

# THE TACHINID TIMES

ISSUE 26

*TTT turns 25 with a new look!*

## BARCODING FINNISH TACHINIDAE

In quest of the  
Tachinid Phylogeny

The pestiferous  
uzifly of India

To 'Die Hel' and back  
Collecting in the Western Cape

*Where* are all the genera?

February 2013





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# THE TACHINID TIMES

February 2013, Issue 26

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ISSN 1925-3435 (Print)

ISSN 1925-3443 (Online)

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## TACHINIDAE RESOURCES

*The Tachinid Times* is hosted on the Tachinidae Resources web pages of the North American Dipterists Society (NADS) website at <http://www.nadsdiptera.org/Tach/home.htm>. The NADS website is kindly hosted by the University of Guelph through arrangement with Stephen A. Marshall of the Department of Environmental Biology, University of Guelph, Guelph, Ontario, Canada.

## DISTRIBUTION

This newsletter is distributed near the end of February each year. It is published simultaneously in hardcopy and online, both based on the same PDF generated from an InDesign file. Hardcopies are distributed to several libraries and to a few readers who request them.

## Message from the editor

This issue of *The Tachinid Times* marks 25 years of continuous publication of this newsletter. It also marks a leap ahead into the digital world with our conversion to the desktop publishing application Adobe InDesign. I hope you like the new "look" of *The Tachinid Times*. We will continue to seek ways to further improve the delivery of this newsletter as future technologies open new possibilities.

## Instructions to authors

This newsletter accepts submissions on all aspects of tachinid biology and systematics. It is intentionally maintained as a non-peer-reviewed publication so as not to relinquish its status as a venue for those who wish to share information about tachinids in an informal medium. All submissions are subjected to careful editing and some are (informally) reviewed if the content is thought to need another opinion. Some submissions are rejected because they are poorly prepared, not well illustrated, or excruciatingly boring.

Authors should try to write their submissions in a style that will be of interest to the general reader, in addition to being technically accurate. This is a newsletter, not *Science* or *Nature*. Illustrate submissions with high quality images sent as separate files at the same time as the text. Text files sent with embedded images will not be considered for publication. All content should be original; if copyrighted material (online or in print) is used then permission from the copyright holder is needed.

Student submissions are particularly welcome. Writing about a thesis study or a side project involving tachinids is a good way to inform others about a study that is underway before it has generated formal publications.

Please send submissions for the 2014 issue of *The Tachinid Times* to the editor by the end of January 2014.

**FRONT COVER** A female *Leschenaultia* sp. rests on a leaf beside Ramsey Creek on the Hamburg Trail in Ramsey Canyon, Huachuca Mountains, Arizona, USA.

Photo: J.E. O'Hara, 21 September 2012

**TABLE OF CONTENTS** A male *Smidtia capensis* (Schiner) awaits a female on a hilltop in 'Del Hel', Swartberg Nature Reserve, Western Cape, South Africa. See article on page 20.

Photo: P. Cerretti, 7 October 2012





# Progress Towards a Phylogeny of World Tachinidae Year 1

by John O. Stireman III<sup>1</sup>, James E. O'Hara<sup>2</sup>, J. Kevin Moulton<sup>3</sup>, Pierfilippo Cerretti<sup>4</sup> and Isaac S. Winkler<sup>1</sup>

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## INTRODUCTION

by John Stireman (Figs. 1–2)

Developing a structural phylogenetic framework for the family Tachinidae has been an interest of mine since I first started working on tachinids as a graduate student. It was then that I developed a new phylogenetic perspective with which to view the world, and many of the questions I wanted to ask of tachinids depended on some level of phylogenetic knowledge of them. I was surprised at the time that no one had attempted a broad quantitative phylogenetic analysis of the family, and a publication from my thesis work on the Exoristinae (Stireman 2002) became the first such study that I know of. Ever since that initial work, I have been seeking ways to continue working towards the development of a broad and robust phylogeny of Tachinidae (e.g., Stireman 2005, 2010).

About ten years ago, Kevin Moulton (Univ. of Tennessee), developed the first full proposal for a molecular phylogeny of Tachinidae and invited me to participate as a postdoc. Unfortunately this, and a subsequent proposal, failed to garner interest from U.S. governmental funding agencies, and we put it “on the back burner” and pursued other research projects. Obtaining a professorship position in 2005 at Wright State University allowed me the resources and opportunity to begin collecting tachinid samples and sequence data



**Figure 1.** John Stireman at Anysberg Nature Reserve, South Africa.



“on the side” while conducting other work. We were not in a big rush to get rejected yet again, so we put off re-submitting a revamped proposal until 2010, when we invited Jim O’Hara (CNC) to be a collaborator. In this revised proposal, we sought to make the tachinid phylogeny project more of a collaborative effort as you can see from my 2010 article in *The Tachinid Times* exhorting aid from tachinid workers. This same year, Tachi and Shima (2010) published their paper focused on the phylogeny of Exoristinae, a vast improvement over my initial attempts. This paper demonstrated the potential insight that phylogenetic analysis of tachinids could provide, and spurred our efforts. Again, our proposal was rejected. But we were not so easily deterred; we revised it and resubmitted it twice more, each time expanding our goals and proposed products.



