scientific session at the Institute of Fishery Resources in 1971.

specialization in the Zoological Institute at Leningrad in 1971. In the latter institution, Venelin met and worked with Alexander Staeckelberg and Emiliya Narchuk and under their influence turned his interests in research on the dipteran family Chloropidae. In 1972 Venelin Beschovski defended his Candidate of Science (Ph. D.) thesis entitled "Ecological investigations of Diptera, Brachycera from the flooded by the sea biotopes along the Bulgarian Black Sea coast", and twelve years later, in 1984, a dissertation for the Doctor of Sciences degree in biology entitled "Origin and formation of the family Chloropidae (Diptera) in the Palaearctic and its fauna at the Balkan Peninsula and Bulgaria" becoming a full professor in 1986. In Sofia, he became the vice director of the Institute of Zoology in April 1993, a position he retained until his retirement as a professor of zoology in 2001.

Figure 5. Venelin (at left) with Emilia Nartshuk, Dmitriy Kasparyan, Vera Richter, Evelina Danzig, and Izyaslav Kerzhner in front of the Zoological Institute of the Russian Academy of Sciences at Leningrad (now Saint Petersburg) in 1971.

Throughout his career, Venelin Beschovski produced more than 120 original, peer-reviewed publications, 4 books, and 9 book chapters as well as numerous popular-science articles. Most notable among his several books are, e.g., the 372-page volume on Odonata in the series Fauna Bulgarica (1994, written in Bulgarian and including over 120 original illustrations of elements of larval and adult dragonfly morphology; which was decisive for our understanding the species composition and diversity of the dragonflies in Bulgaria and today represents a standard reference), or the 421-page volume on Canacidae, Ephydridae, and Tethinidae families of Diptera in the series Fauna Bulgarica (2009, written in Bulgarian and including over 450 original illustrations of elements adult morphology; an example how to create monographs). Additionally, he was an active member of the editorial boards of two scientific journals, Acta entomologica bulgarica and Acta zoologica bulgarica. His diverse focus on the taxonomy and systematics of Diptera-Brachycera, seldom in collaboration with others, resulted in the descriptions of seven genera/subgenera (*Cyclocerculla* (a subgenus in *Oscinella*); *Microcersis* (a subgenus in *Oscinella*); *Nartshukiella* (a subgenus in *Tricimba*); *Neohaplegis* (a subgenus in *Cryptonerva*); *Sclerophallus* (a subgenus in *Chlorops*); *Sabroskyina* (a genus in Chloropidae); *Schmanniella* (a subgenus in *Tricimba*)) and forty-two species new to science. These latter include: 9 from family Chamaemyiidae (*Chamaemyia bicolor*, *Chamaemyia flavoantennata*, *Chamaemyia submontana*, *Chamaemyia triorbiseta*, *Parochthiphila nigrolineata*, *Parochthiphila ruderalicola*, *Leucopis curtisetosa*, *Leucopis dobrodginus*, *Leucopis latifrons*); 12 from family Chloropidae (*Cetema obliqua*, *Chlorops querciphila*, *Dicraeus valkanovi*, *Dicraeus sabroskyi*, *Elachiptera agricola*, *Elachiptera submediterranea*, *Elachiptera submediterranea*, *Meromyza balcanica*, *Meromyza pleurosetosa*, *Oscinella nartshukiana*, *Rhopalopterum brunneipennis*, *Rhopalopterum crucicarinatus*); 1 from family Dolichipodidae (*Epithalassius stackelbergi*); 4 from family Empididae (*Chersodromia bureschi*, *Chersodromia milachvalai*, *Chersodromia neocurtipennis*, *Hilara psammophytophilia*); 2 from family Ephydridae (*Allotrichoma dahli*, *Allotrichoma valkanovi*); 1 from family Stratiomyidae (*Nemotelus rumelicus*); 13 from family Tethinidae (*Tethina acrostichalis*, *Tethina flavoidea*, *Tethina gobii*, *Tethina guttata*, *Tethina luteosetosa*, *Tethina multiplicosa*, *Tethina nigrofemorata*, *Tethina pictipennis*, *Tethina quadricephala*, *Tethina salinicola*, *Tethina shalom*, *Tethina subpunctata*, *Tethina yaromi*).

Publications of Venelin Lazarov Beschovski (all type of publications (scientific articles, popular-science articles, books, book chapters) are included and listed chronologically; in case if two publication years are given, the first is the actual publication year, the second (in parentheses) is the intended but incorrect year given on the title page; author's name is spelled according to the title given in French, German or English summary for the articles written in Bulgarian)

Beschovski, V. 1960. A contribution to the Order Odonata from high-mountain lakes and bogs in Bulgaria. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 9: 451-453 (in Bulgarian).

Beschovski, V. 1960. How many animal species are living on our planet. – Nature and knowledge, (1960), 5: 4-6 (in Bulgarian).

Beschovski, V. 1960. Vegetative reproduction in animals. – Nature and knowledge, (1960), 6: 5-8 (in Bulgarian).

Beschovski, V. 1960. The flight of insects. – Nature and knowledge, (1960), 8: 7-9 (in Bulgarian).

Beschovski, V. & Doykov, V. 1961. Pelicans Lake. Natural science library. Series Biology and Geology. – Narodna Prosveta. Sofia: 1-71 & 2 unnumbered pages (in Bulgarian).

Beshovsky, V. 1964. Dipterons of the littoral area of the Bulgarian Black Sea coast. – Bulletin de l`Institut de Pisciculture et de Pêcherie. Varna, 4: 91-98 (in Bulgarian).

Beshovski, V. 1964. Odonata from the Bulgarian Black Sea coast. – Bulletin de l`Institut et Museé de Zoologie. Sofia, 15: 115-129 (in Bulgarian).

Beschovski, V. 1964. Beitrag zum Studium der Halobionten und halophilen Diptera Brachycera vom Bulgarischen Küstenbereich des Schwarzen Meerses. – Zoologischer Anzeiger, 172: 261-264.

Bechovski, V. 1964. Odonata from South Bulgaria. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 17: 109-124 (in Bulgarian).

Beshovsky, V. 1965. Odonata from the Bulgarian riverside of the Danube and from certain water reservoirs in northern Bulgaria. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 18: 159-168 (in Bulgarian).

Beschovski, V. 1965. Insects on our Black Sea coast. – Georgi Bakalov. Varna: 1-96 (in Bulgarian).

Beschovski, V. 1966. Unbekannte Ephydridae (Dipt.) in der Fauna Bulgariens. – Zoologischer Anzeiger, 176: 270-276 & plate I.

Beshovski, V. 1966. Several families of Diptera unknown to the Bulgarian fauna: Dryomyzidae,

Chammaemyiidae, Trichoselidae, Astiidae, Canacidae and Milchiidae. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 21: 11-13 (in Bulgarian).
Bešovski, V. 1966. Allotrichoma valkanovi n. sp. – Eine neue Art von (Diptera Ephydridae) aus Bulgarien. – Comptes rendus de l`Académie bulgare des Sciences, 19: 851-853.
Bešovski, V. 1966. Allotrichoma dahli n. sp. – Eine neue Art Diptera (Ephydridae) aus Bulgarien. – Comptes rendus de l`Académie bulgare des Sciences, 19: 937-939.
Bešovsky, V. 1966. Epithalassius stackelbergi n. sp. Une nouvelle espèce de Diptera (Dolichopodidae) du littoral Bulgare de la Mer Noire. – Comptes rendus de l`Académie bulgare des Sciences, 19: 1079-1082.
Beschovski, V. 1966 Mediterranean dragonflies in Bulgaria. – Nature. Sofia, (1966), 3: 66 – 68 (in Bulgarian).
Beschovski, V. 1966 Our fauna of Insecta, Diptera. – Nature. Sofia, (1966), 4: 56 – 59 (in Bulgarian).
Beshovski, V. 1967. Unknown Sphaeroceridae (Dipt.) to Bulgaria`s fauna. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 23: 217-228 (in Bulgarian).
Beschovski, V. 1967. Für die Fauna Bulgariens bislang unbekannte Dolichopodidae (Dipt.). – Zoologischer Anzeiger, 178: 219-224 & plate 1.
Beshovski, V. 1967. Ecological survey of the larvae of Odonata in the Bulgarian rivers. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 24: 5-20 (in Bulgarian).
Bešovski, V. 1968. Odonata-Larven der stehenden Gewässer in Bulgarien. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 26: 5-27 (in Bulgarian).
Beshovski, V. 1968. Chloropidae (Diptera), unknown in the fauna of Bulgaria. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 26: 33-38 (in Bulgarian).
Beschovski, V. 1968. Sur la taxonomie des males de l`espèce Limnosina (Opacifrons) maculifrons Becker (1907) (Diptera : Sphaeroceridae). – The Proceedings of the Royal Entomological Society of London. Series B. Taxonomy, 37: 41-42.
Beshovski, V. 1969 (1967). Carp and perch-pike feed in the Bourgasko, Mandernsko and Blatnishko lakes along the Bulgarian Black Sea Coast. – Proceedings of the Research Institute of Fisheries and Oceanography – Varna, 8: 195-209 (in Bulgarian).
Beschovski, V. 1971. A contribution to the dipter fauna (Diptera Brachycera) at the Bulgarian Black Sea Coast. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 33: 5-11 (in Bulgarian).
Bešovski, V. & Lăvčiev, V. 1971. Muscides (Diptera-Brachycera) du littoral Bulgare de la Mer Noire. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 33: 85-98 (in Bulgarian).
Beschovski, V. 1972. A contribution to the dipteral fauna (Diptera, Brachycera) in the region of the Bulgarian Black-Sea coast. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 34: 5-14 (in Bulgarian).
Beshovsky, V. 1972. Ecologic investigations on the representatives of Diptera – Brachycera from the salty biotops along the Bulgarian seaside. 1 communication: dipteral fauna from the cliffs. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 35: 5-21 (in Bulgarian).
Beschovsky, V. 1972. Representatives of Diptera – Brachycera in the caves of Bulgaria. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 35: 23-29 (in Bulgarian).
Beshovsky, V. 1972. The sea-weeds cast ashore around the city of Varna (Bulgaria) and their fauna. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 35: 31-40 (in Bulgarian).
Beschovski, V. 1972. Sur le Microtes mediterraneus Becker, 1919 (Diptera Dolichopodidae) du littoral bulgare de la Mer Noire. – Entomologische Berichten, 32: 141-144.
Beschovski, V. 1973. Contribution to the dipterous fauna (Diptera-Brachycera) of the Bulgarian Black Sea coast. III. Bulletin de l`Institut de Zoologie et Musee. Sofia, 37: 33-41 (in Bulgarian).
Beschovski, V. 1973. Sur la taxonomie et la distribution d`Asmeringa inermis Becker, 1903 (Diptera, Ephydridae). – Nouvelle Revue d`Entomologie, 3: 49-52.

Beschovski, V. 1973. Hilara psammophytophilia n. sp. (Diptera: Empididae) – a new species for the Bulgarian Black-Sea coast. – Comptes rendus de l`Académie bulgare des Sciences, 26: 1061-1063.
Beshovski, V. 1973. Ecological investigations on the representatives of Diptera, Brachycera from the salt biotops along the Bulgarian Black Sea coast. II. The dipteral fauna from the sea-weeds cas. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 38: 5-20 (in Bulgarian).
Beshovski, V. 1973. Ökologische Untersuchungen über Diptera, Brachycera vertreter aus den salzigen Biotopen des bulgarischen Schwarzmeerstrands. III. Die Diptera-Fauna des von Wellen überfluteten sandigen Strandes. – Bulletin de l`Institut de Zoologie et Musee. Sofia, 38: 195-230 (in Bulgarian).
Beschovski, V. 1973. Deux nouvelles espèces du genre Chersodromia (Diptera: Empididae): Chersodromia milachvalai sp. n. et Chersodromia bureschi sp. n. du littoral bulgare de la Mero Noire. – Zoologischer Anzeiger, 191: 337-342.
Beschovski, V. 1974 (1972). Chersodromia neocurtipennis sp. n. a second species with very short wings of the chersodromia genus (diptera, empididae). – Bollettino del Museo Civico di Storia Naturale di Venezia, 35: 65-68.
Beschovski, V. 1974. Sur la position taxonomique de Dicraeus discolor (Becker, 1910) (Diptera: Chloropidae) et Tetanops psammophila Loew, 1862 (Diptera: Otitidae) du littoral bulgare de la Mer Noire. – Nouvelle Revue d`Entomologie, 4: 137-143.
Beschovski, V. 1975. The Black Sea Coast Inundated by Waves and Its Dipterous Fauna (Diptera – Brachycera). – Hydrobiology, 2: 3-18 (in Bulgarian).
Beschovski, V. 1975. Ökologische Untersuchungen über Vertreter von Diptera – Brachycera von den Salzbiotopen der bulgarischen Schwarzmeersküste. – Ecology. Sofia, 1: 64-74 (in Bulgarian).
Beshovski, V. 1976. Acartophthalmidae, Anthomyzidae, Aulacigastridae, Camilidae and Diastatidae – New Diptera-Brachycera fo the Bulgarian Fauna.- Acta zoologica bulgarica, 5: 93-96 (in Bulgarian).
Beshovski, V. 1976. Diptera Brachycera in the dunes along the Bulgarian Black Sea coast. In: Peshev, G. (editor). Terrestrial Fauna of Bulgaria. Materials. – Bulgarian Academy of Sciences. Sofia: 35-60 (1-290) (in Bulgarian).
Beshovski, V. 1976. Aphaerta difficilis Nixon /Braconidae/as a parasite in the larvae of Fucellia tergina Zette. /Diptera, Anthomyidae/. In: Peshev, G. (editor). Terrestrial Faun of Bulgaria. Materials. – Bulgarian Academy of Sciences. Sofia: 212-215 (1-290) (in Bulgarian).
Beschovski, V. 1977. Migrations in the injurious insects. – Nature and knowledge, (1977), 1: 28-30 (in Bulgarian).
Beschovski, V. 1977. As a store clothes production. – Newsletter “Antennas “, (1977), February: 8 (in Bulgarian).
Beschovski, V. 1977. Investigations on the Chloropid flies (Diptera, Chloropidae) of Southwestern Bulgaria. – Acta zoologica bulgarica, 6: 40-49 (in Bulgarian).
Beschovski, V. 1977. Dicraeus sabroskyi sp. n. (Diptera, Chloropidae) – a New Species from Bulgaria- Acta zoologica bulgarica, 6: 54-57.
Beschovski, V. 1978. Subdivision of the Genus Oscinella Becker, 1909 (Diptera, Chloropidae) with Description of a New Species. – Acta zoologica bulgarica, 10: 21-29.
Beschovski, V. 1978. Faunistic and taxonomic investigations on the genus Chlorops Meigen, 1803 (Diptera, Chloropidae) from Bulgaria with description of a new species. – Nouvelle Revue d`Entomologie, 8: 397-402.
Beschovski, V. 1978. Invertebrata. – In: Valkanov A., Marinov, C., Danov, C., Vladev, P. (editors). The Black Sea. – Georgi Bakalov. Varna: 218-230 (1-646) (in Bulgarian).
Beschovski, V. 1979. Contribution to the taxonomy of the Genus Chlorops Meigen, 1803 (Diptera, Chloropidae). – Reichenbachia 17: 219-223.

Beschovski, V. 1980. On the Taxonomic Structure of the Genus Chlorops Meigen, 1803 (Diptera, Chloropidae). – Acta zoologica bulgarica, 14: 19-31.
Beschovski, V. 1980. Beitrag zur Untersuchung der Gattung Platycephala Fallen, 1820 (Diptera, Chloropidae). – Acta zoologica bulgarica, 15: 72-76.
Beschovski, V. 1980. Elachiptera submediterranea sp. n. and a review of the species of the genus Elachiptera (Diptera, Chloropidae) from Bulgaria. – Acta zoologica bulgarica, 16: 57-62.
Beschovski, V. 1981. On the Taxonomy of the Genus Cryptonerva Lloy, 1864 (Diptera, Chloropidae). – Reichenbachia, 19: 51-54.
Beschovski, V. 1981. On the Systematic Status of Oscinella (Microcercis) trigonella Duda, 1933 (Diptera, Chloropidae). – Reichenbachia 19: 59-61.
Beschovski, V. 1981. On the Systematics of the Genus Tricimba Lioy, 1864 (Diptera, Chloropidae). – Reichenbachia, 19: 119-122.
Beshovski, V. 1982. Chloropidae (Diptera) - New to the Bulgarian Fauna. – Acta zoologica bulgarica, 20: 89-95 (in Bulgarian).
Beschovski, V. 1982. Dicraeus valkanovi n. sp., a New Species of Chloropidae from Bulgaria (Diptera). – Reichenbachia, 20: 31-32.
Beschovski, V. 1982. Specific biotopes from the Bulgarian Black Sea coast and their arthropod fauna. In: National Theoretical Conference on Environmental Conservation and Reproduction. 1-5 November 1982 Slunchev Bryg. Volume 1. – Bulgarian Academy of Sciences: 351-354 (1-354) (in Bulgarian).
Beschovski, V. 1983. On the Systematic Status of Steleocerus lindbergi Duda, 1933 (Diptera, Chloropidae). – Acta zoologica bulgarica, 21: 78-82 (in Bulgarian).
Beschovski, V. 1984. A Zoogeographic Review of the Endemic Palearctic Genera of Chloropidae (Diptera) in View of Their Origin and Formation. – Acta zoologica bulgarica, 24: 3-26.
Beschovski, V. 1984. Cetema obliqua sp. n., a New Species of Chloropidae from Southeast Europe (Diptera). – Reichenbachia, 22: 213-214.
Michailova, P. & Beschovski, V. 1984. Problems of the karyotaxonomy of a genus Oscinella (Diptera, Chloropidae). – XVII International Congress of Entomology. Hamburg. Federal Republic of German. August 20-26, 1984. Proceedings, 17: 36.
Beschovski, V. 1984. On the origin and the distribution of Chloropidae genera (Diptera) in the Palaearctic. In: Third National Conference of Zoology. October 18-20 1984. Blagoevgrad. Report abstracts. – Bulgarian Academy of Sciences & State Council Blagoevgrad: 5-6 (1-63 & two unnumbered pages) (in Bulgarian).
Beschovski, V. 1984. Specific patterns of the genera of Chloropidaa (Diptera) in view of their origin and formation. In: Third National Conference of Zoology. October 18-20 1984. Blagoevgrad. Report abstracts. – Bulgarian Academy of Sciences & State Council Blagoevgrad: 6 (1-63 & two unnumbered pages) (in Bulgarian).
Beschovski, V. 1984. Ecological groupings in Chloropidae species (Diptera) in Bulgaria. In: Third National Conference of Zoology. October 18-20 1984. Blagoevgrad. Report abstracts. – Bulgarian Academy of Sciences & State Council Blagoevgrad: 27-28 (1-63 & two unnumbered pages) (in Bulgarian).
Michailova, P. & Beschovski, V. 1985. Karyotaxonomical Studies on Genus Oscinella (Diptera, Chloropidae). – Acta zoologica bulgarica, 29: 25-35.
Beschovski, V. 1985. On the Origin and Formation of Palaearctic-Paleotropical Ranging Genera of Family Chloropidae (Diptera) in the Palaearctic. – Acta zoologica bulgarica, 29: 36-49.
Beschovski, V. 1985. Review. Pavel Angelov. Fauna of Bulgaria – Curculionidae (Coleoptera). 5, 7, 9 and 10. Sofia, Publ. House of Bulg. Acad. Sci. (in Bulgarian). – Acta zoologica bulgarica, 27: 57-58 (in Bulgarian).
Beschovski, V. 1985. Review. Dr. Tenyu M. Marinov. Bulgarian Fauna. 6. Polychaeta. 1977. Sofia,