**Figure 2.** An *Archytas* sp. sitting on a leaf in Tar Hollow State Park, Ohio (USA).

We were finally awarded a grant in 2012 from U.S. National Science Foundation to pursue our goals of developing a broad phylogenetic framework for Tachinidae. This initiative, “The Phylogeny and Evolution of World Tachinidae”, was designed to be a collaborative project, involving many tachinid researchers from around the world. The primary collaborators are John Stireman (me, Wright State Univ.), Jim O’Hara (CNC), Kevin Moulton (Univ. of Tennessee), Pierfilippo Cerretti (Univ. of Roma), and Isaac Winkler (who recently joined my laboratory as a postdoc working on the project). I also have a Ph. D.

student, Zachary Burington, working in my lab on this project (see the Student News section of this newsletter for a note from Zach).

In addition, we have solicited the involvement of many additional tachinid researchers. Thus far, we have received advice and assistance from a number of colleagues, including but not limited to Monty Wood, Ashley Kirk-Spriggs, Dan Janzen, Daniel Whitmore, Takuji Tachi, and Hiroshi Shima.

I don’t believe I need to sell the readers of this newsletter on the importance of Tachinidae or the benefits of an in-depth comprehensive phylogenetic study of the family. Nor do I probably need to impress upon you that the relationships among tribes and subfamilies of Tachinidae are obscure and the family is among the most taxonomically difficult of Diptera.

Thus, I can dispense with justification and get on with the main goals of our proposed research over the next several (many?) years, which include:

- 1) The robust reconstruction of phylogenetic relationships among major tachinid lineages (ca. 200–300 genera) using molecular (5+ genes) and morphological data.
- 2) To use our phylogenetic findings to revise current classificatory schemes and produce a stable, predictive classification of Tachinidae.
- 3) More focused phylogenetic analyses of two biologically interesting and agronomically important groups, the tribe Blondeliini and the subfamily Phasiinae.
- 4) Analysis of the evolution of reproductive traits, oviposition strategy, and host associations and their effects on diversification and biological control success.
- 5) Dissemination of taxonomic and biological information on Tachinidae through the development of web resources and an interactive key to North American (for now) genera.

These goals are a little ambitious given the three year term of NSF grants (and the reduced budgets we were awarded), and to be realistic, I don’t think it is all going to happen in this time frame. But, these are the goals we are working towards, and we seem to be making appreciable progress so far. I have invited each of the major collaborators to provide a brief overview of their recent efforts in relation to the overall goals of our project (below). We plan to provide continued news of our activities and progress in future issues of *The Tachinid Times*.



## MAJOR COLLABORATORS

### Jim O'Hara (Fig. 3)

I first corresponded with John back in 1995.

I think he had recently moved from Utah to Arizona and had spent the summer roaming around southern AZ in his pickup truck looking for tachinids before starting a Ph.D. on a tachinid ecology project at the University of Arizona in Tucson. I met John in person in 1999 during one of my field trips to Arizona. He led me to a remote canyon in the Huachuca Mountains to a spot he had christened “tachinid hole”, which in a good year is rich in tachinids. Although distant by road from my best collecting spot in the Huachuca Mountains (the Hamburg Trail portion of Ramsey Canyon), it was only a couple of kilometers away as the crow flies.

John's interests extended beyond tachinid ecology to evolution, both in the sense of tachinid/host interactions and tachinid phylogeny. Eventually these interests led to John's idea of putting a team together to seek funding from NSF to pursue the present study. The goals of this study actually incorporated some of the ideas put forth by Kevin Moulton in an earlier but unsuccessful attempt to obtain funding from the United States Department of Agriculture to study the phylogenetics of primarily Nearctic Tachinidae. We now hope that with funding in place and goals to achieve, we can make some progress towards understanding the relationships among world tachinid taxa above the generic level.

My contributions to this study are intertwined with my own research program funded by Agriculture and Agri-Food Canada (AAFC) that supports myself and my technician Shannon Henderson. My research over the past decade has shifted away from traditional taxonomic revisions to gathering together information for broader use; e.g., regional catalogues, an ongoing world taxonomic database, and involvement in the Tachinidae chapter of the Manual of Afrotropical Tachinidae (led by Pierfilippo Cerretti). If the present study leads to a better understanding of tachinid relationships and an improved classification, then this will be good for the projects I am pursuing on behalf of AAFC.

For the NSF project, Shannon and I will be expanding the coverage of the Tachinidae in the TachImage Gallery (<http://www.nadsdiptera.org/Tach/Tachgallery/Tachgalleryhom.htm>). I will be supplying Pierfilippo with specimens from the Canadian National Collection of Insects for use in an interactive key to the Tachinidae of America north Mexico and assisting with its development. I will participate in the interpretation of results and the writing of papers, and the collection of specimens for molecular analyses. The last is a vital part of the project and, from my perspective, one of the more enjoyable aspects of it. I started collecting specimens for molecular analyses several years ago in the hopes that the the project would be funded. The method I use for preserving material was described two years ago in this newsletter (*The Tachinid Times* 24: 11–14). Last year I collected specimens for this project in Arizona (Fig. 4) and New Mexico and also participated in the group trip to South Africa that we review elsewhere in this issue.



**Figure 3.** Jim O'Hara at Anysberg Nature Reserve, South Africa.





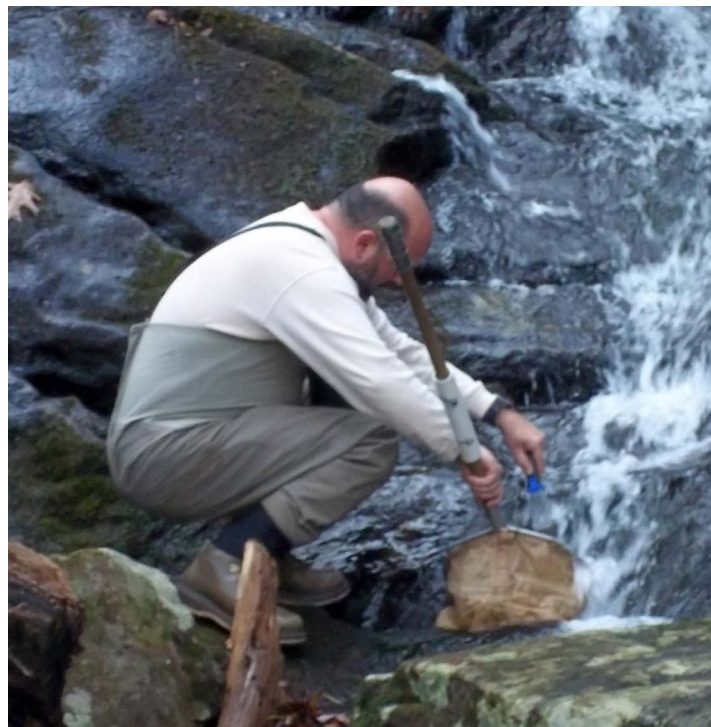
**Figure 4.** Unexplored hilltops near the Winchester Mountains in southern Arizona, USA.

### Kevin Moulton (Fig. 5)

Myself and my Master's student Jeremy Blaschke (see the Student News section of this newsletter for a note from Jeremy) at the University of Tennessee, Knoxville are primarily responsible for collecting molecular data for the subfamily Phasiinae, collection of sequences for the gene MAC, and aiding Stireman's group in the collection of sequences for newly developed genes. The phasiines are an agronomically important group of heteropteran parasitoids and many genera have been used with varied success as biocontrol agents. From personal collecting trips and additional material sent from collaborators, we have been able to extract DNA from 35 phasiines representing 28 genera from 8 of the 9 collectable worldwide tribes. We are sequencing five different genes: CAD, MAC, LGL, MCS, and OPA or TUFT. These genes have varying evolutionary rates and when combined into a single data set will hopefully be able to reconstruct subfamilies, tribes, and beyond. We have sequences for CAD and MAC from all 35 available taxa, 33 for LGL, 16 for MCS, 8 for OPA, and 4 for TUFT.

As mentioned earlier, we are responsible for providing MAC, LGL, and MCS sequence data for a preliminary investigation of gene utility using a sparse though representative sample of genera. This initial study will consist of representative genera from important tribes within each subfamily as well as several outgroup taxa from each oestroidean family. We want to include around 32 taxa in this phylogeny and of those we have 32 for MAC, 30 for LGL, and 24 for MCS. We hope to have sequence data for all genes by the end of spring semester 2013.

Some interesting notes from collecting efforts in 2012. We have been baiting flight intercept traps with pheromones from *Halyomorpha halys* (Stål) (brown marmorated stink bug). The pheromones have successfully doubled (sometimes more) our catch rate of several phasiine genera. We will be exploring heteropteran pheromone baiting in the upcoming collecting season. Lastly, we have discovered what might be two distinct morphotypes of the important biocontrol species *Trichopoda pennipes* (Fab.) in the eastern United States. Further morphological and molecular research will be done to determine if these entities are valid species.



**Figure 5.** Kevin Moulton collecting Blephariceridae at Brasstown Bald, Georgia, USA.



## Pierfilippo Cerretti (Fig. 6)

My focus on tachinid systematics dates back to 1998, when I first met Jim O'Hara and Monty Wood at the International Congress of Dipterology in Oxford (UK). Soon after the meeting Monty kindly introduced me to Benno Herting and Peter Tschorsnig (Stuttgart). Since 1999 I have visited the Tschorsnig lab several times and have learned a lot from Peter about tachinid systematics and biology. In more or less a decade I revised the whole Italian fauna to species level (Cerretti 2010), producing also an interactive key to Palaearctic genera in collaboration with Peter and Massimo Lopresti (Verona) (Cerretti *et al.* 2012). At the same time I started studying the Afrotropical fauna in order to revise the tribal and generic level classification and eventually extend the interactive key to this huge fauna. It is because of my interest in the African fauna that Ashley Kirk-Spriggs in 2009 invited me to lead the tachinid chapter of the upcoming Manual of Afrotropical Diptera (<http://afrotropicalmanual.net/>) that will be co-authored by Jim O'Hara, John Stireman and Monty Wood. In this project Jim is leading a new revised version of the Afrotropical tachinid catalogue.