BAS Publ. House. 258 p. (in Bulgarian). – Acta zoologica bulgarica, 28: 81 (in Bulgarian).
Beschovski, V. 1985. Review. Ilko Bonchev Vasilev. Fauna of Bulgaria. T. 8. Hymenoptera, Symphyta (in Bulgarian language). – Acta zoologica bulgarica, 29: 82 (in Bulgarian).
Beschovski, V. 1985. Fauna Bulgarica, 14. Diptera, Chloropidae. – In Aedibus Academie Scientiarum Bulgaricae. Sofia: 1-220 (in Bulgarian).
Beschovski, V. 1985. XVII iInternational Congress of Entomology in Hamburg. – Nature. Sofia, (1985), 1: 90-92 (in Bulgarian).
Beshovski, V. 1985. Social Realization of Zoological Researches in our Country. – Journal of the Bulgarian Academy of Sciences, 31, (3): 24-29 (in Bulgarian).
Beschovski, V. 1986. Recent Range of the Genus Meromyza Mg. (Diptera, Chloropidae) and Its Historical and Zoogeographical Significance. – Acta zoologica bulgarica, 32: 11-18 (in Bulgarian).
Beschovski V. & Hubenov, S. 1986. Die Insekten von der Familie Tachinidae (Diptera) in den submediterranbiotopen südwestbulgariens. I. Artenbestand und zoogeographische Charakteristik der Tachinidae im Tal zwischen Sandanski und Petrič. In: Botev, B. (editor in chief). Fauna of Southwestern Bulgaria. Part 1. - Bulgarian Academy of Sciences: Sofia: 118-129. (1-158) (in Bulgarian).
Beshovski, V. 1987. Zoogeographical Characteristics of Chloropid Fauna of the Balkan Peninsula and in Bulgaria. In: Botev, B. (editor in chief). Contemporary achievements of Bulgarian zoology. Proceedings of the Fourth Anniversary Scientific Conference on Zoology. – Institute of Zoology. Sofia: 60-62 (1-400) (in Bulgarian).
Beschovski, V. 1987. Meromyza pleurosetosa sp. n. (Diptera, Chloropidae). – Acta zoologica bulgarica, 33: 68-72.
Beschovski, V. 1987. Description of Sabroskyina Genus Novum (Diptera, Chloropidae) and Taxonomic Remarks on the Species Included. – Acta zoologica bulgarica, 34: 36-44.
Beschovski, V. & Lansbury, I. 1987. Two new Rhopalopterum species from England (U.K.) and Hungary (Insecta, Diptera, Chloropidae). – Reichenbachia, 25: 91-96.
Beschovski, V. 1989. Specimens of the Families Epallagidae and Callopterygidae (Odonate) from Bulgaria. – Acta zoologica bulgarica, 38: 3-10 (in Bulgarian).
Beschovski, V. & Tanassijtchuk, V. 1990. Taxonomic notes on the Chamaemyia species in the Collin's collection in Oxford, with description of a new species (Insecta, Diptera: Chamaemyiidae). – Reichenbachia, 28: 79-87.
Bešovski, V. & Dimitorva, B. 1990. Frit flies (Insecta, Diptera, Chloropidae) from Vitoša. In: Botev, B. (editor in chief). Fauna of Southwestern Bulgaria. Part 3. – Publishing House of the Bulgarian Academy of Sciences: 154-160 (1-243) (in Bulgarian).
Nikolov, N., Krusteva, H., Beschovski, V. 1991. New pest on the onion plants in Bulgaria. – Agrokompas, 6: 43 (in Bulgarian).
Tanasijtchuk, V. & Beschovski, V. 1991. A contribution to the study of the Chamaemyia species (Diptera, Chamaemyiidae) from Bulgaria and some East European countries. – Acta zoologica bulgarica, 41: 18-25.
Beshovski, V. 1991. Review of the dragonflies (Odonata species) of Bulgaria. – First International Conference of Entomology. – 28-30 October 1991, Sofia: 33-38 (in Bulgarian).
Beschovski, V. & Minkova, V. 1991. Species from the family Opomyzidae (Diptera) in Bulgaria. – Acta zoologica bulgarica, 42: 62-65 (in Bulgarian).
Beschovski, V. 1992. Taxonomical notes on Chamaemyia flavipalpis (Haliday), Ch. aridella (Fallén) and Ch. junicorum (Fallén) (Diptera, Chamaemyiidae) based on the type specimens. – Acta zoologica bulgarica, 45: 56-60.
Beschovski, V. 1993. A critical notes on some Odonata species (Insecta, donate), reported by Bulgarian authors for the territories of Bulgaria, Greece and Macedonia. – Acta zoologica

bulgarica, 46: 39-43.
Beschovski, V. & Georgiev, G. 1993. Three species of Diptera – Acalyptrata dwelling galls of Paranthrene tabaniformis Rott. (Lepidoptera, Aegeridae). – Acta zoologica bulgarica, 46: 44-49.
Beschovski, V. & Marinov, M. 1993. The dragonflies (Odonata) from thereservation of "Srebarna" in Bulgaria. – Second International Conference of Entomology. – 25-27 October 1993, Sofia: 9-13 (in Bulgarian).
Beschovski, V. 1993. The species of the genus Lipara Meigen (Diptera, Chloroidae), and its galls on the common reed along the Bulgarian Black Sea coast. – Second International Conference of Entomology. – 25-27 October 1993, Sofia: 14-18 (in Bulgarian).
Beschovski, V. 1993. Review of the families of Diptera-Nematocera (Diptera) from Bulgaria. – Second International Conference of Entomology. – 25-27 October 1993, Sofia: 19-23 (in Bulgarian).
Beschovski, V. 1993. Taxonomic and systematic notes on the genera Tethina Haliday, 1838, and Rhicnoessa Loew, 1862 (Insecta : Diptera : Tethinidae). – Reichenbachia, 30: 103-107.
Gueorguiev, V., Beshovski, V., Josifov, M., Kumanski, K., Russev, B., Sakalian, V. 1993. Insecta: Odonata, Ephemeroptera, Plecoptera, Homoptera (Auchenorrhyncha), Heteroptera, Coleoptera (Insecta, Part I). In: Sakalian M. (editor). National Strategy for Conservation of Biological Diversity. Main reports. Volume 1. – Biodiversity Support Program. Washington D.C.: 245-322 (i-viii & 1-663) (in Bulgarian).
Hubenov, Z., Beshkow, S., Beshovski, V., Vassileva, E., Kolarov, J., Kumanski, K., Popov, A. 1993. Insecta: Blattodea, Mantodea, Isoptera, Orthoptera, Dermaptera, Embioptera, Megaloptera, Raphidioptera, Neuroptera, Mecoptera, Hymenoptera, Trichoptera, Lepidoptera and Diptera (Insecta, Part II). In: Sakalian M. (editor). National Strategy for Conservation of Biological Diversity. Main reports. Volume 1. – Biodiversity Support Program. Washington D.C.: 323-404 (i-viii & 1-663) (in Bulgarian).
Beschovski, V. 1994. Tethina subpunctata sp. nov., a new species from Tunisia (Diptera, Tethinidae). – Entomofauna, 15: 197-201.
Beschovski, V. 1994 Three new species of genus Chamaemyia Meigen, 1803 fro Europe (Insecta: Diptera: Chamaemyiidae). – Reichenbachia, 30: 203-209.
Beschovski, V. 1994. Comparative zoogeographical review of Odonata fauna of Bulgaria (Insecta, Odonata). – Acta zoologica bulgarica, 47: 3-15.
Beschovski, V. 1994. Contribution to the study of the West Palaearctic Tethinidae (Diptera). – Acta zoologica bulgarica, 47: 16-29.
Beschovski, V. 1994. Fauna Bulgarica. 23. Insecta: Odonata. – In Aedibus Academiae Scientiarum Bulgaricae. Sofia: 1-373 (in Bulgarian).
Beschovski, V. & Manassieva, E. 1995. Review of the Pipunculidae species in Bulgaria (Insecta: Diptera: Pipunculidae). – Third National Scientific Conference of Entomology. Sofia. 18-20 september 1995: 66-69 (1-280) (in Bulgarian).
Beschovski, V. 1995. Comparative Zoogeographic Structure of the Ephydridae and Chloropidae families on the region of the lakes of Shabla and Ezerez (Insecta: Diptera-Brachycera). – Third National Scientific Conference of Entomology. Sofia. 18-20 september 1995: 70-74 (1-280) (in Bulgarian).
Beschovski, V. 1995. Contribution to the knowledge of the taxonomy and distribution of the Chamaemyia species established in Bulgaria (Insecta, Diptera, Chamaemyidae). – Acta zoologica bulgarica, 48: 34-47.
Beschovski, V. 1995. Key of Determination the Lipara-species (Diptera, Chloropidae) from Bulgaria by the adults, mature larval stage and galls. – Acta entomologica bulgarica, (1), 2: 5-10 (in Bulgarian).

Beshovski, V., Dzambazov, B., Gajdarova, A. 1995. Contribution to the study of Empidoidea fauna from Vitosha Mountain (Insecta: Diptera: Empidoidea). – Acta entomologica bulgarica, (1), 2: 13-15 (in Bulgarian).
Beschovski, V. & Krasteva, C. 1995. Lasiosina brevisurstylata Dely Draskovits, 1977 - an unknown enemy on the spring barley and wheat (Diptera: Chloropidae). – Acta entomologica bulgarica, (1), 2: 32-36 (in Bulgarian).
Beschovski, V. & Manassieva, E. 1996. Contribution to the study of the Stratiomyidae species in the Balkan Peninsula, with description of Nemotelus rumelicus spec. nov. (Insecta: Diptera). – Reichenbachia, 31: 217-223.
Beschovski, V. 1996. Meromyza balcanica spec. nov. – a new chloropid species from Bulgaria (Insecta: Diptera: Chloropidae). – Reichenbachia, 31: 233-235.
Beschovski, V. 1996. Odonatology in Bulgaria, with special considerations of the rheophilous Bulgarian Odonata. – Selysia, 24: 6-8.
Freidberg, A. & Beschovski, V. 1996 A new species group within Tethina Haliday (Diptera: Tethinidae) with descriptions of six Mediterranean species. – Israel Journal of Entomology, 30: 91-113.
Beschovski, V. 1996. Qualitative composition and distribution of the Epydridae species (Diptera) on the moist zones of the Shablenska like system. – Acta entomologica bulgarica, (2), 1: 16-20 (in Bulgarian).
Karadjova, O. & Beshovski, V. 1996. Amazing possibilities for adaptations of one new to the country species – the leaf-miner Liriomyza huidobrensis Blanch. – Plant Protection, 6: 20-21 (in Bulgarian).
Beschovski, V. & Karadjova, O. 1996. The South American leafminer Liriomyza huidobrensis Blanch. (Diptera: Agromyzidae) - a new pest in Bulgarian greenhouses. – Acta entomologica bulgarica, (2), 2: 5-11 (in Bulgarian).
Beschovski, V. 1996. Qualittative composition and distribution of the Chloropidae species (Diptera) on the moist zones of the Shablenska lake system. – Acta entomologica bulgarica, (2), 2: 16-20 (in Bulgarian).
Beschovski, V. & Gashtarov, V. 1997. Selysiothemis nigra (Vander Linden 1825) – a new genus and species for the Bulgarian fauna (Odonata: Anisoptera: Libellulidae). – Entomologische Zeitschrift, 107: 309-310.
Beschovski, V. & Nartshuk, E. 1997. The Tethinidae in the collection of the Zoological Institute in St. Petersburg (Insecta: Diptera: Tethinidae). – Reichenbachia, 32: 129-141.
Beschovski, V. 1997. Contribution to the study of the Tethinidae from the East Mediterranean region, with description of two new species (Insecta: Diptera: Tethinidae). – Reichenbachia, 32: 143-149.
Beschovski, V. & Krasteva, H. 1997. Contribution to the study of the pupa and biology of Lasiosina brevisurstylata and L. cinctipes (Insecta, Diptera, Chloropidae). – Acta zoologica bulgarica, 49: 32-42.
Beschovski, V. & Langourov, M. 1997. Contribution to the study of the distribution of Phoridae species in the Balkan Peninsula (Diptera, Phoridae). – Acta zoologica bulgarica, 49: 43-47.
Beschovski, V. & Dzambazov, B. 1997. New Records of the Genus Platypalpus Macquart, 1827 (Diptera, Empidoidea, Hybotidae) from the Fauna of Bulgaria. – Acta zoologica bulgarica, 49: 94-96.
Beschovski, V. 1997. Review of the Ephydridae species (Insecta: Diptera), established in Bulgaria up to the present. – Acta entomologica bulgarica, (3), 1-2: 7-9 (in Bulgarian).
Beschovski, V. 1997. Ephydrids species from the woodless zone of the National Park “Central Balkan” (Insecta: Diptera: Ephydridae). – Acta entomologica bulgarica, (3), 1-2: 25-28.
Beschovski, V. & Merz, B. 1998. Contribution to the knowledge of the Chamaemyiidae (Diptera),

with particular reference to the fauna of Switzerland. – Mitteilungen der Schweizerischen Entomologischen Gesellschaft, 71: 83-106.

Beschovski, V. 1998. New data on the distribution of some Tethinidae (Diptera) of the western Palaearctic region, with description of a new species. – Mitteilungen der Schweizerischen Entomologischen Gesellschaft, 71: 407-412.

Papp, L. & Beschovski, V. 1998. 67. Chamaemyiidae. In: Merz, B., Bächli, G., Haenni, J.-P., Gonseth, Y. (editors). Fauna Helvetica 1. Diptera – Checklist. – Centre Suisse de cartographie de la faune. Schweizerische Entomologische Gesellschaft: 257-258 (1-369).

Gueorguiev, V., Beshovski, V., Russev, B., Kumanski, K., Josifov, M., Sakalian, V. 1998. Insects of Bulgaria, Part 1: Odonata, Ephemeroptera, Plecoptera, Homoptera (Auchenorrhyncha), Heteroptera, Coleoptera. In: Meine, C. (editor). Bulgaria`s Biological Diversity: Conservation Status and Needs Asessment. Volumes I and II. – Biodiversity Support Program. Washington D.C.: 163-209 (i-xii & 1-810 & 29 maps).

Hubenov, Z., Beschovski, V., Beshkow, S., Kolarov, J., Kumanski, K., Popov, A., Vassileva, E. 1998. Insects of Bulgaria, Part 2: Blattodea, Mantodea, Isoptera, Orthoptera, Dermaptera, Embioptera, Megaloptera, Raphidioptera, Neuroptera, Mecoptera, Hymenoptera, Trichoptera, Lepidoptera, and Diptera. In: Meine, C. (editor). Bulgaria`s Biological Diversity: Conservation Status and Needs Assessment. Volumes I and II. – Biodiversity Support Program. Washington D.C.: 211-259 (i-xii & 1-810 & 29 maps).

Beschovski, V. & Marinov, M. 1998 (1988). Order Odonata. In: Michev, T. (editor in chief). Biodiversity of the Srebarna Biosphere Reserve. Checklist and Bibliography. – Ministry of Environment and Waters. Sofia: 73 (I-XIV & 1-130).

Beschovski, V. 1998. Contribution to the study of the distribution of the Parochthiphila species (Diptera, Chamaemyiidae). – Acta zoologica bulgarica, 50: 3-6.

Beschovski, V. 1998. The species from families Opomyzidae and Chloropidae (Diptera) established in the woodless zone of the National Park “Central Balkan” – Stara Planina Mountains. – Acta zoologica bulgarica, 50: 11-18.

Krusteva, H. & Beschovski, V. 1998. Studies on the species composition of Diptera order internal stem pests and damages caused by them on spring barley. – Acta zoologica bulgarica, 50, (1): 43-50.

Beschovski, V. & Dzambazov, B. 1998. New species from the family Empididae for the Bulgarian Fauna (Diptera, Empidoidea, Empididae). – Acta zoologica bulgarica, 50, (1): 57-59.

Beschovski, V. & Krusteva, H. 1998. Two new Elachiptera from Bulgaria (Insecta: Diptera: Chloropidae). – Reichenbachia, 32: 329-332.

Beschovski, V. 1998. Contribution to the study of the genus Leucopis Meigen, 1830 in Bulgaria (Diptera: Chamaemyiidae) with description of a new species. – Acta zoologica bulgarica, 50: 9-18.

Beschovski, V. 1998. Species from families Opomyzidae and Chloropidae (Diptera) from Rila mountain. – Acta entomologica bulgarica, (4), 1: 16-18 (in Bulgarian).

Hubenov, Z., Beshovski, V., Josifov, M., Kumanski, K., Popov, A., Sakalian, V., Abadjiev, S., Vidinova, Y., Ljubomirov, T. 1999. Entomofaunistic Diversity of the Central Balkan National Park. In: Sakalian, M. (managing editor). Biological Diversity of the “Central Balkan” National Park. Ministry of Environment and Waters of the Republic of Bulgaria & United State Agency for International Development: 333-377 & 558-606 (i-xii & 1-635) (in Bulgarian).

Hubenov, Z., Beshovski, V., Josifov, M., Kumanski, K., Popov, A., Sakalian, V., Abadjiev, S., Vidinova, Y., Ljubomirov, T. 1999. Entomofaunistic Diversity of the “Rila” National Park. In: Sakalian, M. (managing editor). Biological Diversity of the Rila National Park. Ministry of Environment and Waters of the Republic of Bulgaria & United State Agency for

International Development: 307-353 & 557-651 (i-xiv & 1-681) (in Bulgarian).
Beschovski, V. 1999. Contribution to the study of the genus Leucopis Meigen, 1830 in Bulgaria (Diptera: Chamaemyidae) with description of a new species. - Acta zoologica bulgarica, 50, (2&3): 9-18.
Hubenov, Z., Beshovski, V., Josifov, M., Popov, A., Kumanski, K., Sakalian, V., Abadjiev, S., Vidinova, Y., Lyubomirov, T. 2000. Entomofaunistic Diversity of the Central Balkan National Park. In: Sakalian, M. (managing editor). Biological Diversity of the Central Balkan National Park. Ministry of Environment and Waters of the Republic of Bulgaria & United State Agency for International Development: 319-362 & 538-586 (i-xii & 1-616).
Hubenov, Z., Beshovski, V., Josifov, M., Popov, A., Kumanski, K., Sakalian, V., Abadjiev, S., Vidinova, Y., Lyubomirov, T. 2000. Entomofaunistic Diversity of the Rila National Park. In: Sakalian, M. (managing editor). Biological Diversity of the Rila National Park. Ministry of Environment and Waters of the Republic of Bulgaria & United State Agency for International Development: 285-331 & 525-619 (i-xi & 1-649 & one unnumbered page).
Popov, A., Deltshev, C., Hubenov, Z., Beschovski, V., Dobrev, D., Guéorguiev, B. 2000. Invertebrate fauna. In: Meshinev, T. & Popov, A. (editors). High mountain treeless zone of the Central Balkan National Park. Biological Diversity and problems of its conservation. – Bulgarian-Swiss Biodiversity Conservation Programme. Sofia: 351-431 (1-562) (in Bulgarian).
Popov, A., Deltshev, C., Hubenov, Z., Beschovski, V., Dobrev, D., Guéorguiev, B. 2000. Invertebrate fauna. In: Popov, A. & Meshinev, T. (editors). High mountain treeless zone of the Central Balkan National Park. Biological Diversity and problems of its conservation. – Bulgarian-Swiss Biodiversity Conservation Programme. Sofia: 339-416 (1-562).
Dzhambazov, B. & Beschovski, V. 2000. New Records of Empidoidea Fauna from Bulgaria (Diptera: Atelestidae, Microphoridae, Hybotidae, Empididae). – Acta zoologica bulgarica, 52, (1): 3-7.
Beschovski, V. & Zatwarnicki, T. 2000. Faunistic Review of the Subfamily Discomyzinae in Bulgaria (Diptera: Ephydridae) with Some Data from Other Palaearctic Countries. – Acta zoologica bulgarica, 52, (1): 17-28.
Beschovski, V. & Georgieva, R. 2000. Contribution to the Study of the Bulgarian Lonchopteridae (Insecta: Diptera) with Data for Some Localities from Other Geographic Regions. – Acta zoologica bulgarica, 52, (1): 41-44.
Krasteva, H. & Beschovski, V. 2000. Studies on the Species Composition of Stem-boring Dipterous Pests and Damage Caused by Their Larvae on Oats. – Acta zoologica bulgarica, 52, (3): 29-36.
Beschovski, V. & Krusteva, H. 2001. Taxonomical characters in the black wheat flies. – Plant Protection. Sofia, 8&9: 16 (in Bulgarian).
Beschovski, V., 2001. Periscelididae – a New Family to the Bulgarian Fauna (Insecta: Diptera). – Acta zoologica bulgarica, 53, (1): 39 - 40.
Beschovski, V. & Zatwarnicki, T. 2001. Faunistic Review of the Subfamily Hydrelliinae (Insecta: Diptera: Ephydridae) in Bulgaria with Some Data from Other European Countries. – Acta zoologica bulgarica, 53, (3): 3-18.
Beschovski, V. & Zatwarnicki, T. 2001. Faunistic Review of the Subfamily Ilytheinae (Insecta: Diptera: Ephydridae) in Bulgaria with Some Data from Other European Countries. – Acta zoologica bulgarica, 53, (3): 19-26.
Van Zuijlen, J. & Beschovski, V. 2001. Notes on the Bulgarian Opomyzidae (Insecta: Diptera). – Acta zoologica bulgarica, 53, (3): 27-32.
Beschovski, V. & Zatwarnicki, T. 2002. Faunistic Review of the Subfamily Gymnomyzinae (Insecta: Diptera: Ephydridae) in Bulgaria with Some Data from Other European Countries. – Acta

zoologica bulgarica, 54, (1): 3-17.
Beschovski, V. & Dzhambazov, B. 2002. Dolichopodidae Taxa Known and New to the Bulgarian Fauna (Diptera: Empidoidea). – Acta zoologica bulgarica, 54, (1): 19-26.
Beschovski, V. 2004. Diptera Brachycera recorded for the Eastern Rhodopes (Bulgaria). In: Beron P. & Popov A. (editors). Biodiversity of Bulgaria. 2. Biodiversity of Eastern Rhodopes (Bulgaria and Greece). – Pensofft Publishers & National Museum of Natural History. Sofia: 741-757 (1-951).
Beschovski, V. & Zatwarnicki, T. 2004. Faunistic Review of the Subfamily Ephydrinae in Bulgaria (Insecta: Diptera, Ephydridae) with Some Data from Other European Countries. – Acta zoologica bulgarica, 56: 3-17.
Beschovski, V. 2004. Review of Families Milichiidae and Carnidae from Bulgaria (Insecta: Diptera). – Acta zoologica bulgarica, 56: 129-135.
Beschovski, V. 2004. Genus Kesselimyia, K. chandleri and Subfamily Platypezidae (Insecta: Diptera, Platypezidae) – New Taxa to the Bulgarian Fauna. – Acta zoologica bulgarica, 56: 237-238.
Beschovski, V. 2006. Diptera Brachycera (Insecta) established in the Western Rhodopes Mountains (Bulgaria). In: Beron, P. (editor). Biodiversity of Bulgaria. 3. Biodiversity of Western Rhodopes (Bulgaria and Greece). I. – Pensoft & National Museum of Natural History. Sofia: 617-674 (1-974).
Beschovski V. 2006. Faunistic review of some Nematocera families (Diptera) established in the Western Rhodopes (Bulgaria). In: Beron, P. (editor). Biodiversity of Bulgaria. 3. Biodiversity of Western Rhodopes (Bulgaria and Greece). I. – Pensoft & National Museum of Natural History. Sofia: 729-752 (1-974).
Beschovski, V. 2007. Review of the Small Ephydroidea Families (Diptera: Brachycera). – Acta zoologica bulgarica, 59: 29-32.
Beschovski, V. & Marinov, M. 2007. Fauna, Ecology, and Zoogeography of Dragonflies (Insecta: Odonata) of Bulgaria. In: Fet, V. & Popov A. (editors). Biogeography and Ecology of Bulgaria. Monographiae Biologicae. Volume 82. - Springer. Dordrecht: 199-231 (1-687).
Beschovski, V. 2008. Additional Records and Corrections on the Oscinellinae Fauna (Diptera: Chloropidae) of Bulgaria. – Acta zoologica bulgarica, 60: 51-59.
Beschovski, V. 2009. Fauna Bulgarica. 28. (Insecta: Diptera: Ephydridae, Tethinidae, Canacidae). – Edition Academica “Prfessor Marin Drinov”. Sofia: 1-422 (in Bulgarian).
Beschovski V. 2012. Two genera of Long-legged Flies (Diptera: Dolichopodidae) new for the fauna of Bulgaria. – ZooNotes, 29: 1-2.
Beschovski, V. 2013. Dolichopus species (Diptera: Dolichopodidae) in the Entomological Collection of the Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences. – ZooNotes, 38: 1-4.
Beschovski, V. 2013. Catalogus Fauna Bulgaricae. 8. Carnoidea. Insecta, Diptera Brachycera Acaliptratae. – Prof. Marin Drinov Academic Publishing House: 1-152.
Beschovski V. 2013. Additions and corrections to the species list of the Bulgarian Chloropinae (Diptera: Chloropidae). – ZooNotes, 40: 1-4.