Scoring morphological characters and developing interactive key applications is now one of my main activities and the reason why John Stireman and Jim O'Hara kindly asked me to join the "Phylogeny of World Tachinidae" project proposal in 2010. As mentioned already by John, the project has several ambitious goals and these are so interesting to me that I simply could not turn down their request to collaborate. In this context my main responsibilities are 1) to score morphological characters to infer the first phylogenetic reconstruction of the Tachinidae using a cladistic approach (we are

confident that a manuscript with preliminary but interesting results can be submitted in this spring), 2) to lead the development of an interactive key to Nearctic genera, and 3) to supply John's and Kevin's labs with specimens for molecular analyses. Of course, to study the evolution of morphological and biological traits over trees generated by molecular data will probably be the most exciting challenge for all of us!



**Figure 6.** Pierfilippo Cerretti and shy tortoise at Anysberg Nature Reserve, South Africa.



## Isaac Winkler (Fig. 7)

I have been helping to coordinate and assemble the molecular data for the overall tachinid tree (except phasiines). We are focusing initially on getting sequence for CAD and 28S. Our student technician, Beth Stayrook, has also been doing a lot of lab work, and we now have some sequence data from 19 tribes and nearly 200 genera.

Also, we have some transcriptome sequence data now from eight tachinid species (two from each subfamily). These each consist of about 30 million short reads, assembled into sequences for about 20,000 genes. It has been interesting and fun learning how to assemble and analyze this genomic data. Within the next two months we should have a phylogenomic data set put together and analyzed. The data should also be helpful for designing primers, studying specific tachinid genes, and even for learning about genome evolution in tachinids.



Figure 7. Isaac Winkler hard at work in the lab.

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# WHERE IN THE WORLD ARE ALL THE TACHINID GENERA?

by James E. O'Hara

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## INTRODUCTION

Since my earliest studies on tachinids I have been interested in the question of how old are the Tachinidae. I discussed this in a revision of the Siphonini (O'Hara 1989) and concluded that the family must have evolved in the Cenozoic Era because there is no evidence that they appeared any earlier. There are neither Cretaceous fossils nor distribution patterns which suggest that early tachinids existed at the time when Gondwanaland was breaking up. If they had occupied that supercontinent in the Cretaceous, then one might expect to see some tachinid lineages with distributions shared between the southern continents of South America, Africa and Australia, or at least the last two of these to separate, South America and Australia. There may even have been some opportunity for southern dispersal through a more hospitable Antarctica into the early Tertiary (Amorim *et al.* 2009).

A recent "molecular-based time-calibrated phylogeny" of the Diptera by Wiegmann *et al.* (2011) suggested the Schizophora branched off from other cyclorrhaphous flies near the end of the Cretaceous and then underwent a tremendous radiation that "is (together with macrolepidopteran moths) the largest insect radiation in the Tertiary" (p. 5693). In the "Supporting Information" for Wiegmann *et al.* (2011, fig. S3), the Tachinidae were postulated to have separated from their sister-group (the Calliphoridae according to the analysis) about 30 Ma (million years ago) (i.e., during the Oligocene). The fossil record, if taken on face value, sets a minimum age of the Tachinidae at about 44 Ma (i.e., during the Eocene) – but see below!

The "Phylogeny and Evolution of World Tachinidae" project that is discussed by Stireman *et al.* in this issue of *The Tachinid Times* will generate further data relevant to the questions of age and sister group of the Tachinidae. A key goal of the project is the "robust reconstruction of phylogenetic relationships among major tachinid lineages", and this will allow for a bioge-

graphic analysis of tachinid distributions that is not possible outside of a phylogenetic context.

Within this article, I look at distribution patterns of the Tachinidae from the simplistic perspective of genera. The aim is to present the data in visual form and to make a few, mostly obvious, comments about the patterns that are evident. Most of the data are from a list of valid tachinid genera of the world that I first posted on the Internet (along with regional distributions) in 2005 under the title *World Genera of the Tachinidae (Diptera) and their Regional Occurrence*. This document continues to be revised as more papers are published on tachinid systematics and is now in its seventh version (O'Hara 2012). The online data are enhanced here with a new element, that of subfamily placement of each genus.

## MATERIALS AND METHODS

The valid genera of Tachinidae and their distributions are listed by O'Hara (2012). The names and distributions were compiled from regional catalogues and updated from all relevant literature published thereafter. A complete list of the catalogues and other sources (ca. 150 publications) that contributed to the list of names and distributions are given in O'Hara (2012).