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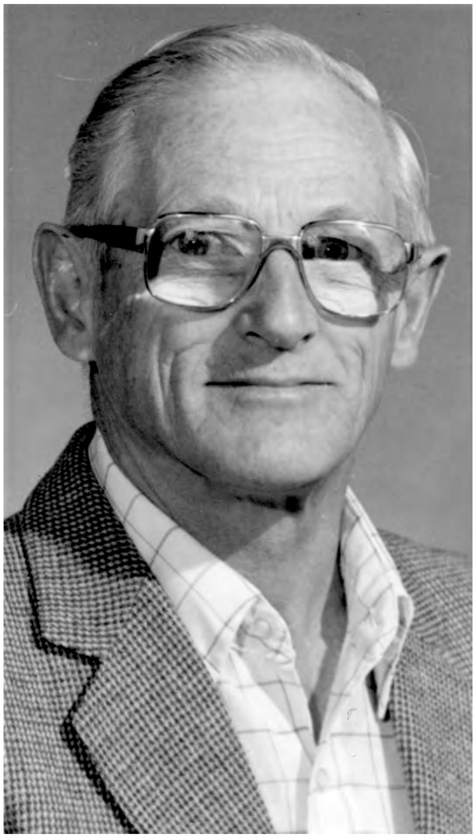
James Francis (Frank) McAlpine
(September 25, 1922 – December 3, 2019)

Jeffrey M. Cumming & D. Monty Wood

Canadian National Collection of Insects, Agriculture and Agri-Food Canada,
960 Carling Ave., Ottawa, Ontario, K1A 0C6, Canada



Frank McAlpine passed away peacefully in Ottawa at the age of 97 after a happy and productive life. We have written a tribute in recognition of his prolific entomological career, which can be found in the March 2020 Bulletin of the Entomological Society of Canada, volume 52(1) at https://esc-sec.ca/wp-content/uploads/2020/03/Bulletin-Volume52-number1-March2020.pdf

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MEETING NEWS

The 7th Symposium of Diptera at the 33rd Brazilian Congress of Zoology

Diego Aguilar Fachin[1], Tiago Kütter Krolow[2] & Paloma Helena Fernandes Shimabukuro[3]

[1] Laboratório de Morfologia e Evolução de Diptera, Departamento de Biologia, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto – FFCLRP, Universidade de São Paulo – USP, Av. Bandeirantes 3900, 14040–901, Ribeirão Preto, São Paulo, Brazil; diegoafachin@gmail.com

[2] Laboratório de Entomologia (LabEnt), Universidade Federal do Tocantins – UFT, Cx. Postal 136, 77500-000, Porto Nacional, Tocantins, Brazil; tkkrolow@gmail.com

[3] Grupo de Estudos em Leishmanioses/Coleção de Flebotomíneos (FIOCRUZ/COLFLEB), Instituto René Rachou/FIOCRUZ-Minas, Avenida Augusto de Lima, 1715, 30190-009, Barro Preto, Belo Horizonte, Minas Gerais, Brazil; palomahfs@gmail.com

Between the 2nd to 6th of March 2020, Brazilian zoologists assembled to participate in the *33rd Brazilian Congress of Zoology* held in Águas de Lindóia, in the state of São Paulo, Brazil, while dipterists met at the *7th Symposium of Diptera*, one of the 29 satellite symposia conducted during the Congress.

The first symposium focused on Diptera in Brazil was held in 2008, and was organized by Vera Cristina Silva, as part of the *27th Brazilian Congress of Zoology* held in Curitiba, in the state of Paraná. Twelve years have now passed since then, with our Symposium occurring biannually as part of the Congress. In all seven of the editions of the Symposium, dipterists from many states in Brazil, as well as many from abroad, have used this event to share and present the results of their studies, dissertations, theses, and projects, and to strengthen collaborations. It has also been a place for discussion of major issues concerning the Brazilian community of Dipterists, such as medium- and long–term goals, collections, funding, and collaborative initiatives and projects that involve and impact all researchers in this subject area.

After three editions headed by Carlos José Einicker Lamas (2014, 2016, and 2018), one by Carlos and Silvio Shigueo Nihei (2012) and, before them, two by Vera Cristina Silva (2008 and 2010), the 2020 symposium was organized by Kirstern Lica Follmann Haseyama and Paloma Helena Fernandes Shimabukuro. Here, on behalf of the Diptera community in Brazil, we would like to express special thanks to Vera, Silvio and Carlos for their wonderful and hard work all these years, leading and keeping the Diptera symposium alive and well.

So, what happened at the event this year? In the two days of the Symposium (Thursday 5th to Friday 6th of March 2020), the scientific program consisted of 9 talks of 30 minutes each, 10 selected oral presentations of 15 minutes each, 46 posters, and 2 open discussions of 2 hours each. On the first day, 6 of 9 talks and all 10 oral presentations were held. On the second day, the remaining 3 talks and, after lunch, a round-table discussion on Diptera collections and then a Diptera Forum took place (see details on them below). The 9 talks were of high quality, and a brief summary is that they were on the subjects of taxonomy, evolutionary relationships based on phylogenomics, ecology, morphology, fossils, and collections, and with each discussing different dipteran families. Among these, the talk entitled “Researchers in Network: initiatives for the Brazilian Dipterist community” was of great relevance, because it reported an updated "who's who" database of Brazilian dipterists (including professors, researchers, postdocs and students), their host institutions, projects and personal data (age, sex, city, etc.), and which dipteran families they have been working on, collecting or have an interest in. The idea for this database began at the 6th Symposium in 2018, with an online survey sent by Lica, Paloma, Rafaela Lopes Falaschi and Frederico Dutra Kirst, and now its first results are coming out. It is part of a bigger collaborative project (see below) to strengthen our community by knowing who we are, our needs, and main problems, and hoping that this self-knowledge will bring opportunities to connect, improve and help each other.

Overall, a total of 890 abstracts (oral and poster presentations) on Zoology were presented at the Congress, dealing with a huge variety of animal taxa and different aspects of them (i.e., taxonomy, phylogeny, ecology, behavior, etc.). Of these, a total of 114 involved Diptera (12.8 % of all abstracts) and 36 of the families in this order (Fig. 1). Given the economic, forensic and public health importance, some families – among them Tephritidae, Calliphoridae, and Culicidae – had a high number of abstracts submitted to other symposia. In the Diptera Symposium alone, 56 abstracts (nearly half of all those on Diptera) were submitted and presented during the two days, 10 of which were as oral presentations (mentioned above) and the other 46 as posters, mostly on systematics. In total, 20 different dipteran families were treated in these 56 presentations, with: Psychodidae and Stratiomyidae as the main subject in six studies each; followed by Drosophilidae in five; Dolichopodidae, Muscidae and Odiniidae in four; and Mycetophilidae and Keroplatidae in three (Fig. 2). Together with the talks, at least 25 families were formally presented in the Symposium (Fig. 2). In fact, when all symposia at the Congress are considered, research on 36 families was reported (see Fig. 1), with Tephritidae having 12 abstracts, followed by Psychodidae with seven, and the remaining in a similar order as presented above, but including Calliphoridae and Cecidomyiidae among the most discussed. It is worth mentioning that this summary does not take into consideration abstracts placed into the category of "faunal surveys", which included oral presentations such as "The Diptera checklist in the Maracá Ecological Station" and "The Diptera checklist in the Fernando de Noronha Island", which could have raised the number of families treated to nearly a hundred.

Among the authors (professional and student delegates), as expected, the majority (99%) were Brazilians, but we were very pleased to have some colleagues from Colombia, Guyana, and the USA as coauthors of some studies, such as Martin Hauser (USA) on Stratiomyidae and Steve Gaimari (USA) on Odiniidae.

At the end of the meeting, we took a Symposium photo (Fig. 3) but unfortunately not including all the delegates who attended, and without many other dipterists that could not attend the event this time. The abstract volume can be provided on demand by e-mail to one of us.

In conclusion, Brazil has a large community of dipterists, and this has increased even more in recent years. So, the Symposium represents an opportunity to share our discoveries, and find the means to develop dipterological research in our country and continent. It also fills a gap and need in the conference calendar, as the *International Congress of Diptera* only occurs every four years, and can be expensive for many professionals and students.

We are looking forward to the next meeting, which will be in 2022. Yes, the same year of the next *ICD* to be hosted in California, but we hope not competing, as our Symposium will be earlier in the year. Having two Diptera events in the same year is a dream we want never to wake up from!

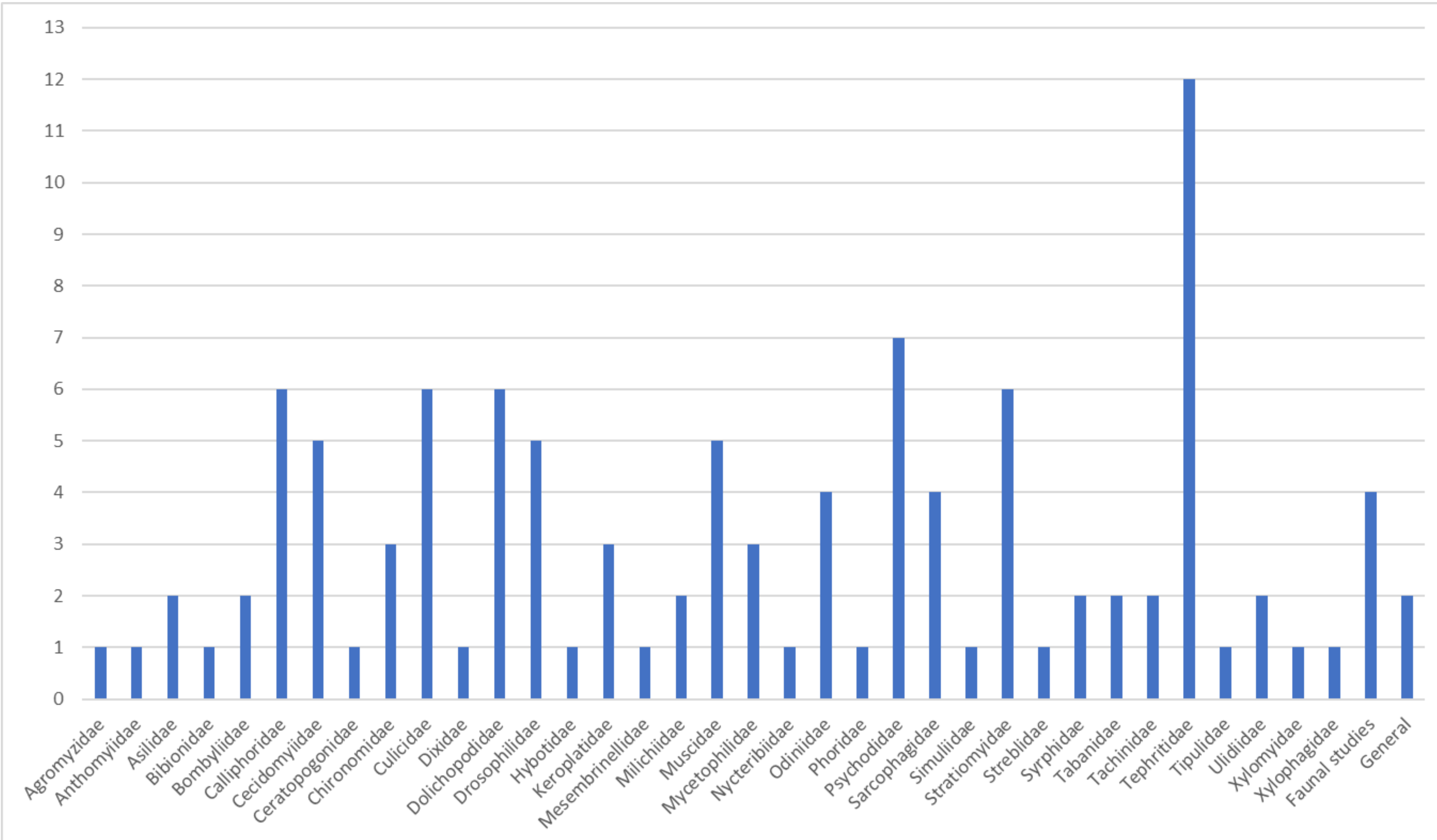

Figure 1. All Diptera families treated at *the 33rd Brazilian Congress of Zoology*, including also the studies exclusively presented at the *7th Diptera Symposium* (Fig. 2).

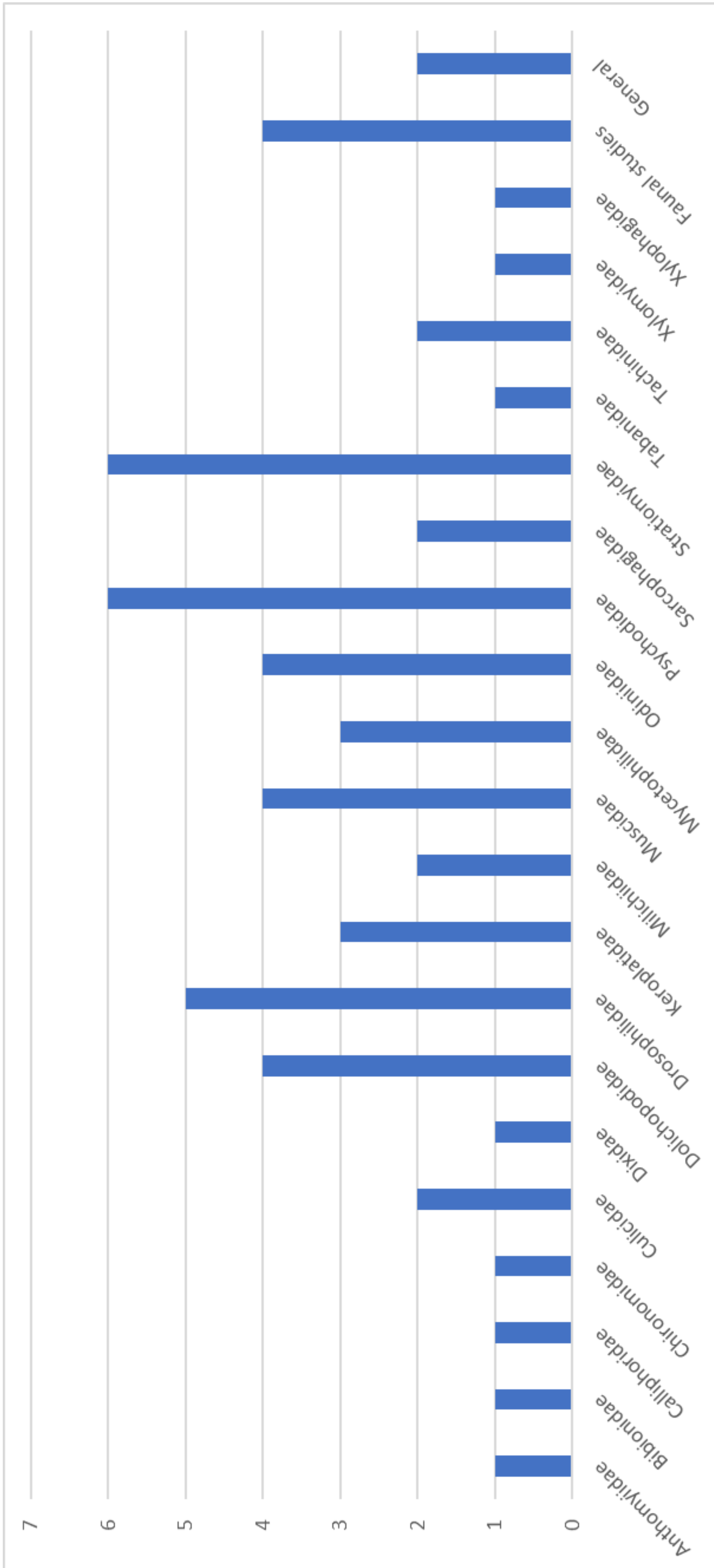

Figure 2. All Diptera families treated in oral and poster presentations at the *7th Diptera Symposium*.

Figure 3. Group photo of some of the attendees of the *7th Diptera Symposium*. (inset, 1. Matheus Miguel da Silva Sá; 2. Rita de Cássia de Oliveira Santos; 3. Melquisedeque Valente Campos; 4. Maycon Neves; 5. Danilo César Ament; 6. Frederico Dutra Kirst; 7. Marlúcia Bonifácio Martins; 8. Maria Clara Alves Santarem; 9. Barbara Proença do Nascimento; 10. Lívia Maria Frare; 11. Caio Cezar Dias Corrêa; 12. Gabriel Santos Vieira; 13. Cátia Antunes de Mello-Patiu; 14. Larissa Thans Carneiro; 15. Paula Raile Riccardi; 16. Claudemir Patiu; 17. Renato Soares Capellari; 18. Sávio Cunho Costa; 19. Samuel Wagner Tiburi Silveira; 20. Agostinho Cardoso Nascimento Pereira; 21. Paulino Siqueira Ribeiro; 22. Freddy Bravo Quijano; 23. Marco Antônio Menezes; 24. Welinton Ribamar Lopes; 25. Kirstern Lica Follmann Haseyama; 26. Claudio José Barros de Carvalho; 27. Márcia Souto Couri; 28. Paloma Helena Fernandes Shimabukuro; 29. Carlos José Einicker Lamas; 30. Maria Virgínia Urso-Guimarães; 31. Francisco Limeira de Oliveira; 32. Diego Aguilar Fachin; 33. Tiago Kütter Krolow; 34. Inezita Catanhede Lima Neta; 35. Luana Machado Barros; 36. Ana Alice Tôrres de Sousa; 37. Matheus Mickael Mota Soares; and 38. Paulo César da Silva.

Diptera Forum

The idea of having an integrated "Diptera Network" in Brazil has been discussed in previous *Diptera Symposia*, in which many colleagues expressed the need for an online space (e.g., website) where the community of dipterists could share information on different subjects (e.g., collections, fieldwork, sharing/exchange of material, references, etc.).

The first step towards the creation of the network was an initial online survey undertaken in 2018 to better understand who we are, following which we then proposed the creation of the "Rede de Dipteristas do Brasil" (Network of Dipterists from Brazil), whose realization is already underway. The idea is to be as inclusive as possible, so there is free membership without charging any fees, and to have all Brazilian dipterists databased (professionals and students, active and non-active) and collaborating with the network of their own volition and to serve as a source of knowledge for the community. After spreading the word during the two last months, we so far have more than 105 people registered in the database, of which 79 want to actively participate, while 26 are either retired or deceased, and have integrated this with previous records of Brazilian dipterists kindly provided by Claudio José Barros de Carvalho. To be part of the network, one only needs to access the page <https://docs.google.com/forms/d/e/1FAIpQLSdEBAxrwj1uP0w8xbz5SIxWpoqjPm-a3aj1LtQNX6L2nmXJKA/viewform?fbzx=6235831508920913601>, and to fill out a form which will work as a directory or a "who's who" available at: <https://docs.google.com/spreadsheets/d/1YrywA7DuwekzlejWi_wHatHW-7yHFE56YsgSNJHRL4A/edit?usp=sharing>.

The network *Rede de Dipteristas do Brasil* should foster communication among its members, with the aim of discussing and promoting initiatives to address any problems that affect the community as a whole, or just some of its members (i.e., training, events, preparation of technical documents, sharing of material and references, etc.). A set of directives was created through a 15-day public consultation of all members, a final version of which is available here: < https://drive.google.com/file/d/1ABsdA9J2vt-YqkqnIpxYutz1_kyO7dcL/view>.

The proposal is to build a non-hierarchical network, in a way that decision-making structures should be horizontal rather than vertical, so no one dominates anyone else or has priority over others or resources. We choose not to define an individual person or group to lead, mainly because most of us are already very busy and sharing tasks among a larger group of people seems more likely to engage everyone in the construction and maintenance of the network, rather than concentrating interactions among a small group of individuals. Specific actions for the construction of the network will be conducted by workgroups for which anyone can volunteer, and these will have the freedom to define and organize themselves on their own terms. These volunteers will work for a limited period of time to avoid overwork. The workgroups will initially be in charge of: (i) developing a website for the network to contain data on the Brazilian dipterists; (ii) test and implement different tools for communication among people; (iii) produce a magazine; (iv) produce a platform to share information on collecting sites, projects and expeditions, and to promote the exchange of fieldwork samples.

So far, we have an e-mail address (redediptera@gmail.com), a Google Groups e-mail list with 95 members, a *WhatsApp* group with 80 members, a *workspace* in the online platform *Slack* with 49 members, and a *Facebook* page: https://www.facebook.com/Rede-de-Dipteristas-106127387665174/. Right now, we are looking to recruit volunteers for the workgroups, so that soon we will have a website, a platform for sharing field samples between labs, and news from Brazil to be published in our network magazine.

We would like to thank everyone for their collaboration in the construction of the document stating our directives, and in the discussions that generated the initiatives described above. We hope the network will have a prosperous life, and become a hub for Brazilian dipterists to interact and be productive.

Round-table discussion on Diptera collections

Brazil is world famous for its biodiversity – the Amazon rainforest and beautiful beaches – and also for its large cities, such as Rio de Janeiro and São Paulo, but what is less appreciated is that Brazil is the largest country in South America, occupying almost 50% of the continent, which is divided into 27 federative units (or states) and covered by different types of biomes. Many of these federative units are far from large centers, lack public investment and shortage of specialized professionals, but all of them have in common the presence of public universities (federal and/or state). Such universities have a crucial role in the formation of human resources and in the preservation of Brazilian biodiversity, as in them research is developed at local and regional levels, providing a large database and biological samples. Often the accumulation of biological samples in these regions requires the creation of local and/or regional collections. However, the material gathered and accumulated over many years and held in these collections, as well as the difficulties that curators of them have faced, are poorly known by most people. Considering the relevance and importance of this subject given the current threats to biodiversity, the round-table discussion was on "The Diptera collections outside the major centers: challenges and prospects".

For this, four Diptera researchers from different regions of Brazil (from the north to the south) were invited to present their work and the collections they represent:

- ✓ Freddy Ruben Bravo Quijano
  - Talk: "Strategies to overcome Linnean and Wallacean shortfalls in Diptera in the state of Bahia and semi-arid region"
  - Institution: Universidade Estadual de Feira de Santana (UEFS)
- ✓ Frederico Dutra Kirst
  - Talk: "Diptera diversity of Pampa biome"
  - Institution: Universidade Federal de Pelotas (UFPEL)/ Universidade Federal de Minas Gerais (UFMG)
- ✓ Francisco Limeira-de-Oliveira
  - Talk: "A brief history of "the unknown" of the known about some groups of Diptera from the collection of the Zoological Collection of Maranhão – CZMA"
  - Institution: Universidade Estadual do Maranhão (UEMA)
- ✓ Tiago Kütter Krolow
  - Talk: "The UFT Entomology Collection and its contribution to the knowledge of Diptera in Tocantins"
  - Institution: Universidade Federal do Tocantins (UFT)

Many subjects were discussed by the speakers, but most emphasized were the difficulties with organizing and maintaining the collections (i.e., issue related to infrastructure, financial resources and technical staff), and the lack of recognition of their importance by institutional managers. On the other hand, all the speakers presented with great enthusiasm the results of their work, whether through the publication of scientific papers or the development of monographs, dissertations and theses. Another two points highlighted were: (i) the importance of local collections for the knowledge of biodiversity in unexplored or little explored areas, as they are often the only samples from a given region or ecosystem (which sometimes no longer exist), and (ii) their key role in providing specimens from these areas to other researchers, allowing the expansion of the records of occurrence of certain species or even the description of new taxa.

After the presentations by each speaker, a round-table discussion was opened to all for questions and debate. The audience showed great concern regarding the difficulties and specific demands of local collections. Several proposals were discussed on how to strengthen and encourage the continuity of these collections, such as: donation of materials (pins, drawers, boxes for insects), donation/exchange of specimens, training to identify specimens, partnerships with larger collections, etc. At the end, there was consensus on the importance of a network of Brazilian dipterists for the accomplishment of these actions.

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DIPTERA ARE AMAZING!

We had several great submissions from Gina Durham Ballard, Bob Parks, Greg Courtney and Isaí Madriz. Thanks so much for the wonderful photos!

Hexatoma austera (Doane) (Limoniidae), mating pair on gravel bar, Shell Creek, Big Horn County, Wyoming, 25 June 2019 [Thanks to Jon Gelhaus for identification]. Photo by Greg Courtney.

Hexatoma austera (Doane) (Limoniidae) males aggregating at night, Shell Creek, Big Horn County, Wyoming, 25 June 2019 [Thanks to Jon Gelhaus for identification]. Photo by Greg Courtney.

Stacked image of female *Neoderus chonos* Madriz (Tanyderidae). Photo by R. Isaí Madriz

Deuterophlebia vernalis Courtney (Deuterophlebiidae) larva, Major Creek, Klickitat County, Washington, 18 March 2018. Photo by Greg Courtney.

Agathon markii (Garrett) (Blephariceridae) larva ready to pupate, Windfall Creek, Mineral County, Montana, 30 June 2019. Photo by Greg Courtney.

Stichopogon trifasciatus (Say) (Asilidae) from Bear Canyon, Huachuca Mountains, Cochise County Arizona, 3 August 2009. Prey is a species of *Geron* Meigen (Bombyliidae). Photos by Bob Parks.

Efferia mortensoni Wilcox (Asilidae), San Pedro Riparian Area, Cochise County Arizona, 9 October 2009. Prey *Poecilanthrax poecilogaster* (Osten Sacken) (Bombyliidae). Photo by Bob Parks.

Promachus atrox Bromley (Asilidae), photographed in the Huachuca Mountains, Cochise County Arizona. Photo by Bob Parks.

Stenopogon Loew (Asilidae) species, near Hereford, Arizona, in the foothills of the Huachuca Mountains, 16 September 2009. Photo by Bob Parks.

Proctacanthella Bromley (Asilidae) species with male leaf cutter bee *Megachile*. Photo by Bob Parks.

Odontoloxus longicornis (Coquillett) (Neriidae) on an Emory oak. There were several coming to a gall that was exuding fluid as were several beetles. The glob of fluid is from the gall. Hereford, Arizona. Photo by Bob Parks.

Exoprosopa Macquart (Bombyliidae) species, Hereford, Cochise County, Arizona, 30 September 2007. Photo by Bob Parks.

Geminaria canalis (Coquillett) (Bombyliidae), Madera Canyon, Santa Cruz County Arizona. Photo by Bob Parks.

Black-shouldered Drone Fly, *Eristalis dimidiata* (Wiedemann) (Syrphidae) female, Hurricane Mills, Tennessee, 22 April 2020. Photo by Gina Durham Ballard.

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DIPTERIST LAIRS

Many of you heeded my call for photos of your "home-Diptera-space" in this time of world isolation during the Covid-19 pandemic. Thanks to Greg Dahlem for the excellent suggestion!

Greg Dahlem in his Bug Lab

Adrian Plant in his improvised home space in Mahasarakham, Thailand.

Thomas Pape on lockdown at home in Denmark

Greg Courtney trying not to get too distracted by the river valley in the back yard in Iowa

Rob Cannings in his home lab in Victoria, British Columbia

Robin Gray in her home office in Nevada

Adrian Pont in his home office in the UK

Terry Whitworth's home office space in Washington state

Armin Namayandeh working on chironomids

George Foster working in his home space

Art Borkent has been practicing social distancing since 1988 when he moved from Ottawa to Salmon Arm, British Columbia to work independently

Art shares his space with his Klingon half-brother jagh ylbusStaH (jag for short)

And finally, yours truly, editor Steve Gaimari, in his home office editing this issue of Fly Times!

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BOOKS AND PUBLICATIONS

Hopefully, you are all staying happy and healthy in these crazy times. Here is the latest offering of Diptera related papers to help fill those hours in the back garden or in the home office 😊

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.

Abdelsalam K. M. 2019. First record of a larva of the dipteran genus *Aphrosylus* Haliday, 1851 (Dolichopodidae) from the Egyptian Mediterranean Sea. Polish Journal of Entomology **88 (1):** 79–92. DOI: 10.2478/pjen-2019-0006

Adams, R.M.M., Wells, R.L., Yanoviak, S.P., Frost, C.J. and Fox, E.G.P. 2020. Interspecific eavesdropping on ant chemical communication. Frontiers in Ecology and Evolution **8**. doi:10.3389/fevo.2020.00024.

Adler, P.H., Fukuda, M., Takaoka, H., Reeves, W.K., Kim, S.-K. and Otsuka, Y. 2020. Revision of *Simulium rufibasis* (Diptera: Simuliidae) in Japan and Korea: Chromosomes, DNA, and morphology. Journal of Medical Entomology **57(2)**: 388-403. doi:10.1093/jme/tjz197.

Amaral, A.P., Mariano, R. and Pinho, L.C. 2019. Four new species and some new records of Brazilian frog-biting midges (Diptera: Corethrellidae). Zootaxa **4706(1)**: 103-120. doi:10.11646/zootaxa.4706.1.4.

Amorim, D.S. and Brown, B.V. 2020. Urban Scatopsidae (Diptera) of Los Angeles, California, United States. Insect Systematics and Diversity **4(1):** 1-41.

Amorim, D.S. and Greenwalt, D.E. 2020. Cretaceous and Eocene fossils of the rare extant genus *Synneuron* Lundstrom (Diptera: Canthyloscledidae): evidence of a true Pangean clade. Cladistics. doi:10.1111/cla.12413.

Anbalagan, S., Vijayan, S., Balachandran, C., Thiyonila, B. and Surya, A. 2020. Two new species of *Simulium* (*Gomphostilbia*) (Diptera: Simuliidae) from South India. Zootaxa **4742(1)**: 57-72. doi:10.11646/zootaxa.4742.1.3.

Anooj, S.S., Kalia, V., Krishna, G.K. and Ghopade, K.D. 2020. New biogeographic distribution record of phytophagous syrphid, *Eumerus vestitus* Bezzi, its biosystematics, host preferences and association behavior. International Journal of Tropical Insect Science. doi:10.1007/s42690-020-00100-3.

Araujo, M.X. and Bravo, F. 2020. Two new species of *Australopericoma* Vaillant (Diptera: Psychodidae: Psychodinae) from the Brazilian Atlantic Rainforest. Zootaxa **4732(2)**: 317-322. doi:10.11646/zootaxa.4732.2.6.

Arias-Robledo, G., Wall, R., Szpila, K., Shpeley, D., Whitworth, T., Stark, T., King, R.A. and Stevens, J.R. 2019. Ecological and geographical speciation in *Lucilia bufonivora*: The evolution of amphibian obligate parasitism. International Journal for Parasitology-Parasites and Wildlife **10**: 218-230. doi:10.1016/j.ijppaw.2019.09.005.

Baechli, G. and Vilela, C.R. 2020. On the identity of *Paracacoxenus kaszabi* Okada, with the formal description of a new closely related species (Diptera, Drosophilidae). Alpine Entomology **4**: 1-20.

Bartlett, J.C., Convey, P., Pertierra, L.R. and Hayward, S.A.L. An insect invasion of Antarctica: the past, present and future distribution of *Eretmoptera murphyi* (Diptera, Chironomidae) on Signy Island. Insect Conservation and Diversity: 14. doi:10.1111/icad.12389.

Baur, J., Giesen, A., Rohner, P.T., Blanckenhorn, W.U. and Schafer, M.A. Exaggerated male forelegs are not more differentiated than wing morphology in two widespread sister species of black scavenger flies. Journal of Zoological Systematics and Evolutionary Research: 15. doi:10.1111/jzs.12327.

Baur, J., Roy, J., Schafer, M.A., Puniamoorthy, N., Blanckenhorn, W.U.B. and Rohner, P.T. 2020. Intraspecific mating system evolution and its effect on complex male secondary sexual traits: Does male-male competition increase selection on size or shape? Journal of Evolutionary Biology **33(3)**: 297-308. doi:10.1111/jeb.13565.

Beebe, N.W. 2018. DNA barcoding mosquitoes: advice for potential prospectors. Parasitology **145(5)**: 622-633. doi:10.1017/s0031182018000343.

Begosh, A., Smith, L.M., Park, C.N., McMurry, S.T. and Lagrange, T.G. 2019. Effects of wetland presence and upland land use on wild hymenopteran and dipteran pollinators in the Rainwater Basin of Nebraska, USA. Wetlands. doi:10.1007/s13157-019-01244-w.

Behrstock, R.A., Sullivan, P.H., Moran, K.M. and Hauser, M. 2020. First records of *Copestylum opinator* (Williston, 1891) (Diptera: Syrphidae) for the United States. Pan-Pacific Entomologist **96(1)**: 31-36. doi:10.3956/2020-96.1.031.

Berrones-Morales, M., Vanoye-Eligio, V., Coronado-Blanco, J.M., Gaona-Garcia, G. and Sanchez-Ramos, G. 2020. Species diversity of fruit flies (Diptera: Tephritidae) through different ecosystems in a Neotropical transition zone in Mexico. Journal of Insect Conservation **24(1)**: 219-231. doi:10.1007/s10841-019-00192-4.

Billingham, Z.D. and Theischinger, G. 2019. A new species of *Atarba* Osten Sacken from Victoria, Australia (Diptera: Limonidae). Australian Entomologist **46(4)**: 161-166.

Blagoderov, V., Krzemnski, W. and Skibinska, K. 2019. A new species of *Micrepimera* Matile (Diptera: Keroplatidae) from Baltic Amber. Palaeoentomology **2(6)**: 643-649.

Blanckenhorn, W.U., Baur, J., Busso, J.P., Giesen, A., Gourgoulianni, N., van Koppenhagen, N., Roy, J., Schaefer, M.A., Wegmann, A. and Rohner, P.T. 2020. Sexual size dimorphism is associated with reproductive life history trait differentiation in coexisting sepsid flies. Oikos. doi:10.1111/oik.07036.

Bouchard, R.W., Jr. and Gelhaus, J.K. 2020. First record of a skating crane fly: The unusual ecology, behavior, and morphology of *Phantolabis lacustris* (Alexander, 1938) (Diptera:Limoniidae) with descriptions of the immature stages. Freshwater Science **39(1)**: 86-100. doi:10.1086/707406.

Boudot, J.-P., Havelka, P. and Martens, A. 2019. The biting midge *Forcipomyia paludis* as a parasite of Odonata in North Africa (Diptera: Ceratopogonidae). Notulae Odonatologicae **9(4)**: 164-168.

Brousseau, P.-M., Giroux, M. and Handa, I.T. 2020. First record on the biology of *Sarcophaga* (*Bulbostyla*) (Diptera, Sarcophagidae). Zookeys **(909)**: 59-66. doi:10.3897/zookeys.909.46488.

Brown, B.V. and Vendetti, J.E. 2020. *Megaselia steptoeae* (Diptera: Phoridae): specialists on smashed snails. Biodiversity Data Journal **8**. doi:10.3897/BDJ.8.e50943.

Bruno, D., Bonelli, M., Cadamuro, A.G., Reguzzoni, M., Grimaldi, A., Casartelli, M. and Tettamanti, G. 2019. The digestive system of the adult *Hermetia illucens* (Diptera: Stratiomyidae): morphological features and functional properties. Cell and Tissue Research **378(2)**: 221-238. doi:10.1007/s00441-019-03025-7.

Budiaman, A., Haneda, N.F., Indahwati, Febrian, D. and Rahmah, L.N. 2020. Temporal effects of cutting intensity on Diptera assemblages in eastern Borneo rainforest Indonesia. Biodiversitas **21(3)**: 1074-1081.

Buenaventura, E., Szpila, K., Cassel, B.K., Wiegmann, B.M. and Pape, T. 2020. Anchored hybrid enrichment challenges the traditional classification of flesh flies (Diptera: Sarcophagidae). Systematic Entomology **45(2)**: 281-301. doi:10.1111/syen.12395.

Burdikova, N., Kjaerandsen, J., Lindemann, J.P., Kasprak, D., Tothova, A. and Sevcik, J. 2019. Molecular phylogeny of the Paleogene fungus gnat tribe Exechiini (Diptera: Mycetophilidae) revisited: Monophyly of genera established and rapid radiation confirmed. Journal of Zoological Systematics and Evolutionary Research **57(4)**: 806-821. doi:10.1111/jzs.12287.

Burington, Z.L., Inclan-Luna, D.J., Pollet, M. and Stireman, J.O., III. 2020. Latitudinal patterns in tachinid parasitoid diversity (Diptera: Tachinidae): a review of the evidence. Insect Conservation and Diversity. doi:10.1111/icad.12416.

Byriel, D.B., Schmidt, I.K., Justesen, M.J., Pape, T., Hansen, A.K., Riis-Nielsen, T. and Kepfer-Rojas, S. 2020. Forest management affects crane fly (Tipuloidea) community structure through changes in edaphic conditions. Forest Ecology and Management **457**. doi:10.1016/j.foreco.2019.117756.

Caitano, B., Chaves, T.P., Dodonov, P. and Delabie, J.H.C. 2020. Edge effects on insects depend on life history traits: a global meta-analysis. Journal of Insect Conservation **24(2)**: 233-240. doi:10.1007/s10841-020-00227-1.

Camier, M. and Nel, A. 2020. The oldest fungus gnat of the tribe Exechiini in the lowermost Eocene Oise amber (Diptera: Mycetophilidae). Zootaxa **4722(1)**: 91-98. doi:10.11646/zootaxa.4722.1.9.

Campoy, A., Saez, L., Perez-Banon, C. and Rojo, S. 2020. Demography and population parameters of two species of eristaline flower flies (Diptera, Syrphidae, Eristalini). Journal of Applied Entomology **144(1-2)**: 133-143. doi:10.1111/jen.12717.

Cannings, R.A., Ehlers, T., Manweiler, A., Kohler, T., Hayes, E. and Knopp, D. 2019. *Promachus dimidiatus* Curran (Diptera: Asilidae): a robber fly genus and species new to British Columbia. Journal of the Entomological Society of British Columbia **116**: 59-63.

Cannings, R.A. and Gibson, J.F. 2019. *Toxonevra muliebris* (Harris) (Diptera: Pallopteridae): a European fly new to North America. Journal of the Entomological Society of British Columbia **116**: 64-68.

Capellari, R.S. and Bickel, D.J. 2020. New or little-known Neotropical Dolichopodidae (Diptera) (I): the enigmatic genus *Notobothrus* Parent. Journal of Insect Biodiversity **15(1)**: 16-21.

Castelli, L.E., Gleiser, R.M. and Battan-Horenstein, M. 2020. Role of saprophagous fly biodiversity in ecological processes and urban ecosystem services. Ecological Entomology **45(3)**: 718-726. doi:10.1111/een.12849.

Cerretti, P., Badano, D., Gisondi, S., Lo Giudice, G. and Pape, T. 2020. The world woodlouse flies (Diptera, Rhinophoridae). Zookeys**(903)**: 1-130. doi:10.3897/zookeys.903.37775.

Chen, L. and Porter, S.D. 2020. Biology of *Pseudacteon* decapitating flies (Diptera: Phoridae) that parasitize ants of the *Solenopsis saevissima* complex (Hymenoptera: Formicidae) in South America. Insects **11(2)**. doi:10.3390/insects11020107.

Chesters, D. 2019. The phylogeny of insects in the data-driven era. Systematic Entomology. doi:10.1111/syen.12414.

Chroni, A., Stefanovic, M., Djan, M., Vujic, A., Zoric, L.S., Tubic, N.K. and Petanidou, T. Connecting the dots: Bridging genetic and spatial differentiation of the genus *Eumerus* (Diptera: Syrphidae) in the Mediterranean Basin and Balkans. Journal of Zoological Systematics and Evolutionary Research: 18. doi:10.1111/jzs.12300.