The data presented here are from a Microsoft Excel spreadsheet that generates the online world list. In addition to names and distributions it also contains tribal and subfamilial placements of genera. Tribes and tribal placements on a world scale are not sufficiently stable to discuss here and also would go beyond the generalizations I want to focus on in this informal newsletter. The "Phylogeny and Evolution of World Tachinidae" project may provide results that can be interpreted within a bio-





geographic context to the tribal level for some lineages of Tachinidae.

Genera are assigned to subfamilies Dexiinae, Exoristinae, Phasiinae and Tachininae or left unplaced. In the last category are the Neotropical genera *Ceratometopa* Townsend, *Marnefia* Cortés, *Parabrachycoma* Blanchard, *Tachinophasia* Townsend, *Tromodesiana* Townsend, and *Xeoprosopa* Townsend and the Australasian genus *Graphia* van der Wulp. Genera that have not been treated universally by modern authors are assigned as follows for the purposes of this article: *Euthera* Loew and *Redtenbacheria* Schiner (both Eutherini) are placed in Dexiinae; *Imitomyia* Townsend and allies (Imitomyiini) are placed in Dexiinae; *Acemya* Robineau-Desvoidy and allies (Acemyini) are placed in Exoristinae; *Palpostoma* Robineau-Desvoidy and allies (Palpostomatini) are placed in Tachininae; *Rondaniooestrus* Villeneuve (sole member of Rondaniooestrini) is placed in Tachininae; and *Strongygaster* Macquart and allies (Strongygastrini) are placed in Phasiinae. In total there are 1516 genera; 1509 are assigned to subfamilies and seven are left unplaced. The Dexiinae and Phasiinae are each generally regarded as monophyletic, Exoristinae may be largely monophyletic, and Tachininae are paraphyletic (e.g., Tschorsnig 1985; also Tachi & Shima 2010 for Exoristinae).

For the sake of simplicity, America north of Mexico is referred to as the Nearctic Region and America south of United States is referred to as the Neotropical Region. The actual boundary between the Nearctic and Neotropical Regions is recognized as a sinuous line through the middle of Mexico. It is difficult to apply this boundary to New World Tachinidae because the distributions of tachinid species in Mexico are so poorly known. The boundary between the Palaearctic and Oriental Regions within China is unsettled and I therefore follow Herting and Dely-Draskovits (1993) for the listing of Palaearctic genera and Crosskey (1976) for the listing of Oriental genera.

## ARE THERE EOCENE FOSSIL TACHINIDAE?

New methods for estimating the age of higher taxa are rejuvenating the question of the age of the Tachinidae. Wiegmann *et al.* (2011) recently suggested an age of about 30 Ma. One way of testing whether this is a realistic estimate is to compare it with the fossil record of Tachinidae. This is quite meager for such a huge family: only 10 described species according to Evenhuis (1994), ranging in age from Holocene to Eocene. Some are in the range of Wiegmann's 30 Ma (Oligocene), and this is true also of some specimens of undescribed species preserved in Dominican amber (Evenhuis 1994). If we accept some or all of these as Tachinidae, then the family is at least as old as the Oligocene.

My interest here is to examine whether the Eocene fossils reputed to be Tachinidae can be confidently identified as belonging to this family. If they can, then a minimum age of Eocene can be accepted for the Tachinidae. If they cannot, then the minimum age of the Tachinidae based on the fossil record is Oligocene.

Evenhuis (1994) listed three tachinids of Eocene age: *Palaeotachina smithii* Townsend (Baltic amber), *Electrotachina smithii* Townsend (Baltic amber), and *Vinculomusca vinculata* (Scudder) (compression fossil from Chagrin Valley, Colorado). The amber speci-