Chua, K.S., Borkent, A. and Wong, S.Y. 2020. Floral biology and pollination strategy of seven *Tacca* species (Taccaceae). Nordic Journal of Botany **38(2)**. doi:10.1111/njb.02594.

Chursina M.A., Grichanov I.Ya. 2019. Analysis of the differences between *Syntormon pallipes* and *S. pseudospicatus* (Diptera: Dolichopodidae): morphological and molecular data. Zoosystematica Rossica, **28(2):** 305-316. DOI 10.31610/zsr/2019.28.2.305

Chursina M.A., Negrobov O.P. 2020. Legs morphometric characters of the *Dolichopus* Latreille, 1796 species (Diptera, Dolichopodidae). Samarskii nauchnyi vestnik, **9(1):** 106-112.

Common, L.K., O'Connor, J.A., Dudaniec, R.Y., Peters, K.J. and Kleindorfer, S. 2020. Evidence for rapid downward fecundity selection in an ectoparasite (Philornis downsi) with earlier host mortality in Darwin's finches. Journal of Evolutionary Biology **33(4)**: 524-533. doi:10.1111/jeb.13588.

Craig, D.A. 2019. Redescription of *Austrosimulium bancrofti* (Taylor) (Diptera: Simuliidae): Australia's second-worst problem black fly. Zootaxa **4700(4)**: 535-556. doi:10.11646/zootaxa.4700.4.10.

Cranshaw, W., Forrence, P. and Kondratieff, B. 2020. Observations on development of *Diogmites angustipennis* Loew (Diptera: Asilidae) in a cultivated field. Journal of the Kansas Entomological Society **92(2)**: 492-494. doi:10.2317/0022-8567-92.2.492.

Cranston, P.S. 2019. An enigmatic Chironomidae (Diptera): First larval description for *Nandeva* Wiedenbrug, Reiss and Fittkau and evidence for phylogenetic position in Tanytarsini. Chironomus **32**: 25-32.

Cranston, P.S. 2019. Identification guide to genera of aquatic larval Chironomidae (Diptera) of Australia and New Zealand. Zootaxa **4706(1)**: 71-102. doi:10.11646/zootaxa.4706.1.3.

Culbert, N.J., Kaiser, M., Venter, N., Vreysen, M.J.B., Gilles, J.R.L. and Bouyer, J. 2020. A standardised method of marking male mosquitoes with fluorescent dust. Parasites & Vectors **13(1)**. doi:10.1186/s13071-020-04066-6.

Cumming, J.M. and Brooks, S.E. 2020. A new species of *Philetus* Melander (Diptera: Empididae) from the Yukon Territory, Canada. Zootaxa **4718(3)**: 447-450. doi:10.11646/zootaxa.4718.3.12.

Cumming, J.M. and Cumming, H.J. 2019. Additional DNA barcodes confirm recent morphological species concepts and synonymies in *Callomyia* Meigen (Diptera: Platypezidae). Zootaxa **4712(2)**: 296-298. doi:10.11646/zootaxa.4712.2.9.

Curler, G. 2020. Descriptions of two new genera of Maruinini (Diptera, Psychodidae, Psychodinae) from the Mitaraka range of French Guiana. Zoosystema **42(10)**: 139-149. doi:10.5252/zoosystema2020v42a10.

Czechowski, P., Stevens, M.I., Madden, C. and Weinstein, P. 2020. Steps towards a more efficient use of chironomids as bioindicators for freshwater bioassessment: Exploiting eDNA and other genetic tools. Ecological Indicators **110**. doi:10.1016/j.ecolind.2019.105868.

Da Silva, F.L. and Pinho, L.C. 2020. *Macropelopia* (*Macropelopia*) *patagonica*, a new Tanypodinae (Diptera: Chironomidae) from the Patagonian Andes. Zootaxa **4731(4)**: 574-580. doi:10.11646/zootaxa.4731.4.10.

Daniels, G. 2019. The first confirmed records of the subfamily Trigonomiminae (Diptera: Asilidae) from Australia and Papua New Guinea, with the description of two new species of *Damalina* Doleschall. Australian Entomologist **46(4)**: 229-239.

Dantas, G.P.S., Amat, E. and Hernandez-Rangel, S.M. 2019. A new Andean species of *Ablabesmyia* Johannsen from Colombia (Diptera: Chironomidae) with an updated taxonomic key for Neotropical species. Studies on Neotropical Fauna and Environment. doi:10.1080/01650521.2019.1697162.

Dantas, G.P.S., Huamantinco Araujo, A.A. and Hamada, N. 2020. A new species of *Rheotanytarsus* Thienemann & Bause (Diptera: Chironomidae) from Peruvian Andes, with updated key to South American species. Zootaxa **4722(2)**: 195-200. doi:10.11646/zootaxa.4722.2.6.

David, K.J., Sachin, K. and Hancock, D.L. 2020. A new species of *Acrotaeniostola* Hendel and new records of Gastrozonini and Ceratitidini (Diptera: Tephritidae) from India. Zootaxa **4731(3)**: 425-432. doi:10.11646/zootaxa.4731.3.10.

David, K.J., Sachin, K. and Hancock, D.L. 2020. Two new species and a new record of *Dacus* Fabricius (Diptera: Tephritidae) from India. Zootaxa **4743(4)**: 553-560. doi:10.11646/zootaxa.4743.4.5.

Dawah, H.A., Ahmad, S.K., Abdullah, M.A. and Zatwarnicki, T. 2019. An overview of the Ephydridae (Diptera) of Saudi Arabia. Zootaxa **4711(3)**: 401-445. doi:10.11646/zootaxa.4711.3.1.

De, J., Duoji, Z.-m., Zhuoma, Y.-j., Yong, J., Zhaxi, Z.-m., Yang, X.-d., Yang, G.-r., Wang, J., Zhou, H.-n. and Gong, Z.-d. 2019. Taxonomy and fauna of Culicidae in Tibet VIII. First discovery of genus *Tripteriodes* and two species in Tibet. Zhongguo Meijieshengwuxue Ji Kongzhi Zazhi **30(6)**: 665-667.

de Manincor, N., Hautekeete, N., Piquot, Y., Schatz, B., Vanappelghem, C. and Massol, F. 2020. Does phenology explain plant-pollinator interactions at different latitudes? An assessment of its explanatory power in plant-hoverfly networks in French calcareous grasslands. Oikos **129(5)**: 753-765. doi:10.1111/oik.07259.

De Santis, M.D., Alvarez-Garcia, D.M. and Lavinscky Pereira, T.P. 2020. Taxonomic update of the Neotropical genus *Cryptocladocera* Bezzi, 1923 (Diptera: Tachinidae), with remarks on tachinids with fissicorn antennae. Zootaxa **4755(3)**: 531-544. doi:10.11646/zootaxa.4755.3.5.

de Silva, W.A.P.P., Bernal, X.E., Chathuranga, W.G.D., Herath, B.P., Ekanayake, C., Abeysundara, H.T.K. and Karunaratne, S.H.P.P. 2020. Feeding patterns revealed host partitioning in a community of frog-biting mosquitoes. Ecological Entomology. doi:10.1111/een.12874.

de Sousa, V.R., Magalhaes Pereira, A.F. and Couri, M.S. 2020. On *Aethiopomyia* Malloch (Diptera, Muscidae) with the revision of the type specimens deposited in the Museum fur Naturkunde, Berlin (Germany) with a key to species. Zookeys **(926)**: 73-80. doi:10.3897/zookeys.926.49210.

Delatte, H., De Meyer, M. and Virgilio, M. 2019. Genetic structure and range expansion of *Zeugodacus cucurbitae* (Diptera: Tephritidae) in Africa. Bulletin of Entomological Research **109(6)**: 713-722. doi:10.1017/s0007485319000026.

Disney, R.H.L. and Durska, E. 2020. New species and new records of *Megaselia* Rondani (Insecta: Diptera: Phoridae) from Wigry National Park (Poland). Annales Zoologici **70(1)**: 97-108. doi:10.3161/00034541anz2020.70.1.004.

Doorenweerd, C., San Jose, M., Barr, N., Leblanc, L. and Rubinoff, D. 2020. Highly variable COI haplotype diversity between three species of invasive pest fruit fly reflects remarkably incongruent demographic histories. Scientific Reports **10(1)**. doi:10.1038/s41598-020-63973-x.

Du, J., Hao, B., Xue, W. and Zhang, C. 2019. Five new species of *Mydaea* from China (Diptera, Muscidae). Zookeys**(897)**: 101-114. doi:10.3897/zookeys.897.39232.

Duan, C., Jiang, X.H., Han, X.J. and Hou, X.H. 2019. Description of a new species of *Forcipomyia* (*Forcipomyia*) (Diptera: Ceratopogonidae) and a key to species of the subgenus from the Chinese mainland. Journal of Medical Entomology **56(6)**: 1614-1622. doi:10.1093/jme/tjz108.

Duchenne, F., Thébault, E., Michez, D., Elias, M., Drake, M., Persson, M., Piot, J.S., Pollet, M., Vanormelingen, P. and Fontaine, C. 2020. Phenological shifts alter the seasonal structure of pollinator assemblages in Europe. Nature Ecology & Evolution **4:** 115-121. https://doi.org/10.1038/341559-019-1062-4.

Eeraerts, M., Smagghe, G. and Meeus, I. 2019. Pollinator diversity, floral resources and semi-natural habitat, instead of honey bees and intensive agriculture, enhance pollination service to sweet cherry. Agriculture Ecosystems & Environment **284**. doi:10.1016/j.agee.2019.106586.

Egan, A.T. and Ferrington, L.C., Jr. 2019. Chironomidae of the upper Saint Croix River, Wisconsin. Transactions of the American Entomological Society **145(3)**: 353-384. doi:10.3157/061.145.0307.

Ekholm, A., Tack, A.J.M., Pulkkinen, P. and Roslin, T. 2020. Host plant phenology, insect outbreaks and herbivore communities - The importance of timing. Journal of Animal Ecology **89(3)**: 829-841. doi:10.1111/1365-2656.13151.

El-Hawagry, M.S., Abdel-Dayem, M.S. and Al Dhafer, H.M. 2019. On the taxonomy of the genus *Thyridanthrax* Osten Sacken in Egypt and the Kingdom of Saudi Arabia, with description of a new species (Diptera: Bombyliidae). Zootaxa **4701(6)**: 501-519. doi:10.11646/zootaxa.4701.6.1.

El-Hawagry, M.S., El-Azab, S.E.-D.A., Abdel-Dayem, M.S. and Al Dhafer, H.M. 2020. Biting midges of Egypt (Diptera: Ceratopogonidae). Biodiversity Data Journal **8**. doi:10.3897/BDJ.8.e52357.

El-Hawagry, M.S.A., Ebrahim, A.M.E. and Nada, M.S.E. 2020. First detection of the Nearctic parasitoid species *Trichopoda pennipes* (Fabricius) (Diptera: Tachinidae) in Egypt. Egyptian Journal of Biological Pest Control **30(1)**. doi:10.1186/s41938-020-0211-z.

Elsayed, A.K., Wheeler, G.S., Purcell, M., Dyer, K., Zhang, J. and Tokuda, M. 2019. A new *Schizomyia* species (Diptera: Cecidomyiidae) inducing flower bud galls on Chinese tallow tree *Triadica sebifera* in its native range. Applied Entomology and Zoology **54(4)**: 429-436. doi:10.1007/s13355-019-00639-9.

Engelmark, R. and Haarto, A. 2019. Review of Fennoscandian species of *Gimnomera* Rondani (Diptera: Scathophagidae) with description of *Gimnomera freyi* sp. n. and *Ozerovia* subg. n. Entomologica Fennica **30(4)**: 145-158. doi:10.33338/ef.87170.

Engels, S., Medeiros, A.S., Axford, Y., Brooks, S.J., Heiri, O., Luoto, T.P., Nazarova, L., Porinchu, D.F., Quinlan, R. and Self, A.E. 2020. Temperature change as a driver of spatial patterns and long-term trends in chironomid (Insecta: Diptera) diversity. Global Change Biology **26(3)**: 1155-1169. doi:10.1111/gcb.14862.

Eriksson, A., Doherty, J.-F., Fischer, E., Graciolli, G. and Poulin, R. 2020. Hosts and environment overshadow spatial distance as drivers of bat fly species composition in the Neotropics. Journal of Biogeography **47(3)**: 736-747. doi:10.1111/jbi.13757.

Evans, M.J., Wallman, J.F. and Barton, P.S. 2020. Traits reveal ecological strategies driving carrion insect community assembly. Ecological Entomology. doi:10.1111/een.12869.

Evenhuis, N.L. 2020. Mine's longer than yours: two new *Strongylophthalmyia* Heller (Diptera: Strongylophthalmyiidae) with remarkably long antennal processes. Bishop Museum Occasional Papers **132**: 1-7.

Evenhuis, N.L. 2020. A new genus for Painter & Painter's *Villa* "*celer*"-group in the New World (Diptera: Bornbyliidae). Zootaxa **4748(2)**: 296-314. doi:10.11646/zootaxa.4748.2.4.

Evenhuis, N.L. 2020. New records of Sciaroidea (Diptera: Mycetophilidae, Keroplatidae) in the Hawaiian Islands. Bishop Museum Occasional Papers **129:** 33–36.

Evenhuis, N.L. and Pape, T. 2019. Nomenclatural Studies Toward a World List of Diptera Genus-Group Names Part VII: Johann Wilhelm Meigen. Zootaxa **4703(1)**: 1-193. doi:10.11646/zootaxa.4703.1.1.

Fachin, D.A. and Carvalho-Filho, F.D.S. 2020. New findings on the Neotropical species *Hermetia goncalvensi* Albuquerque, 1955 (Diptera: Stratiomyidae): redescription, puparium, and geographical records. Zootaxa **4755(3)**: 515-530. doi:10.11646/zootaxa.4755.3.4.

Farder-Gomes, C.F., de Oliveira, M.A., Ribeiro de Oliveira, A.C., Goncalves, P.L., Pires, E.M., Vinha Zanuncio, A.J., Serrao, J.E. and Zanuncio, J.C. 2020. Seasonal parasitism of the leaf-cutting ant *Atta sexdens* Linnaeus (Hymenoptera: Formicidae) by phorid flies (Diptera: Phoridae) in a Brazilian Cerrado-Atlantic Forest ecotone. Florida Entomologist **103(1)**: 112-115. doi:10.1653/024.103.0418.

Fedotova, Z.A. and Perkovsky, E.E. 2019. First findings of gall midges (Diptera, Cecidomyioidea, Cecidomyiidae) of the tribes Karshomyiini (Mexican Amber) and bremiini (Dominican Amber). Paleontological Journal **53(10)**: 1060-1073. doi:10.1134/s0031030119100058.

Feng, C., Wang, F., Shih, C., Ren, D. and Wang, Y. 2019. New species of *Archisargus* from the middle Jurassic Daohugou of northeastern China (Diptera: Brachycera: Archisargidae). Palaeoentomology **2(6)**: 581-584.

Ferreira, A.D.S., Araujo, M.X., Vilarinho, N.T., Da Silva-Neto, A.M. and Bravo, F. 2020. Catalogue of type specimens of Insecta (Arthropoda: Hexapoda) deposited in the entomological collection of the Museum of Zoology of Universidade Estadual de Feira de Santana, Brazil. Zootaxa **4728(4)**: 501-546. doi:10.11646/zootaxa.4728.4.10.

Finnegan, S.R., Nitsche, L., Mondani, M., Camus, M.F., Fowler, K. and Pomiankowski, A. 2020. Does meiotic drive alter male mate preference? Behavioral Ecology **31(1)**: 194-201. doi:10.1093/beheco/arz176.

Fitzgerald, S.J., Gonzalez, C.R. and Elgueta, M. 2020. A catalog of the Bibionidae (Diptera: Bibionomorpha) of Chile. Zootaxa **4766(1)**: 48-60. doi:10.11646/zootaxa.4766.1.2.

Fleming, A.J., Wood, D.M., Smith, M.A., Dapkey, T., Hallwachs, W. and Janzen, D. 2020. A new genus and new species in the tribe Uramyini (Diptera: Tachinidae) from Area de Conservacion Guanacaste in northwestern Costa Rica. Biodiversity Data Journal **8**. doi:10.3897/BDJ.8.e48907.

Fleming, A.J., Wood, D.M., Smith, M.A., Dapkey, T., Hallwachs, W. and Janzen, D. 2020. Revision of *Telothyria* van der Wulp (Diptera: Tachinidae) and twenty-five new species from Area de Conservacion Guanacaste in northwestern Costa Rica with a key to Mesoamerican species. Biodiversity Data Journal **8**. doi:10.3897/BDJ.8.e47157.

Folgarait, P.J., Plowes, R., Gomila, C. and Gilbert, L.E. 2020. A small parasitoid of fire ants, *Pseudacteon obtusitus* (Diptera: Phoridae): native range ecology and laboratory rearing. Florida Entomologist **103(1)**: 9-15. doi:10.1653/024.103.0402.

Francuski, L., Ludoski, J., Lukac, M. and Milankov, V. 2020. Fine scale population structure of hoverfly pollinator, *Eristalis arbustorum*: an integrative study. Journal of Insect Conservation **24(1)**: 49-63. doi:10.1007/s10841-019-00202-5.

Fusari, L.M., Dantas, G.P.S., Hamada, N., Andrade-Ouza, V., Lima, K.M. and Silva, J.G. 2019. Not endemic after all: *Imparipecten* Freeman, 1961 (Diptera: Chironomidae) described from the Neotropical Region (vol 4532, pg 396, 2018). Zootaxa **4712(4)**: 600-600. doi:10.11646/zootaxa.4712.4.9.

Garcete-Barrett, B.R., Morales, M.N., Hauser, M., Smit, J.T., Gonzalez, L., Ramirez De Lopez, M.B., Arias, O., Adorno, M., Sormanti, G. and Mereles, A. 2020. New geographical records and key to the species of *Eumerus* Meigen, 1823 (Diptera, Syrphidae) introduced into the Americas and Hawaii. Revista Brasileira De Entomologia **64(1)**. doi:10.1590/1806-9665-rbent-2019-0016.

Gauterio, T.B., Machado, S., da Silva Loreto, E.L., Gottschalk, M.S. and Robe, L.J. 2020. Phylogenetic relationships between fungus-associated Neotropical species of the genera *Hirtodrosophila*, *Mycodrosophila* and *Zygothrica* (Diptera, Drosophilidae), with insights into the evolution of breeding sites usage. Molecular Phylogenetics and Evolution **145**. doi:10.1016/j.ympev.2020.106733.

Gaytan, A., Ricarte, A. and Gonzalez-Bornay, G. 2020. Hoverfly diversity (Diptera: Syrphidae) of Pyrenean oak woodlands in Central-Western Spain: a preliminary study with conservation outcomes. Journal of Insect Conservation **24(1)**: 163-173. doi:10.1007/s10841-019-00208-z.

Gilasian, E., Ziegler, J. and Parchami-Araghi, M. 2020. Review of the genus *Synamphichaeta* Villeneuve (Diptera: Tachinidae), with the description of a new species from Iran. Zootaxa **4718(2)**: 251-260. doi:10.11646/zootaxa.4718.2.6.

Gilka, W., Zakrzewska, M. and Makarchenko, E.A. 2020. *Burmochlus* gen. nov., the first Cretaceous member of the *Archaeochlus* cluster (Diptera: Chironomidae: Podonominae). Cretaceous Research **106**. doi:10.1016/j.cretres.2019.104261.

Gillespie, M.A.K., Alfredsson, M., Barrio, I.C., Bowden, J.J., Convey, P., Culler, L.E., Coulson, S.J., Krogh, P.H., Koltz, A.M., Koponen, S. and others. 2020. Status and trends of terrestrial arthropod abundance and diversity in the North Atlantic region of the Arctic. Ambio **49(3)**: 718-731. doi:10.1007/s13280-019-01162-5.

Goffre, D. and Folgarait, P.J. 2019. Phorid species from *Acromyrmex's* hosts and effect on their survival of two fungi proposed for the control of leafcutter ants. Entomologia Experimentalis Et Applicata **167(11)**: 939-949. doi:10.1111/eea.12842.

Gonzalez, C.R., Elgueta, M. and Santos, C.M.D. 2020. A catalog of Rhagionidae (Diptera: Brachycera) from Chile. Zootaxa **4728(2)**: 237-248. doi:10.11646/zootaxa.4728.2.5.

Green, K. and Slatyer, R. 2020. Arthropod community composition along snowmelt gradients in snowbeds in the Snowy Mountains of south-eastern Australia. Austral Ecology **45(2)**: 144-157. doi:10.1111/aec.12838.

Grichanov, I.Y. 2019. Discovery of *Udzungwomyia* Grichanov in South Africa and definition of a new tribe Udzungwomyiini (Diptera: Dolichopodidae). Israel Journal of Entomology **49(2)**: 267-275.

Grichanov I.Y. 2019. New Afrotropical species of *Tenuopus* Curran, 1924 (Diptera: Dolichopodidae). Russian Entomological Journal **28(4):** 460-463. doi: 10.15298/rusentj.28.4.15

Grichanov, I.Y. 2020. New species and new records of *Lichtwardtia* Enderlein, 1912 (Diptera: Dolichopodidae) from Australasian and Oriental regions. Far Eastern Entomologist **399**: 1-13.

Grichanov I.Ya. A new species of Pseudargyrochlamys Grichanov, 2006 from South Africa (Diptera: Dolichopodidae). Russian Entomological Journal **29(1):** 97-101. doi: 10.15298/rusentj.29.1.14

Grichanov I.Ya., Nourti M., Kettani K. 2020. The *Hercostomus exarticulatus* species group in the Palaearctic Region (Diptera: Dolichopodidae). Caucasian Entomological Bulletin **16(1):** 27-34. DOI: 10.23885/181433262020161-2734

Grichanov I.Y. and Rezaei, S. 2019. A new species of *Asyndetus* Loew, 1869 from Iran (Diptera: Dolichopodidae). Halteres **10:** 35-39. doi: 10.5281/zenodo.3553175

Grković, A., van Steenis, J., Tubić, N. K., Nedeljković, Z., Hauser, M., Hayat, R., Demırözer, O., Đan, M., Vujić, A. & Radenković, S. 2019. Revision of the bactrianus subgroup of the genus *Eumerus* Meigen (Diptera: Syrphidae) in Europe, inferred from morphological and molecular data with descriptions of three new species. Arthropod Systematics & Phylogeny **77(1):** 21-37.

Grogan, W.L., Jr., Diaz, F., Spinelli, G.R. and Ronderos, M.M. 2019. The biting midges of the Caribbean island Curacao (Diptera: Ceratopogonidae). I. Species in the genus *Dasyhelea* Kieffer. Zootaxa **4700(3)**: 301-325. doi:10.11646/zootaxa.4700.3.1.

Gualdron-Diaz, J.C. and Gorayeb, I.D.S. 2020. *Esenbeckia* (*Esenbeckia*) *auribrunnea* n. sp. (Diptera: Tabanidae) from the Amazon, with a key to the Neotropical species of the subgenus. Zootaxa **4718(1)**: 67-76. doi:10.11646/zootaxa.4718.1.5.

Ham, D., Jaschhof, M. and Bae, Y.J. 2020. Mycophagous gall midges (Diptera: Cecidomyiidae) in Korea: Newly recorded species with discussion on four years of taxonomic inventory. Animal Systematics Evolution and Diversity **36(1)**: 60-77.

Han, H.-Y. and Ro, K.-E. 2019. DNA barcoding reveals a species group of the genus *Campiglossa* (Diptera, Tephritidae, Tephritinae) with recognition of a new species from East Asia and previously unknown females of *Campiglossa coei* (Hardy). Zookeys**(899)**: 1-36. doi:10.3897/zookeys.899.46779.

Han, W. and Tang, H. 2019. Phylogeny of marine *Ainuyusurika tuberculata* (Tokunaga) (Diptera: Chironomidae: Chironominae), with description of the immature stages. Zootaxa **4695(2)**: 131-147. doi:10.11646/zootaxa.4695.2.3.

Han, W., Wei, J., Lin, X. and Tang, H. 2020. The Afro-Oriental genus *Yaeprimus* Sasa et Suzuki (Diptera: Chironomidae: Chironomini): Phylogeny, new species and expanded diagnoses. Diversity-Basel **12(1)**. doi:10.3390/d12010031.

Hancock, D.L. 2019. Comments on the genus *Coelopacidia* Enderlein (Diptera: Tephritidae: Trypetinae: Adramini), with a key to known species. Israel Journal of Entomology **49(2)**: 215-222.

Hernandez-Amparan, S., Perez-Santiago, G., Ibanez-Bernal, S., Antonio Hinojosa-Ontiveros, G. and Alvarez-Zagoya, R. 2020. An update of the mosquito species richness from Durango, Mexico. Southwestern Entomologist **45(1)**: 251-262. doi:10.3958/059.045.0126.

Holmes, C.J. and Benoit, J.B. 2019. Biological adaptations associated with dehydration in mosquitoes. Insects **10(11)**. doi:10.3390/insects10110375.

Huerta, H. and Fitzgerald, S.J. 2020. A new species of *Setostylus* Matile and new records of *Setostylus bellulus* (Williston) (Diptera: Keroplatidae). Zootaxa **4722(1)**: 84-90.

Imada, Y. 2020. A novel leaf-rolling chironomid, *Eukiefferiella endobryonia* sp. nov. (Diptera, Chironomidae, Orthocladiinae), highlights the diversity of underwater chironomid tube structures. Zookeys**(906)**: 73-111. doi:10.3897/zookeys.906.47834.

Irvin, N.A. and Hoddle, M.S. 2020. Assessing the flight capabilities of fed and starved *Allograpta obliqua* (Diptera: Syrphidae), a natural enemy of Asian citrus psyllid, with computerized flight mills. Florida Entomologist **103(1)**: 139-141. doi:10.1653/024.103.0425.

Irwin, M.E. and Winterton, S.L. 2019. A new stiletto fly in the genus *Anabarhynchus* Macquart (Diptera: Therevidae) from Fiji. Zootaxa **4700(3)**: 385-393. doi:10.11646/zootaxa.4700.3.7.

Irwin, M.E. and Winterton, S.L. 2020. A new stiletto fly genus from South America (Diptera: Therevidae: Agapophytinae). Zootaxa **4751(2)**: 276-290. doi:10.11646/zootaxa.4751.2.4.

Ivkovic, M., Doric, V., Baranov, V., Mihaljevic, Z., Kolcsar, L.-P., Kvifte, G.M., Nerudova, J. and Pont, A.C. 2020. Checklist of aquatic Diptera (Insecta) of Plitvice Lakes National Park, Croatia, a UNESCO world heritage site. Zookeys**(918)**: 99-142. doi:10.3897/zookeys.918.49648.

Iwasa, M. 2020. Contribution to the knowledge of the genus *Cordilura* Fallen (Diptera, Scathophagidae) from Japan, with descriptions of three new species. Zootaxa **4748(3)**: 471-484. doi:10.11646/zootaxa.4748.3.4.

Jankovic, M., Milicic, M., Acanski, J. and Vujic, A. 2020. Protected areas and prime hoverfly areas: Safe haven for hoverflies or not? Entomological Science. doi:10.1111/ens.12411.

Jaschhof, M. and Jaschhof, C. 2020. The Porricondylini (Diptera: Cecidomyiidae: Porricondylinae) of Sweden revisited: descriptions of nineteen new species of ten genera, including a new genus. Zootaxa **4728(2)**: 151-182. doi:10.11646/zootaxa.4728.2.1.

Jaschhof, M. and Jaschhof, C. 2020. An update of Micromyinae (Diptera: Cecidomyiidae) taxonomy, with descriptions of a new genus and 13 new species from Northern Europe. Zootaxa **4750(3)**: 349-369. doi:10.11646/zootaxa.4750.3.3.

Jaume-Schinkel, S., Soares, M.M.M. and Barros, L.M. 2020. *Chvalaea yolkamini* sp. nov. (Diptera: Hybotidae), the first Mexican species of genus discovered on instagram. Zootaxa **4748(3)**: 592-600. doi:10.11646/zootaxa.4748.3.12.

Jezek, J., Votypka, J., Brzonova, J. and Obona, J. 2019. Horse flies (Diptera: Tabanidae) collected in Central African Republic, Gabon and Liberia with comments on their updated distribution. Acta Musei Silesiae Scientiae Naturales **68(3)**: 263-274.

Jiao, K.-L., Wang, H. and Bu, W.-J. 2020. *Pararhizomyia* Mamaev (Diptera: Cecidomyiidae) from China. Oriental Insects **54(1)**: 75-87. doi:10.1080/00305316.2019.1580626.

Jiao, K.-L., Zhou, X.-Y., Wang, H., Fu, H.-J., Zhou, K., Li, J.-B., Xiong, D.-P., Wang, Y.-H., Bu, W.-J. and Kolesik, P. 2020. A new genus and species of gall midge (Diptera: Cecidomyiidae) inducing leaf galls on Peking lilac, *Syringa reticulata* subsp. *pekinensis* (Oleaceae), in China. Zootaxa **4742(1)**: 194-200. doi:10.11646/zootaxa.4742.1.13.

Jitklang, S., Sawangproh, W., Kuvangkadilok, C., Baimai, V. and Adler, P.H. 2020. Ecology of black flies (Diptera: Simuliidae) in streams of northern and southern Thailand: Factors associated with larval and pupal distributions. Acta Tropica **204**. doi:10.1016/j.actatropica.2020.105357.

Johnson, K.P. 2019. Putting the genome in insect phylogenomics. Current Opinion in Insect Science **36**: 111-117. doi:10.1016/j.cois.2019.08.002.

Johnson, P.H. and Russell, R.C. 2020. Description of the fourth-instar larva of *Coquillettidia linealis* (Diptera: Culicidae). Austral Entomology **59(1)**: 119-126. doi:10.1111/aen.12430.

Jones, B.M. and Tomberlin, J.K. 2019. Impact of larval competition on life-history traits of the black soldier fly (Diptera: Stratiomyidae). Annals of the Entomological Society of America **112(6)**: 505-510. doi:10.1093/aesa/saz014.

Jonsell, M., Ols, C., Victorsson, J. and Hellqvist S. 2019 Diptera in clear-felling stumps like it dry, Scandinavian Journal of Forest Research, **34(8):** 673-677. DOI: 10.1080/02827581.2019.1663916

Kameneva, E.P. and Korneyev, V.A. 2019. New species and synonymies in the genus *Ulidia* (Diptera: Ulidiidae) from the Middle East. Israel Journal of Entomology **49(2)**: 243-266.

Karlsson, D., Hartop, E., Forshage, M., Jaschhof, M. and Ronquist, F. 2020. The Swedish Malaise Trap Project: A 15 Year Retrospective on a Countrywide Insect Inventory. Biodiversity Data Journal **8**. doi:10.3897/BDJ.8.e47255.

Khameneh, R.N., Khaghaninia, S., Disney, R.H.L. and Maleki-Ravasan, N. 2019. Twenty one new species of *Megaselia* Rondani (Diptera: Phoridae) from Iran. Zootaxa **4711(1)**: 1-50. doi:10.11646/zootaxa.4711.1.1.

Khramov, A.V., Nam, G.-S. and Vasilenko, D.V. 2020. First long-proboscid flies (Diptera: Zhangsolvidae) from the Lower Cretaceous of South Korea. Alcheringa **44(1)**: 160-168. doi:10.1080/03115518.2019.1664634.

Kim, W., Minami, T., Tokuda, M., Matsuo, K., Harris, K.M. and Yukawa, J. 2019. Detection of two new cryptic species of *Kiefferia* (Diptera: Cecidomyiidae) by means of morphological, molecular and ecological studies. Entomological Science. doi:10.1111/ens.12390.

Kim, Y. and Kwon, O. 2020. Analysis on the insect community dynamics of Dokdo Island, Korea from 1978 to 2015. Entomological Research **50(1)**: 34-37. doi:10.1111/1748-5967.12407.

Koehler, A. 2019. The genus *Pseudolycoriella* Menzel & Mohrig, 1998 (Diptera, Sciaridae) in New Zealand. Zootaxa **4707(1)**: 1-69. doi:10.11646/zootaxa.4707.1.1.

Kopec, K., Ansorge, J., Soszynska-Maj, A. and Krzeminski, W. 2020. Revision of the genus *Mesotipula* Handlirsch, 1920 (Diptera, Limoniidae, Architipulinae) from the Lower Jurassic of Northeast Germany. Historical Biology **32(4)**: 500-507. doi:10.1080/08912963.2018.1503257.

Korneyev, S.V. and Evstigneev, D.A. 2019. Review of the *Tephritis hyoscyami-conura* group of species (Diptera: Tephritidae) with description of a new species. Annales Zoologici **69(4)**: 719-736. doi:10.3161/00034541anz2019.69.4.007.

Korneyev, V.A. and Phauk, S. 2019. Preliminary data on the fruit flies (Diptera: Tephritidae) of Cambodia. Cambodian Journal of Natural History **2**: 85-97.

Korneyev, S.V., Smit, J.T., Hulbert, D.L., Norrbom, A.L., Gaimari, S.D., Korneyev, V.A. and Smith, J.J. (2020). Phylogeny of the genus *Tephritis* Latreille, 1804 (Diptera: Tephritidae). Arthropod Systematics & Phylogeny **78(1)**: 111-132. doi: 10.26049/ASP78-1-2020-05

Kotrba, M. 2020. Setting the records straight II: "single spermatheca" of *Braula coeca* (Diptera: Braulidae) is really the ventral receptacle. Organisms Diversity & Evolution **20(1)**: 117-122. doi:10.1007/s13127-019-00423-1. https://rdcu.be/b2UnM

Kotrba, M. and Rung, A. 2020. The internal female genitalia of *Aulacigaster* (Diptera: Aulacigastridae)-description and phylogenetic analysis. Organisms Diversity & Evolution **20(1)**: 123-140. doi:10.1007/s13127-019-00425-z. https://rdcu.be/b2Uuq

Krosch, M.N., Herold, N., Thornhill, A.H. and Cranston, P.S. 2020. How 'Gondwanan' is *Riethia*? Molecular phylogenetics elucidates the mode and tempo of diversification in Austro-Pacific Chironominae (Diptera). Invertebrate Systematics **34(3)**: 328-341. doi:10.1071/is19053.

Krosch, M.N., Strutt, F., Blacket, M.J., Batovska, J., Starkie, M., Clarke, A.R., Cameron, S.L. and Schutze, M.K. 2020. Development of internal COI primers to improve and extend barcoding of fruit flies (Diptera: Tephritidae: Dacini). Insect Science **27(1)**: 143-158. doi:10.1111/1744-7917.12612.

Kunprom, C. and Pramual, P. 2019. DNA barcoding of fruit flies (Diptera: Tephritidae) in Thailand: ambiguity, misidentification and cryptic diversity. Mitochondrial DNA Part A **30(8)**: 861-873. doi:10.1080/24701394.2019.1693550.

Kurina, O. 2020. New species and new records of *Sciophila* Meigen (Diptera: Mycetophilidae) from the Afrotropical region. Zootaxa **4722(4)**: 339-351. doi:10.11646/zootaxa.4722.4.3.

Kutty, S.N., Meusemann, K., Bayless, K.M., Marinho, M.A.T., Pont, A.C., Zhou, X., Misof, B., Wiegmann, B.M., Yeates, D., Cerretti, P. and others. 2019. Phylogenomic analysis of Calyptratae: resolving the phylogenetic relationships within a major radiation of Diptera. Cladistics **35(6)**: 605-622. doi:10.1111/cla.12375.

Kuwahara, G.K. and Marshall, S.A. 2020. A revision of the Neotropical genus *Chespiritos* (Diptera: Sphaeroceridae: Limosininae). European Journal of Entomology **117**: 164-189. doi:10.14411/eje.2020.019.

Kuznetsova, V., Grozeva, S. and Gokhman, V. 2020. Telomere structure in insects: A review. Journal of Zoological Systematics and Evolutionary Research **58(1)**: 127-158. doi:10.1111/jzs.12332.

Lee, H.S., Lee, H.A. and Lee, Y.S. 2020. First report of dandelion leaf gall midge, *Cystiphora* sp. (Diptera: Cecidomyiidae), from Korea. Korean Journal of Applied Entomology **59(1)**: 23-24.

Legros, V., Rochat, J., Reynaud, B. and Strasberg, D. 2020. Known and unknown terrestrial arthropod fauna of La Reunion Island, Indian Ocean. Journal of Insect Conservation **24(1)**: 199-217. doi:10.1007/s10841-019-00188-0.

Lendzele, S.S., Eisenbarth, A., Christophe, Z.K.R., Mavoungou, J.F. and Renz, A. 2019. Aspects of the bionomics of hematophagous symbovine dipterans in a hyper-infested rangeland of Ngaoundere (Adamawa-Cameroon). Journal of Asia-Pacific Entomology **22(4)**: 1019-1030. doi:10.1016/j.aspen.2019.08.012.

Lessard, B.D., Yeates, D.K. and Woodley, N.E. 2019. Revision of the Hermetiinae of Australia (Diptera: Stratiomyidae). Austral Entomology **58(1)**: 122-136. doi:10.1111/aen.12392.

Lessard, B.D., Yeates, D.K. and Woodley, N.E. 2020. Generic revision of the Chiromyzinae soldier flies of Australia (Diptera: Stratiomyidae), including the first record of *Boreoides* Hardy, 1920, from New Zealand. Austral Entomology **59**: 302-322. doi:10.1111/aen.12449.

Levesque-Beaudin, V. and Mlynarek, J.J. 2020. Revision of Nearctic *Paramyia* Williston (Diptera: Milichiidae). Zootaxa **4732(1)**: 1-56. doi:10.11646/zootaxa.4732.1.1.

Li, C., Bellis, G., Wu, X. and Li, J. 2019. A new species of *Nilobezzia* Kieffer (Diptera, Ceratopogonidae) from the mangrove forest of Hainan Island, China. Zookeys**(893)**: 135-141. doi:10.3897/zookeys.893.39032.

Li, W.L., Qi, L. and Yang, D. Four species of the genus *Lauxania* Latreille 1804 (Diptera, Lauxaniidae) from China. Oriental Insects: 16. doi:10.1080/00305316.2019.1665595.

Li, X. and Yeates, D.K. 2019. Revision of the Australian bee fly genus *Sisyromyia* White, 1916 (Bombyliidae, Bombyliinae, Acrophthalmydini). Zootaxa **4711(2)**: 201-244. doi:10.11646/zootaxa.4711.2.1.

Li, X.-Y., Pape, T. and Zhang, D. 2019. Taxonomic review of *Gasterophilus* (Oestridae, Gasterophilinae) of the world, with updated nomenclature, keys, biological notes, and distributions. Zookeys**(891)**: 119-156. doi:10.3897/zookeys.891.38560.

Li, X.-y., Yan, L.-p., Pape, T., Gao, Y.-y. and Zhang, D. 2020. Evolutionary insights into bot flies (Insecta: Diptera: Oestridae) from comparative analysis of the mitochondrial genomes. International Journal of Biological Macromolecules **149**: 371-380. doi:10.1016/j.ijbiomac.2020.01.249.

Lievano-Romero, K.S., Rodriguez-Posada, M.E. and Cortes-Vecino, J.A. 2019. New records of bat ectoparasites in floodplains ecosystems of the Colombian Orinoquia. Mastozoologia Neotropical **26(2)**: 377-389.

Limeira-De-Oliveira, F., Marques, D.W.A., Gaimari, S.D. and Rafael, J.A. 2020. *Pauximyia*, a new genus of Odiniidae (Diptera: Acalyptratae) with description of two new species from Brazil. Zootaxa **4728(2)**: 227-236. doi:10.11646/zootaxa.4728.2.4.

Lin, S.-F., Tokuda, M. and Yang, M.-M. 2020. Leaf gall polymorphism and molecular phylogeny of a new *Bruggmanniella* species (Diptera: Cecidomyiidae: Asphondyliini) associated with *Litsea acuminata* (Lauraceae) in Taiwan, with ecological comparisons and a species description. Entomological Science **23(1)**: 10-22. doi:10.1111/ens.12391.

Liu, Y., Hakim, M. and Huang, D. 2020. First stratiomyomorphan larvae in the mid-Cretaceous amber from Myanmar (Diptera: Brachycera). Cretaceous Research **106**. doi:10.1016/j.cretres.2019.104265.

Liu, Y. and Huang, D. 2019. New materials of Nemestrinidae (Diptera: Brachycera) from the mid-Cretaceous Burmese amber. Cretaceous Research **104**. doi:10.1016/j.cretres.2019.07.003.

Loni, A., Fornaciari, A., Canale, A., Giuffra, V., Vanin, S. and Benelli, G. 2019. Insights on funeral practices and insects associated with the tombs of King Ferrante II d'Aragona and other renaissance nobles. Journal of Medical Entomology **56(6)**: 1582-1589. doi:10.1093/jme/tjz102.

Lonsdale, O. 2020. Family groups of Diopsoidea and Nerioidea (Diptera: Schizophora)-Definition, history and relationships. Zootaxa **4735(1)**: 1-177. doi:10.11646/zootaxa.4735.1.1.

Lopes, A.C., De Carvalho, C.J.B. and Nihei, S.S. 2020. Morphological phylogeny and classification of Winthemiini (Diptera: Tachinidae: Exoristinae). Systematic Entomology **45(1)**: 48-59. doi:10.1111/syen.12378.

Lopez-Garcia, G.P., Reemer, M., Debandi, G. and Mengual, X. 2019. New information about the third stage larva and larval habitat of *Microdon* (*Chymophila*) *bruchi* Shannon, 1927 (Diptera, Syrphidae) from Argentina. Journal of Natural History **53(45-46)**: 2833-2853. doi:10.1080/00222933.2020.1746847.

Lorenz, C. and Suesdek, L. 2020. The use of wing shape for characterising macroevolution in mosquitoes (Diptera: Culicidae). Infection Genetics and Evolution **77**. doi:10.1016/j.meegid.2019.104052.

Lukashevich, E.D. 2020. Male terminalia and their rotation in Tanyderidae (Insecta, Diptera, Nematocera) since the Mesozoic. Historical Biology **32(4)**: 462-475. doi:10.1080/08912963.2018.1500568.