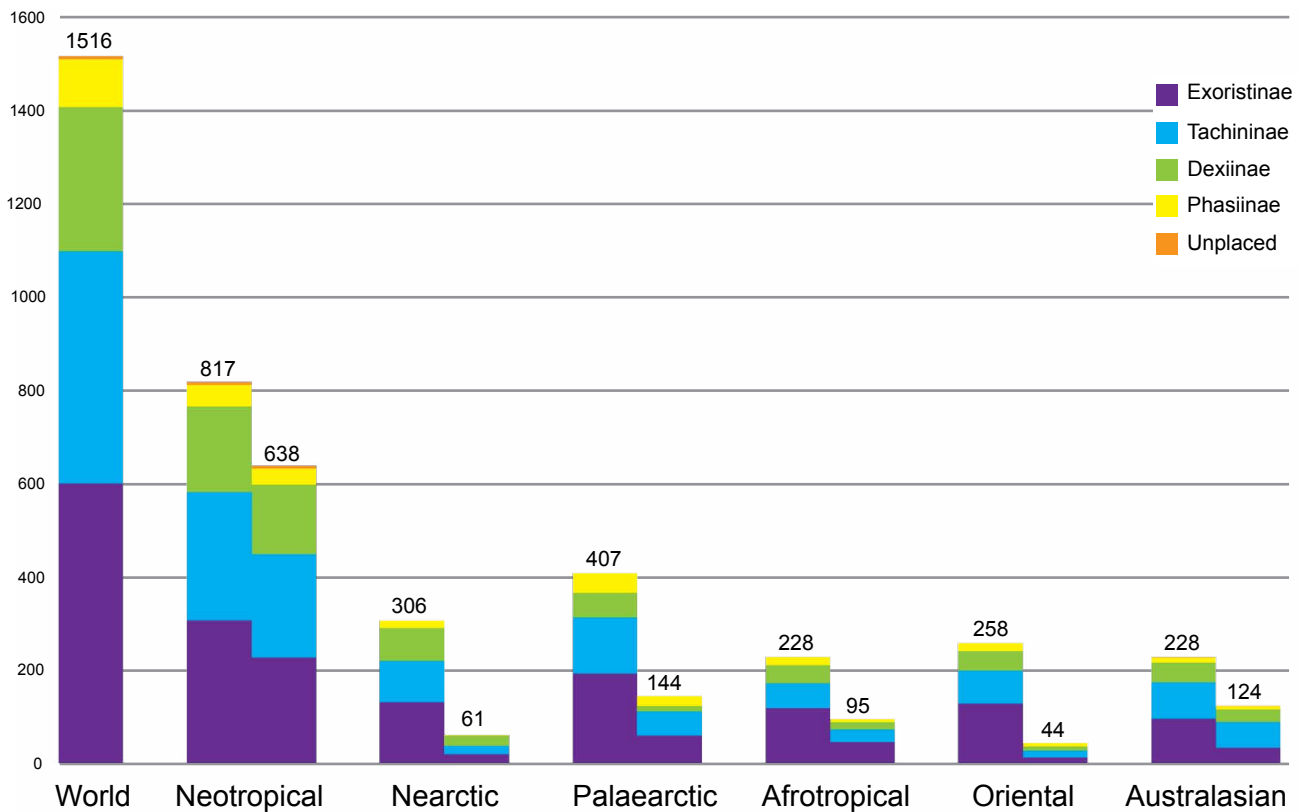


**Figure 1.** Two flies in Baltic amber from Smith (1868). Based on these drawing and brief notes by Smith, Townsend assigned both to the Tachinidae and named the top one as *Palaeotachina smithii* Townsend, 1921 and the bottom one as *Electrotachina smithii* Townsend, 1938.

mens date to  $44.1 \pm 1.1$  Ma according to Engel's (2001) review of Baltic amber. To my knowledge, no one has doubted that Townsend's Eocene fossil taxa belong to the Tachinidae. However, just a cursory examination of the evidence is enough to make one question the familial placements of these taxa.

Zaddach (1868) published on the origin and history of the amber of "Samland", a famous source area for Baltic amber. The editors of the journal in which Zaddach's paper appeared inserted a plate of amber fossils after the paper "for the benefit of such students as desire to inform themselves more fully concerning the natural history of Amber" (p. 183). The





**Figure 2.** The leftmost bar in the graph shows the number of valid tachinid genera in the world. Bars for each region show the total number of genera on the left and number of endemic genera on the right. Colours represent the four tachinid sub-families and unplaced genera.