Lukashevich, E.D. and Blagoderov, V. 2020. Review of Mesozoic Perissommatidae (Insecta: Diptera). Zootaxa **4718(4)**: 481-496. doi:10.11646/zootaxa.4718.4.3.

Lukashevich, E.D., Pepinelli, M. and Currie, D.C. A new family and genus of Mesozoic Simulioidea (Insecta: Diptera). Journal of Systematic Palaeontology: 19. doi:10.1080/14772019.2019.1588796.

MacGowan, I. 2019. New species of Lonchaeidae (Diptera: Schizophora) from Madagascar. Israel Journal of Entomology **49(2)**: 223-242.

Macgowan, I. 2020. Two new species of *Silba* (Diptera; Lonchaeidae) from Japan with unusual larval development sites. Zootaxa **4755(1)**: 177-182. doi:10.11646/zootaxa.4755.1.10.

Maheu, A. and Nel, A. 2020. The oldest representative of the bombyliid bee fly in the earliest Eocene French amber. Acta Palaeontologica Polonica **65(1)**: 81-83. doi:10.4202/app.00657.2019.

Makarchenko, E.A. and Hansen, D.C. 2020. *Pagastia* (*P.*) *donoliveri* sp. nov.-a new Nearctic alpine stream chironomid species (Diptera: Chironomidae: Diamesinae) from the Beartooth Mountains, Wyoming, USA. Zootaxa **4755(1)**: 171-176. doi:10.11646/zootaxa.4755.1.9.

Maquart, P.-O., Richard, D. and Willems, J. 2020. First record of the Black Soldier Fly, *Hermetia illucens*, in the Western regions of France (Vendee, Loire-Atlantique, Ille-et-Vilaine) with notes on its worldwide repartition (Diptera, Stratiomyidae). Bulletin de la Societe Entomologique de France **125(1)**: 13-18.

Marigo, T.C., Einicker Lamas, C.J. and Fusari, L.M. 2020. A new marine intertidal chironomid from the Brazilian coast (Diptera: Chironomidae: Telmatogetoninae). Zootaxa **4763(1)**: 117-124. doi:10.11646/zootaxa.4763.1.10.

Maroneze, D.M., Florencio Pujoni, D.G., Arcifa, M.S. and Maia-Barbosa, P.M. 2020. Can chaoborid larvae control their zooplanktonic prey populations in a neotropical lake? Austral Ecology. doi:10.1111/aec.12881.

Marshall, S.A. 2020. Revision of the genus *Systellapha* Enderlein (Micropezidae, Taeniapterinae). Zootaxa **4751(2)**: 369-376. doi:10.11646/zootaxa.4751.2.11.

Mauch, E. 2019. Diptera larvae in a sap run of a beech tree in a mixed forest in Bavaria/Germany. Lauterbornia **86**: 131-143.

McNew, S.M., Goodman, G.B., Yepez R, J. and Clayton, D.H. 2020. Parasitism by an invasive nest fly reduces future reproduction in Galapagos mockingbirds. Oecologia **192(2)**: 363-374. doi:10.1007/s00442-019-04582-y.

Meisel, R.P., Olafson, P.U., Adhikari, K., Guerrero, F.D., Konganti, K. and Benoit, J.B. 2020. Sex chromosome evolution in muscid flies. G3-Genes Genomes Genetics **10(4)**: 1341-1352. doi:10.1534/g3.119.400923.

Men, Q. 2020. Three new species of the subgenus *Tipula* (*Sivatipula*) from Yunnan and Tibet, China (Diptera: Tipulidae), with an updated key for Chinese species. Zoological Systematics **45(1)**: 59-68.

Men, Q., Hu, Z. and Mu, D. 2019. New species of *Lebania* (Diptera: Limoniidae) from mid-Cretaceous amber of northern Myanmar. Cretaceous Research **104**. doi:10.1016/j.cretres.2019.07.013.

Mendez-Soto, M. 2020. The diversity of the Order Diptera from Isla del Coco represented in the collection of arthropods of the National Museum of Costa Rica and other institutions. Revista De Biologia Tropical **68**: 144-154.

Mengual, X. 2020. Phylogenetic relationships of the bacchine flower flies (Diptera: Syrphidae) based on molecular characters, with a description of a new species of *Melanostoma* (Schiner, 1860). Contributions to Zoology **89(2)**: 210-244. doi:10.1163/18759866-20191410.

Mengual, X., Bot, S., Chkhartishvili, T., Reimann, A., Thormann, J. and von der Mark, L. 2020. Checklist of hover flies (Diptera, Syrphidae) of the Republic of Georgia. Zookeys**(916)**: 1-123. doi:10.3897/zookeys.916.47824.

Mengual, X., Ssymank, A., Skevington, J.H., Reemer, M. and Stahls, G. 2020. The genus *Afrosyrphus* Curran (Diptera, Syrphidae), with a description of a new species. European Journal of Taxonomy **635**: 1-17. doi:10.5852/ejt.2020.635.

Michelsen, V. 2019. Macaronesian Muscidae (Diptera). I. The genus *Hebecnema* Schnabl with description of a new Canarian endemic species and a review of the European fauna. Zootaxa **4706(2)**: 332-348. doi:10.11646/zootaxa.4706.2.7.

Michelsen, V. and Palmer, M.W. 2020. *Pegomya disticha* Griffiths and *P.cedrica* Huckett (Diptera: Anthomyiidae)-first documented case of insects trespassing the silica barrier of Common scouring-rush, *Equisetum hyemale* L. Zootaxa **4718(3)**: 355-370. doi:10.11646/zootaxa.4718.3.4.

Milosevic, D., Milosavljevic, A., Predic, B., Medeiros, A.S., Savic-Zdravkovic, D., Piperac, M.S., Kostic, T., Spasic, F. and Leese, F. 2020. Application of deep learning in aquatic bioassessment: Towards automated identification of non-biting midges. Science of the Total Environment **711**. doi:10.1016/j.scitotenv.2019.135160.

Moghbeli, S., Fekrat, L. and Gharali, B. 2020. *Empidideicus jirofti* sp. nov. (Diptera: Mythicomyiidae: Empidideicinae), a new microbombyliid from Kerman province, southern Iran, with a key to species of *Empidideicus* from Iran. Zootaxa **4722(4)**: 352-360. doi:10.11646/zootaxa.4722.4.4.

Mohammed, S.E.A.R. 2020. First report of *Apis mellifera carnica* Ruttner (Hymenoptera, Apidae) in Saudi Arabia parasitized by a phorid parasitoid (Diptera: Phoridae) Journal of Apicultural Research **57(1)**: 565-568. doi:10.1080/00218839.2019.1687805.

Mohrig, W., Kauschke, E. and Broadley, A. 2020. Black fungus gnats (Diptera: Sciaridae) of Queensland, Australia. Part II. Genus *Pseudolycoriella* Menzel & Mohrig, 1998. Zootaxa **4751(3)**: 487-506. doi:10.11646/zootaxa.4751.3.4.

Molineri, C., Tejerina, E.G., Torrejon, S.E., Pero, E.J.I. and Hankel, G.E. 2020. Indicative value of different taxonomic levels of Chironomidae for assessing the water quality. Ecological Indicators **108**. doi:10.1016/j.ecolind.2019.105703.

Montes Beltran, F.A. 2019. Records of a bee fly ectoparasitic on *lberodorcadion* Breuning beetles (Coleoptera: Cerambycidae) in the Iberian Peninsula: *Anthrax virgo* Egger, 1859 (Diptera: Bombyliidae). Boletin de la SEA **65**: 255-258.

Montoya, A.L. and Wolff, M. 2020. Description of six new large species of *Argentinomyia* Lynch-Arribalzaga, 1891 and redescription of *Talahua fervida* (Fluke, 1945) (Diptera, Syrphidae, Syrphinae). Zookeys**(929)**: 19-51. doi:10.3897/zookeys.929.37666.

Motamedinia, B., Skevington, J.H. and Kelso, S. 2020. Taxonomic revision of *Dasydorylas* Skevington, 2001 (Diptera, Pipunculidae) in the Middle East. Peerj **8**. doi:10.7717/peerj.8511.

Moubayed, J. and Kettani, K. 2019. *Rheocricotopus* (*Rheocricotopus*) *rifensis* sp. n., a new rheobiontic species from waterfalls located in the Moroccan Rif (Diptera, Chironomidae, Orthocladiinae). Ephemera **20(2)**: 87-97.

Moubayed, J. and Langton, P.H. 2019. *Chaetocladius berythensis* sp.n., *C. callauensis* sp.n., *C. guardiolei* and *C. parerai* sp.n., four relict species inhabiting glacial springs and streams in eastern Pyrenees and Lebanon (Diptera: Chironomidae). Chironomus **32**: 42-59.

Moubayed-Breil, J. and Bitusik, P. 2019. Taxonomic notes on the genus *Chaetocladius* (*laminatus*-group) (Diptera: Chironomidae, Orthocladiinae) II. Descriptions of *C. bitusiki* sp. n. and *C. mantetensis* sp. n., two relict species inhabiting cold alpine springs and streams. Biologia **74(11)**: 1489-1500. doi:10.2478/s11756-019-00253-8.

Moubayed-Breil, J. and Dominici, J.-M. 2019. *Clunio boudouresquei* sp.n. and *Thalassosmittia ballestai* sp.n., two tyrrhenian marine species occurring in Scandola Nature Reserve, West Corsica (Diptera: Chironomidae). Chironomus **32**: 4-24.

Mukherjee, T., Pal, G. and Hazra, N. 2020. On a new species of the genus *Dicrotendipes* Kieffer, 1913 from West Bengal, India with cladistic analysis and key to the Oriental species (Diptera: Chironomidae). Oriental Insects **54(2)**: 216-240. doi:10.1080/00305316.2019.1612477.

Mutin, V.A. 2019. A new species of the genus *Eumerus* Meigen, 1822 (Diptera: Syrphidae) from Turkmenistan. Far Eastern Entomologist **397**: 9-12.

Natarajan, R., Eapen, A. and Jambulingam, P. 2020. *Heizmannia rajagopalani* n. sp. (Diptera: Culicidae) in Kerala, India, a species previously misidentified as *Hz. metallica* (Leicester). Zootaxa **4722(5)**: 472-478. doi:10.11646/zootaxa.4722.5.5.

Nazareth, T., Craveiro, I., Moutinho, A., Seixas, G., Goncalves, C., Goncalves, L., Teodosio, R. and Sousa, C.A. 2020. What happens when we modify mosquitoes for disease prevention? A systematic review. Emerging Microbes & Infections **9(1)**: 348-365. doi:10.1080/22221751.2020.1722035.

Ngo-Muller, V., Garrouste, R., Pouillon, J.-M. and Nel, A. 2020. A new species of the long-legged fly genus *Microphorites* in Burmese amber (Dolichopodidae: Microphorinae). Cretaceous Research **107**. doi:10.1016/j.cretres.2019.104284.

Ngo-Muller, V. and Nel, A. 2020. A new hoverfly genus and species from the middle Eocene Baltic amber (Diptera: Syrphidae). Palaeoentomology **3(1)**: 68-75.

Ni, Z., Zhang, E., Herzschuh, U., Mischke, S., Chang, J., Sun, W. and Ning, D. 2020. Taxonomic and functional diversity differentiation of chironomid communities in northern Mongolian Plateau under complex environmental impacts. Hydrobiologia **847(9)**: 2155-2167. doi:10.1007/s10750-020-04241-x.

Niederegger, S., Akbarzadeh, K. and Szpila, K. 2019. Muscle attachment site patterns for species determination in West Palaearctic *Wohlfahrtia* (Diptera: Sarcophagidae) of medical and veterinary importance. Scientific Reports **9**. doi:10.1038/s41598-019-55127-5.

Oboňa J., Dvořák L., Haenni J.-P., Hrivniak Ľ., Japoshvili B., Ježek J., Kerimova I., Máca J., Murányi D., Rendoš M., Słowińska I., Snegovaya N., Starý J. and Manko P. 2019. New and interesting records of Diptera from Azerbaijan and Georgia. Zoosystematica Rossica, **28(2):** 277–295.

O'Hara, J.E. & Henderson, S.J. 2020. World genera of the Tachinidae (Diptera) and their regional occurrence. Version 11.0. PDF document, 90 pp. Available at : http://www.nadsdiptera.org/Tach/WorldTachs/Genera/Gentach_ver11.pdf.

O'Hara, J.E., Henderson, S.J. & Wood, D.M. 2020. Preliminary checklist of the Tachinidae (Diptera) of the world. Version 2.1. PDF document, 1039 pp. Available at: http://www.nadsdiptera.org/Tach/WorldTachs/Checklist/Tachchlist_ver2.1.pdf.

Okuyama, T. 2020. Concurrently burrowing host fly larvae reciprocally enhance pupation depth to minimise parasitism risk. Ecological Entomology **45(3)**: 493-497. doi:10.1111/een.12818.

Oliveira da Silva, I.C., de Carvalho, S.S., Ceron, K., Santana, D.J. and Roland Tavares, L.E. 2019. A case of Dipteran parasitism in *Trachycephalus typhonius* (Anura: Hylidae), with a summary of myiasis parasitism in anurans. Phyllomedusa **18(2)**: 283-292. doi:10.11606/issn.2316-9079.v18i2p283-292.

Paiero, S.M. and Marshall, S.A. 2020. A revision of the genus *Rudolfina* Rohacek (Sphaeroceridae: Limosininae). European Journal of Taxonomy **593**: 1-48. doi:10.5852/ejt.2020.593.

Pakum, W., Kongbangkerd, A., Srimuang, K.-O., Gale, S.W. and Watthana, S. 2019. Reproductive biology of a rare, fly-pollinated orchid, *Bulbophyllum nipondhii* Seidenf., in Thailand. Flora **260**. doi:10.1016/j.flora.2019.151467.

Pang, X.n., Liu, G., Wang, Q., Elgar, M.A. and Zhang, D. 2020. Oviposition preferences and antennal size in carrion flies. Entomologia Experimentalis Et Applicata **168(4)**: 332-338. doi:10.1111/eea.12905.

Passaseo, A., Petremand, G., Rochefort, S. and Castella, E. 2020. Pollinator emerging from extensive green roofs: wild bees (Hymenoptera, Antophila) and hoverflies (Diptera, Syrphidae) in Geneva (Switzerland). Urban Ecosystems. doi:10.1007/s11252-020-00973-9.

Patitucci, L.D., Olea, M.S. and Mulieri, P.R. 2019. A review of *Spathipheromyia* (Diptera: Muscidae) from Argentina with the description of an extra-large new species. Zootaxa **4701(2)**: 168-178. doi:10.11646/zootaxa.4701.2.3.

Pavitra, S.P., Low, V.L., Tan, T.K., Lim, Y.A.L. and Ya'cob, Z. 2020. Temporal variation in diversity and community structure of preimaginal blackflies (Diptera: Simuliidae) in a tropical forest reserve in Malaysia. Acta Tropica **202**. doi:10.1016/j.actatropica.2019.105275.

Peach, D.A.H. and Gries, G. 2020. Mosquito phytophagy - sources exploited, ecological function, and evolutionary transition to haematophagy. Entomologia Experimentalis Et Applicata **168(2)**: 120-136. doi:10.1111/eea.12852.

Pelayo, R.C., Soriano, P.J., Marquez, N.J. and Navarro, L. 2019. Phenological patterns and pollination network structure in a Venezuelan paramo: a community-scale perspective on plant-animal interactions. Plant Ecology & Diversity. doi:10.1080/17550874.2019.1675096.

Penaforte, F.L.G. and Henriques, A.L. 2019. Description of *Dichelacera* (*Dichelacera*) *lamasi* n. sp. (Diptera: Tabanidae), a new species from the state of Mato Grosso do Sul, Brazil. Biodiversity Data Journal **7**. doi:10.3897/BDJ.7.e48283.

Perez-Banon, C., Rojas, C., Vargas, M., Mengual, X. and Rojo, S. 2020. A world review of reported myiases caused by flower flies (Diptera: Syrphidae), including the first case of human myiasis from *Palpada scutellaris* (Fabricius, 1805). Parasitology Research **119(3)**: 815-840. doi:10.1007/s00436-020-06616-4.

Piel Dornelles, G.D., Bordignon, M.O. and Graciolli, G. 2020. Description of the external morphology of the puparia of eight species of bat flies (Diptera: Streblidae). Studies on Neotropical Fauna and Environment **55(1)**: 58-81. doi:10.1080/01650521.2019.1693242.

Pilipenko, V.E., Starkevich, P. and Gavryushin, D.I. 2019. A new *Tipula* (*Vestiplex*) Bezzi crane fly species (Diptera: Tipulidae from Vietnam. Entomologica Americana **125(1-4)**: 10-15. doi:10.1664/1947-5136-125.1.10.

Pinho, L.C. and Da Silva, F.L. 2020. Description of two new species of *Polypedilum* (Asheum) and immature stages of *Polypedilum* (*A.*) *curticaudatum* (Diptera: Chironomidae). Zootaxa **4759(2)**: 179-190. doi:10.11646/zootaxa.4759.2.2.

Plant, A.R. 2020. New species of *Hemerodromia* Meigen (Diptera: Empididae: Hemerodromiinae) associated with limestone karstic waters in Thailand. Zootaxa **4758(3)**: 549-560. doi:10.11646/zootaxa.4758.3.7.

Podenas, S., Podeniene, V., Seo, H.-Y., Kim, A.Y., Park, S.-J., Byun, H.-W., Kim, H.-C. and Aukstikalniene, R. 2020. New *Atypophthalmus* (Diptera: Limoniidae) from South Korea. Zootaxa **4732(2)**: 281-294. doi:10.11646/zootaxa.4732.2.3.

Pollock, D.A. and Davidson, R.L. 2020. New records of ground and tiger beetles (Coleoptera: Carabidae) as prey for Asilidae (Diptera) in the high plains of New Mexico and Texas. Coleopterists Bulletin **74(1)**: 15-23. doi:10.1649/0010-065x-74.1.15.

Pollock, D.A. and Reichert, L.A. 2019. Review of the Nearctic genus *Wilcoxia* James (Diptera: Asilidae: Stenopogoninae), with descriptions of three new species. Zootaxa **4695(5)**: 401-437. doi:10.11646/zootaxa.4695.5.1.

Polseela, R., Wagner, R., Kvifte, G.M., Rulike, B. and Apiwathnasorn, C. 2019. Revision of Bruchomyiinae (Diptera, Psychodidae) of the Oriental Region, with description of a new genus and species and discussion of putative male/female antagonistic coevolution. Insect Systematics & Evolution **50(1)**: 67-82. doi:10.1163/1876312x-00002183.

Pont, A.C., Duvallet, G. and Changbunjong, T. 2020. A new species of *Haematobosca* Bezzi (Diptera: Muscidae) from Thailand. Zootaxa **4763(4)**: 538-544. doi:10.11646/zootaxa.4763.4.4.

Proenca, B. and Maia, V.C. 2020. A new species of *Clinodiplosis* Kieffer (Diptera, Cecidomyiidae) associated with *Cecropia* sp. (Urticaceae) in Brazil. Papeis Avulsos de Zoologia (Sao Paulo) **60**: 1-7.

Qilemoge, Lin, C., Qi, P., Li, D. and Yang, D. 2020. Two new species of *Rhaphium* from Qinghai Province, China (Diptera, Dolichopodidae, Rhaphiinae). Zookeys**(931)**: 73-84. doi:10.3897/zookeys.931.49671.

Rader, R., Cunningham, S.A., Howlett, B.G. and Inouye, D.W. 2020. Non-Bee Insects as Visitors and Pollinators of Crops: Biology, Ecology, and Management. *In* Annual Review of Entomology, Vol 65. *Edited by*A. E. Douglas. pp. 391-407.

Rafael, J.A., Marques, D.W.A. and Limeira-de-Oliveira, F. 2020. *Atriadops macula* (Wiedemann) inhabiting the canopy: the first record of Nemestrinidae (Diptera) in the Amazon Basin. Zootaxa **4722(5)**: 486-490. doi:10.11646/zootaxa.4722.5.7.

Raguso, R.A. 2020. Don't forget the flies: dipteran diversity and its consequences for floral ecology and evolution. Applied Entomology and Zoology **55(1)**: 1-7. doi:10.1007/s13355-020-00668-9.

Randrianambinintsoa, F.J., Robert, V., Blavier, A., Leger, N. and Depaquit, J. 2020. Two new phlebotomine sandfly species (Diptera: Psychodidae) from the Highlands of Madagascar. Acta Tropica **202**. doi:10.1016/j.actatropica.2019.105260.

Reemer, M., Skevington, J.H. and Kelso, S. 2019. Revision of the Neotropical hoverfly genus *Peradon* Reemer (Diptera, Syrphidae, Microdontinae). Zookeys**(896)**: 1-93. doi:10.3897/zookeys.896.36493.

Rezaei, S., Grichanov I.Ya., Fallahzadeh, M., Dousti, A.F. and Saghaei, N. 2019. A faunistic study of the Dolichopodidae (Diptera, Brachycera) in Fars Province of Iran. Acta Biologica Sibirica, **5(4):** 89-95. doi: https://doi.org/10.14258/abs.v5.i4.7069

Ringo, J.M. 2020. How do flies keep clean? Head grooming in *Drosophila*. Journal of Ethology **38(2)**: 167-172. doi:10.1007/s10164-019-00635-0.