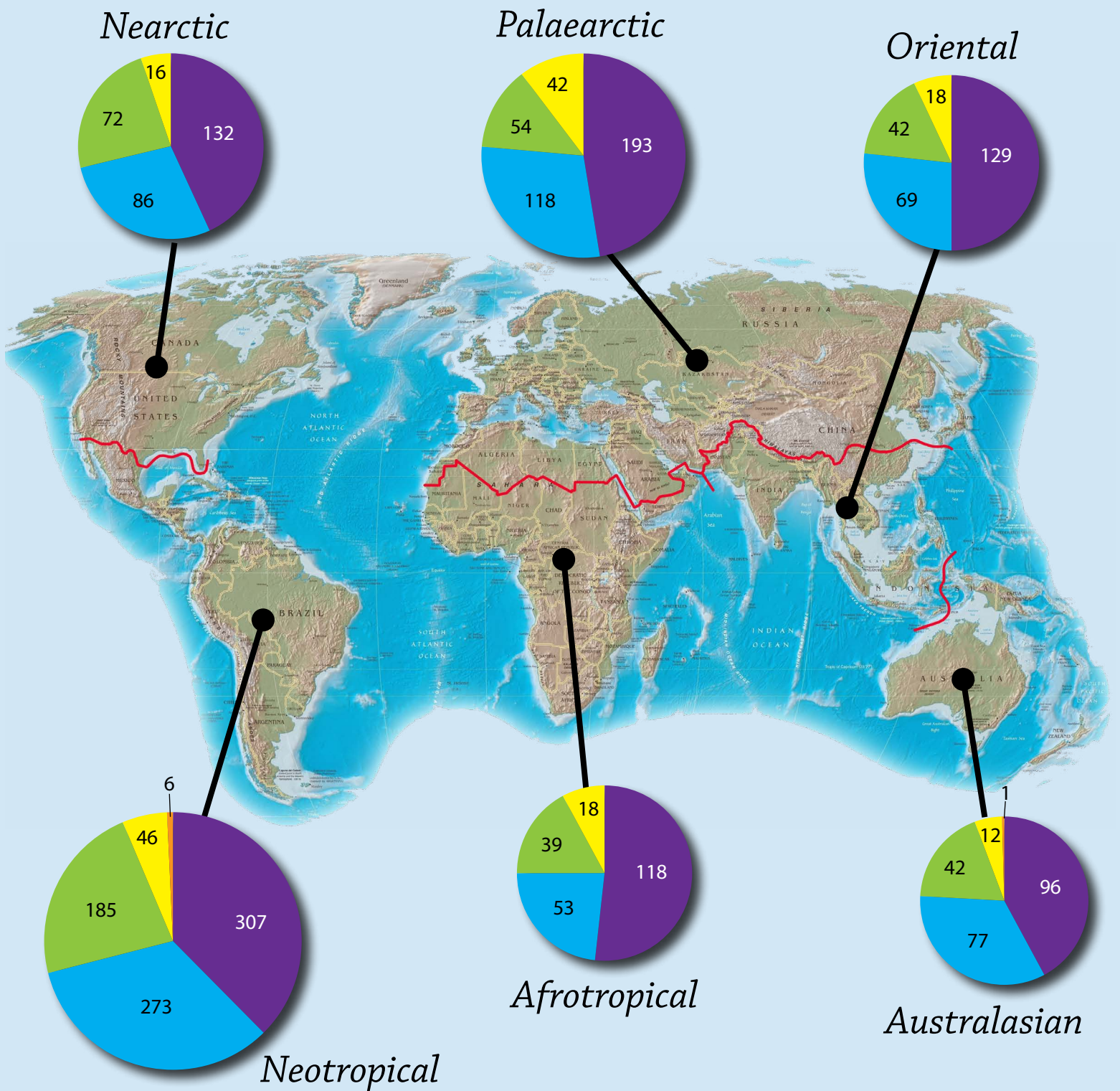
plate illustrates 11 fossils from the British Museum and Frederick Smith of that institution provided a caption for each (plate and captions cited here as Smith 1868). Three flies are depicted in the plate, of which two are shown here in Fig. 1 in their original position of one above the other (numbered on the plate as 2 and 5). This reproduction of a portion of the plate is from a PDF available from the Biodiversity Heritage Library (<http://www.biodiversitylibrary.org/>). Although the reproduction is poor, it appears as though the figures were intended to show the general aspect of fossils in amber rather than the precise anatomical features of the material illustrated. This is borne out by a remark from the editors that the plate “will convey some idea of the organic remains usually found in this fossil resin” (p. 183). Smith (1868) was able to examine the fossils and wrote of his fig. 2: “A Dipterous Insect belonging to the European genus *Echinomyia*”. Of his fig. 5, Smith wrote: “A Dipterous Insect belonging to a new genus of Muscidae, allied to the European genus *Tachinus*”. Townsend (1921), apparently without seeing the fossil and relying upon the drawing in Fig. 1 and Smith’s brief note, described the fly in Smith’s fig. 2 as a new genus and species of “Larvaevorini or allied tribes” under the name *Palaeotachina smithii*. Years later, Townsend (1938) described the fly in Smith’s fig. 5 as a new genus

and species “probably [of] exoristid or tachinid stock” under the name *Electrotachina smithii*, again presumably without seeing the actual specimen. The strongest evidence that these taxa might belong to the Tachinidae is the identifications by Smith (a non-specialist on the Diptera) who saw the specimens; even a specialist like Townsend would not be able to conclusively identify the taxa from the drawings published of them.

The other so-called tachinid of Eocene origin is *Vinculomusca vinculata* (Scudder). This species was originally described by Scudder (1877) in the genus *Musca* based on compression fossils of several empty larval skins. Townsend (1938) transferred the species to his new genus *Vinculomusca* and declared it of “apparently exoristid or tachinid stock”. There is no reason to suppose that the larvae were arthropod parasitoids, which one would expect of tachinid larvae.

This cursory review of reputed Eocene Tachinidae is enough to cast doubt on the familial placements of these fossil Diptera. Until such time as the type specimens can be examined it is best to treat the familial placements of these taxa as questionable. If these taxa cannot be confirmed as Tachinidae, then there is no credible proof that the tachinid lineage existed in the Eocene. It could have, but there is no fossil evidence in support of it.





**Figure 3.** The number of valid genera of Tachinidae in each biogeographic region of the world is shown in proportionally-sized pie charts. The number of genera per subfamily is shown within each pie chart. The total number of genera for the world is 1516.

**LEGEND**

- Exoristinae
- Tachininae
- Dexiinae
- Phasiinae
- Unplaced



Understanding the historical biogeography of tachinid flies is hampered by this sketchy knowledge of their age, as it is by the lack of a well-supported phylogeny. I leave open the question of when the Tachinidae began their diversification in the Tertiary and turn my attention to a review of the present distributions of the genera of world Tachinidae.

## DISTRIBUTION OF TACHINID GENERA

### Genera per region

The total number of extant and valid genera of Tachinidae in the world (currently 1516) and number of genera per region are shown graphically in Fig. 2 with different colours representing the tachinid subfamilies. A second bar to the right of the first for each region shows the number of endemic genera (see discussion below).