Rochlin, I., Faraji, A., Healy, K. and Andreadis, T.G. 2019. West Nile Virus mosquito vectors in North America. Journal of Medical Entomology **56(6)**: 1475-1490. doi:10.1093/jme/tjz146.

Rodrigues, A.R., Carvalho-Fernandes, S.P., Maia, V.C. and Oliveira, L.A. 2020. Three new species of *Bruggmanniella* Tavares, 1909 (Diptera, Cecidomyiidae) from Brazil with a key to species. Revista Brasileira De Entomologia **64(1)**. doi:10.1590/1806-9665-rbent-2019-17.

Rodriguez-Martinez, L.M., Yzquierdo-Gomez, P., Gonzalez-Acosta, C. and Correa-Morales, F. 2020. First Record of *Aedes* (*Ochlerotatus*) fulvus in Tabasco and Distribution Notes of Other *Aedes* in Mexico. Southwestern Entomologist **45(1)**: 263-268. doi:10.3958/059.045.0127.

Rohacek, J. 2020. Anthomyzidae (Diptera) of Taiwan: new species but no new records. Acta Entomologica Musei Nationalis Pragae **60(1)**: 269-290. doi:10.37520/aemnp.2020.015.

Rohacek, J. 2020. Sugar factory sedimentation basins as a refugium of endangered soldierflies (Diptera: Stratiomyidae) in the Czech Silesia (Czech Republic). Journal of Insect Conservation **24(1)**: 87-101. doi:10.1007/s10841-019-00203-4.

Ronquist F, Forshage M, Häggqvist S, Karlsson D, Hovmöller R, et al. (incl. Pollet, M.). 2020. Completing Linnaeus's inventory of the Swedish insect fauna: Only 5,000 species left?. Plos One **15(3):** e0228561. https://doi.org/10.1371/journal.pone.0228561.

Roquer-Beni, L., Rodrigo, A., Arnan, X., Klein, A.-M., Fornoff, F., Boreux, V. and Bosch, J. 2020. A novel method to measure hairiness in bees and other insect pollinators. Ecology and Evolution **10(6)**: 2979-2990. doi:10.1002/ece3.6112.

Rueda, L.M. 2020. *Mosquitoes, Communities, and Public Health in Texas*. Elsevier.

Saha, P., Brahma, S. and Hazra, N. 2020. Three new species of predaceous midges *Brachypogon* Kieffer from northern plains of West Bengal, India (Diptera: Ceratopogonidae). Oriental Insects **54(2)**: 241-258. doi:10.1080/00305316.2019.1616000.

Salvetti, M., Bianchi, A., Marangi, M., Barlaam, A., Giacomelli, S., Bertoletti, I., Roy, L. and Giangaspero, A. 2020. Deer keds on wild ungulates in northern Italy, with a taxonomic key for the identification of *Lipoptena* spp. of Europe. Medical and Veterinary Entomology **34(1)**: 74-85. doi:10.1111/mve.12411.

Samocha, Y. and Scharf, I. 2020. Comparison of wormlion behavior under man-made and natural shelters: urban wormlions more strongly prefer shaded, fine-sand microhabitats, construct larger pits and respond faster to prey. Current Zoology **66(1)**: 91-98. doi:10.1093/cz/zoz006.

Sankararaman, H., Daniel, J.A., Manickavasagam, S. and Pennards, G. 2020. First record of two interesting genera of hover flies (Diptera: Syrphidae) in South India. Journal of Insect Biodiversity **14(2)**: 54-63.

Santarem, M.C.A., Borkent, A. and Felippe-Bauer, M.L. 2020. Taxonomic Revision of Neotropical *Downeshelea* Wirth and Grogan Predaceous Midges (Diptera: Ceratopogonidae). Insects **11(1):** 9. doi:10.3390/insects11010009.

Santos, D., Santos, R.D.R. and Ribeiro, G.C. 2019. Systematics of the genus *Maietta* Alexander with description of three new species (Diptera: Tipulomorpha: Limoniidae). Zootaxa **4695(4)**: 331-350. doi:10.11646/zootaxa.4695.4.2.

Sato, S., Harris, K.M., Collet, D.M., Kim, W. and Yukawa, J. 2020. Genetic variation in intraspecific populations of *Rabdophaga rosaria* (Diptera: Cecidomyiidae) indicating possible diversification scenarios into sibling species along with host range expansion on willows (Salicaceae: *Salix*). Zoological Journal of the Linnean Society. doi:10.1093/zoolinnean/zlz179.

Scarparo, G., d'Ettorre, P. and Di Giulio, A. 2019. Chemical deception and structural adaptation in *Microdon* (Diptera, Syrphidae, Microdontinae), a genus of hoverflies parasitic on social insects. Journal of Chemical Ecology **45(11-12)**: 959-971. doi:10.1007/s10886-019-01121-0.

Seehausen, M., Kunz, B., Havelka, P. and Martens, A. 2019. An ectoparasite of caterpillars, *Forcipomyia fuliginosa* (Diptera: Ceratopogonidae), recorded sucking haemolymph from an *Aeshna juncea* just before maiden flight (Odonata: Aeshnidae). Notulae Odonatologicae **9(4)**: 169-172.

Sepulveda, T.A., Echeverry, A. and Souza, D.D.S. 2020. New species of *Chaetonerius* Hendel (Diptera: Neriidae) and key for identification of the Neriidae of Tanzania. Zootaxa **4755(1)**: 190-194. doi:10.11646/zootaxa.4755.1.12.

Sepulveda, T.A., Gomes, L.R.P. and Limeira-de-Oliveira, F. 2020. Neriidae (Diptera: Schizophora) of the Northeastern Brazil: new records and an identification key. Biota Neotropica **20(1)**. doi:10.1590/1676-0611-bn-2019-0854.

Shamshev, I.V. 2020. *Empis* s. str. (Diptera: Empididae) from Egypt, Israel and Syria: notes on some species described by JE Collin and a key to species. Zootaxa **4743(2)**: 266-274. doi:10.11646/zootaxa.4743.2.9.

Shamshev, I.V. 2020. Notes on species of Empididae (Diptera) described by R. Frey from the Swedish Kamchatka Expedition 1920-1922. Zootaxa **4758(3)**: 532-548. doi:10.11646/zootaxa.4758.3.6.

Skartveit, J. and Krizmanic, K. 2020. Revision of fossil Bibionidae (Insects: Diptera) from the Miocene of Radoboj, Croatia. Zootaxa **4759(3)**: 351-378. doi:10.11646/zootaxa.4759.3.3.

Skibinska, K. and Krzeminski, W. 2020. Two new species of the genus *Dacochile* (Diptera, Tanyderidae) from Burmese amber. Historical Biology **32(3)**: 356-361. doi:10.1080/08912963.2018.1494735.

Smit, J., Zeegers, T. and Cramer, T. 2019. The exotic black solder fly *Hermetia illucens* found in the Netherlands (Diptera: Stratiomyidae). Nederlandse Faunistische Mededelingen **53**: 11-15.

Smit, J., Zeegers, T. and Dorji, P. 2020. A new species of *Eumerus* (Diptera, Syrphidae) from the Kingdom of Bhutan, the easternmost representative of the *bactrianus* subgroup. Zookeys**(906)**: 141-151. doi:10.3897/zookeys.906.48501.

Solecki, A.M., Skevington, J.H., Buddle, C.M. and Wheeler, T.A. 2019. Phylogeography of higher Diptera in glacial and postglacial grasslands in western North America. Bmc Ecology **19:** 53. doi:10.1186/s12898-019-0266-4.

Solorzano-Kraemer, M.M., Delclos, X., Penalver, E. and Sinclair, B.J. 2020. New genus and first record of Hybotinae (Diptera: Empidoidea: Hybotidae) in middle Eocene Dominican amber. Novitates Caribaea **15**: 1-8.

Song, C., Wang, X., Bu, W. and Qi, X. 2020. Morphology lies: a case-in-point with a new non-biting midge species from Oriental China (Diptera, Chironomidae). Zookeys**(909)**: 67-77. doi:10.3897/zookeys.909.39347.

Song, C., Zheng, J., Wang, X. and Qi, X. 2020. A new species of *Limnophyes* Eaton (Diptera: Chironomidae) from Xizang, China. Zootaxa **4722(3)**: 295-300. doi:10.11646/zootaxa.4722.3.7.

Souza, E.L., Sousa, R.P., Sousa, L.M. and Roque, F. 2019. Diversity of Brazilian savanna drosophilids in two forest fragments with contrasting degrees of conservation. Drosophila Information Service **102**: 49-53.

Srivathsan, A., Hartop, E., Puniamoorthy, J., Lee, W.T., Kutty, S.N., Kurina, O. and Meier, R. 2019. Rapid, large-scale species discovery in hyperdiverse taxa using 1D MinION sequencing. Bmc Biology **17(1)**. doi:10.1186/s12915-019-0706-9.

Starkevich, P., Men, Q.-L. and Sivell, D. 2020. Redescriptions of the poorly known crane fly species *Tipula* (*Vestiplex*) *scandens* and *Tipula* (*Vestiplex*) *subscripta* from Tibet and Yunnan, China (Diptera, Tipulidae). Zookeys**(917)**: 127-140. doi:10.3897/zookeys.917.38044.

Steck, G.J., Rodriguez, E.J., Norrbom, A.L., Dutra, V.S., Ronchi-Teles, B. and Silva, J.G. 2019. Review of *Anastrepha* (Diptera: Tephritidae) Immature Stage Taxonomy. In: Perez-Staples, D., Diaz-Fleischer, F., Montoya, P. & Vera, M.T. (eds.), Area-Wide Management of Fruit Fly Pests. CRC Press, Boca Raton, 414 pp.

Stuke, J.-H. 2019. New conopid records from the Afrotropical Region (Diptera: Conopidae). Part 2: Conopinae excluding Physocephalini. Israel Journal of Entomology **49(2):** 277-349. http://doi.org/10.5281/zenodo.3592432

Stur, E. and Ekrem, T. 2020. The Chironomidae (Diptera) of Svalbard and Jan Mayen. Insects **11(3):** 183. doi:10.3390/insects11030183.

Sun, C. and Wei, L. 2020. A definition and review of the *Myospila argentata* species-group (Diptera: Muscidae: Mydaeinae) from China. Oriental Insects **54(1)**: 127-142. doi:10.1080/00305316.2019.1583613.

Szadziewski, R., Dominiak, P. and Withers, P. 2020. Two new species of biting midges from France and Algreria (Diptera: Ceratopogonidae). Annales Zoologici **70(1)**: 113-120. doi:10.3161/00034541anz2020.70.1.006.

Szadziewski, R., Sontag, E., Krzeminski, W. and Szwedo, J. 2019. Two new genera of insectivorous biting midges (Diptera: Ceratopogonidae) from mid-Cretaceous Burmese amber. Palaeoentomology **2(6)**: 657-664.

Szpila, K., Wyborska, D., Bystrowski, C. and Pape, T. 2020. Redescription of *Sphecapatoclea excisa* Villeneuve, 1909 (Diptera: Sarcophagidae). Zootaxa **4728(1)**: 110-122. doi:10.11646/zootaxa.4728.1.5.

Taber, S.W. 2019. A new Nearctic species of *Diadocidia* Ruthe fungus gnat (Diptera: Diadocidiidae). Southwestern Entomologist **44(4)**: 897-903. doi:10.3958/059.044.0418.

Talaga, S., Gantier, J.-C. and Girod, R. 2020. Mosquitoes (Diptera: Culicidae) originally described from French Guiana. Zootaxa **4747(2)**: 361-377. doi:10.11646/zootaxa.4747.2.8.

Tang, C., Shi, C., Wang, S. and Yang, D. 2019. The first report of Dolichopodidae from mid-Cretaceous amber of Northern Myanmar. Cretaceous Research **104**. doi:10.1016/j.cretres.2019.07.009.

Tang, H. and Cranston, P.S. 2020. Phytophagy in a *Polypedilum* (Diptera: Chironomidae) species new to Australia and Japan: taxonomy and expanded Asian distribution. Austral Entomology **59(1)**: 102-118. doi:10.1111/aen.12428.

Tang, H. and Niitsuma, H. 2020. Review of the genus *Aminihayesomyia* Niitsuma (Diptera: Chironomidae: Tanypodinae), with descriptions of three new species from China. Zootaxa **4743(3)**: 411-418. doi:10.11646/zootaxa.4743.3.8.

Taylor, G.J., Hall, S.A., Gren, J.A. and Baird, E. 2020. Exploring the visual world of fossilized and modern fungus gnat eyes (Diptera: Keroplatidae) with X-ray microtomography. Journal of the Royal Society Interface **17(163)**. doi:10.1098/rsif.2019.0750.

Taylor, G.S., Hyder, B.K. and Davies, K.A. 2019. New species of gall fly (Diptera: Fergusoninidae) from *Eucalyptus camaldulensis* (Myrtaceae) in southern Australia and its associated parasitoids and inquilines. Zootaxa **4701(5)**: 401-416. doi:10.11646/zootaxa.4701.5.1.

Tejeda, M.T., Arredondo, J., Diaz-Fleischer, F. and Perez-Staples, D. 2020. Does Size Matter? Mate Choice in Two Lekking Flies. Journal of Insect Science **20(2):** 13. doi:10.1093/jisesa/ieaa019.

Tian, J., Huo, K.-K., Zhang, C.-T. and Ren, B.-Z. 2019. *Microdon dentigiganteum* sp. nov. and other Microdontinae species (Diptera: Syrphidae) from Northeast China. Zootaxa **4712(1)**: 65-76. doi:10.11646/zootaxa.4712.1.4.

Valan, M., Makonyi, K., Maki, A., Vondracek, D. and Ronquist, F. 2019. Automated Taxonomic Identification of Insects with Expert-Level Accuracy Using Effective Feature Transfer from Convolutional Networks. Systematic Biology **68(6)**: 876-895. doi:10.1093/sysbio/syz014.

van Steenis, J. 2020. A new species of the genus *Myolepta* Newman (Diptera: Syrphidae), with short description and key to all species of the *M. vara* subgroup. Zootaxa **4750(3)**: 370-390. doi:10.11646/zootaxa.4750.3.4.

Vasanthakumar, D., Palanisamy, S., Peter, V.R. and Sharma, R.M. 2020. A new species of *Asphondylia* (Diptera: Cecidomyiidae) causing leaf galls on jujube, *Ziziphus jujuba* Mill. (Rhamnaceae) in India. Zootaxa **4758(1)**: 196-200. doi:10.11646/zootaxa.4758.1.11.

Verves, Y.G. and Khrokalo, L.A. 2020. Review of the genus *Sphenometopa* Townsend, 1908 (Diptera: Sarcophagidae) of the Middle East. Biologia. doi:10.2478/s11756-020-00425-x.

Verves, Y., Khrokalo, L. and Panchuk, O. 2019. Review of the Middle Eastern species of *Dolichotachina* Villeneuve, 1913 (Diptera: Sarcophagidae, Miltogramminae) with the description of a new species. Zoology in the Middle East: **8**. doi:10.1080/09397140.2019.1663889.

Vujic, A., Likov, L., Radenkovic, S., Tubic, N.K., Djan, M., Sebic, A., Perez-Banon, C., Barkalov, A., Hayat, R., Rojo, S. and others. 2020. Revision of the *Merodon serrulatus* group (Diptera, Syrphidae). Zookeys**(909)**: 79-158. doi:10.3897/zookeys.909.46838.

Wagner, R. and Mueller, P. 2020. The oldest of the rare: A new species of the family Nymphomyiidae (Diptera) from Burmese amber. Zootaxa **4763(2)**: 287-293. doi:10.11646/zootaxa.4763.2.11.

Wagner, R. and Withers, P. 2020. The West-Palearctic species of the genus *Tonnoiriella* Vaillant, 1971 (Diptera: Psychodidae, Psychodinae). Zootaxa **4728(2)**: 183-210. doi:10.11646/zootaxa.4728.2.2.

Wang, M.-Q., Yang, D. and Zhang, L.-S. 2020. Review of the genus *Neurigona* (Diptera: Dolichopodidae) from Thailand with three new species. Oriental Insects **54(1)**: 114-126. doi:10.1080/00305316.2019.1568924.

Wendt, L.D. and Marinoni, L. 2019. Taxonomic revision of *Megalothoraca* (Diptera: Richardiidae) with description of a new species, synonyms and new combination. Zoologia **36:** 1-15. doi:10.3897/zoologia.36.e31456.

Woznica, A.J. 2019. *Gedanoleria eocenica* - a new genus and species from Eocene Baltic amber (Diptera: Heleomyzidae), with notes on heleomyzid-like flies from African copal. Polish Journal of Entomology **88(4)**: 395-406.

Wylde, Z., Crean, A. and Bonduriansky, R. 2020. Effects of condition and sperm competition risk on sperm allocation and storage in neriid flies. Behavioral Ecology **31(1)**: 202-212. doi:10.1093/beheco/arz178.

Xi, Y. and Yin, X. 2020. Three new *Cryptochetum* Rondani, 1875 (Diptera: Cryptochetidae) from Yunnan Province, China and an identification key to Chinese species. European Journal of Taxonomy **605**: 1-15. doi:10.5852/ejt.2020.605.

Xi, Y.Q., Yang, D. and Yin, X.M. *Phyllomyza* Fallen newly recorded from Laos with descriptions of three new species (Diptera, Milichiidae). Oriental Insects: 10. doi:10.1080/00305316.2019.1647574.

Young, A.D. and Gillung, J.P. 2020. Phylogenomics - principles, opportunities and pitfalls of big-data phylogenetics. Systematic Entomology **45(2)**: 225-247. doi:10.1111/syen.12406.

Young, A.D., Skevington, J.H. and van Steenis, W. 2020. Revision of the *Psilota* Meigen, 1822 flower flies (Diptera: Syrphidae) of Australia. Zootaxa **4737(1)**: 1-+. doi:10.11646/zootaxa.4737.1.1.

Yukawa, J., Fujimoto, K., Ganaha-Kikumura, T. and Kim, W. 2020. Effects of typhoons on an arthropod community centered upon a leaf gall midge, *Pseudasphondylia neolitseae* (Diptera: Cecidomyiidae) and its host plant, *Neolitsea sericea* (Lauraceae) through leaf fall and late-season shoot production. Ecological Research **35(1)**: 252-264. doi:10.1111/1440-1703.12082.

Yukawa, J., Harris, K.M. & Kim, W. 2020. Descriptions of two new species of the genus *Lasioptera* (Diptera: Cecidomyiidae) that infest tomato in the Mediterranean Region and Hokkaido, Japan. Applied Entomology and Zoology **55:** 129–140. doi.org/10.1007/s13355-019-00662-w

Yukawa, J., Tokuda, M., Uechi, N., Yasuda, K., Ganaha-Kikumura, T., Matsuo, K., Shimizu, Y. and Yamaguchi, D. 2019. Ecological divergence among morphologically and genetically related *Asphondylia* species (Diptera: Cecidomyiidae), with new life history data for three congeners including the Alpinia fruit gall midge. Entomological Science **22(4):** 437-449. doi:10.1111/ens.12389.

Yuzuki, K. and Tidon, R. 2020. Identification key for drosophilid species (Diptera, Drosophilidae) exotic to the Neotropical Region and occurring in Brazil. Revista Brasileira De Entomologia **64(1)**. doi:10.1590/1806-9665-rbent-2019-100.

Zoric, L.S., Acanski, J., Vujic, A., Stahls, G., Djan, M. and Radenkovic, S. 2020. Resolving the taxonomy of the *Merodon dobrogensis* species subgroup (Diptera: Syrphidae), with the description of a new species. Canadian Entomologist **152(1)**: 36-59. doi:10.4039/tce.2019.72.

Zou, Y., van der Werf, W., Liu, Y. and Axmacher, J.C. 2020. Predictability of species diversity by family diversity across global terrestrial animal taxa. Global Ecology and Biogeography **29(4)**: 629-644. doi:10.1111/geb.13043.

Zuijlen, J.W. van, von Tschirnhaus, M., Wielink, P. van, Erkelens, J. van, Roháček, J., Broek, R. van den, Eck, A. van, Huijbregts, H., Brake, I., Gaimari, S., Nartshuk, E., Meuffels, H., Bächli, G., Leij, L. van der, Zatwarnicki, T., MacGowan, I., Prescher, S., Dempewolf, M. and Jong, H. de. 2020. Diptera-Brachycera (Vliegen). In: Wielink, P. van, Felix, R., Kemenade, J. van, Mol, A., Peeters, T. and Stooker, G. (eds.), De Kaaistoep, het best onderzochte stuk natuur in Nederland. KNNV-afd. Tilburg, Tilburg, pp. 361–366.

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Dr. James O'Hara
Canadian National Collection of Insects
Agriculture & Agri-Food Canada
K.W. Neatby Building, C.E.F.
Ottawa, Ontario, CANADA, K1A 0C6

Tel.: (613) 759-1795
FAX: (613) 759-1927
Email: james.ohara@canada.ca

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