The number of genera per region is shown again in Fig. 3 using pie charts. These charts are proportionally-sized with their volumes representing the number of genera per region, thereby visually depicting differences between regions.

Without getting too speculative about what the numbers might mean, there are some patterns that I think are evident:

1) The dominant subfamily in the world is the Exoristinae with 601 genera.

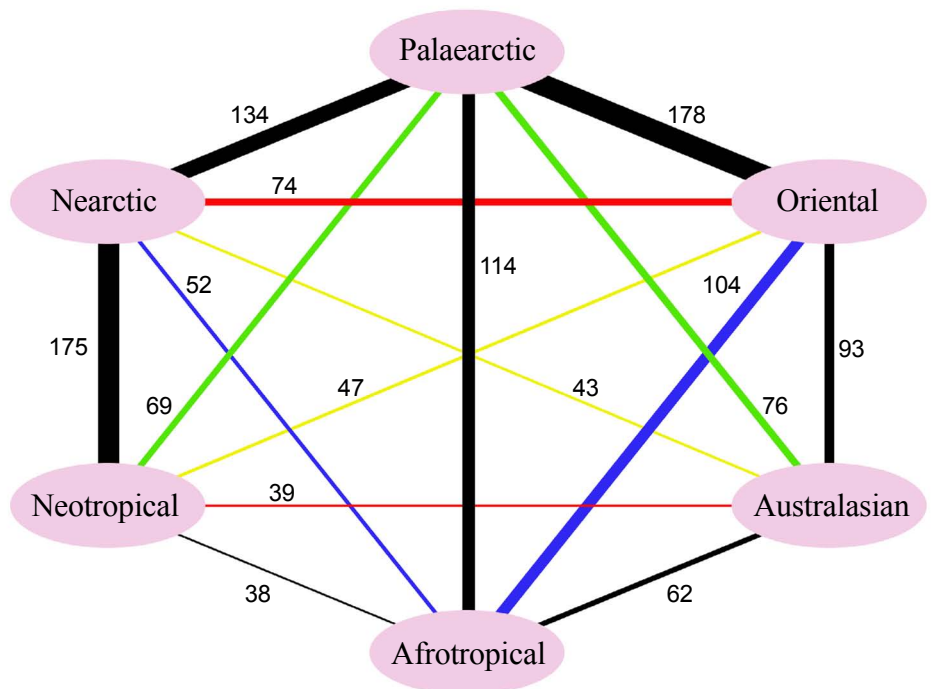
2) Regardless of where tachinid lineages evolved or what hosts are parasitized, the same order from largest to smallest subfamily is repeated in each of the six biogeographic regions: Exoristinae, Tachininae, Dexiinae and Phasiinae.

3) The Neotropical Region leads the world with 817 genera, twice the number of any other region and fully 54% of the world's genera. There are, however, extenuating circumstances. Townsend, for example, named an extraordinary number of genera from the Neotropics and was a renowned "splitter". A careful reappraisal of his Neotropical genera will lower their number considerably. However, the number will creep up again (but probably not to where it is today) because the Neotropics has a vast number of undescribed species in addition to its 3000-odd current species and some of these will need new genera. The Neotropics is blessed with an unusually diverse tachinid fauna and I suspect the region will always be dominant in number of genera despite

the downsizing that will occur as broader generic limits are set for existing genera.

4) The Palaearctic Region is comfortably in second place with 407 genera. The simplest explanation for this is the immense size of the region, its physiographic diversity, and its physical connection with two other regions (Afrotropical and Oriental) and former connection with another (Nearctic). The fauna of the Palaearctic Region is the best known in the world, particularly in the West Palaearctic subregion, Russian Far East, and Japan; Palaearctic China and mountainous areas of Central Asia are less well known.

5) The most peculiar aspect of the Australasian tachinid fauna in my view is how little it differs in number of genera from the Oriental Region. It also harbours much greater diversity than current catalogues would suggest (e.g., O'Hara *et al.* 2004). One might expect that the isolated nature of Australia throughout most of the Tertiary would have resulted in a depauperate fauna if tachinids evolved elsewhere. Is it possible that tachinids have had a long history in Australia? Or, did they disperse from elsewhere across water barriers more successfully and earlier than the megafauna?



**Figure 4.** The number of genera shared between two regions is shown with proportionally-sized lines between the six biogeographic regions. The greatest number of genera is shared between the Palaearctic–Oriental regions and Nearctic–Neotropical regions, respectively.



## Endemic genera

The number of endemic genera per region is shown in Fig. 2. The Neotropical Region is the overwhelming leader with 638 genera, which is 78% of all Neotropical genera. This is an extraordinary figure but is tempered by the fact that many of the genera of the region are too restricted in their concepts (as discussed in the previous section). Numerous genera will eventually be merged with other Neotropical genera or with genera known from the Nearctic Region (as already done for a large portion of the *Blondeliini* by Wood 1985). Be this as it may, there is a great deal of endemism in the Neotropical tachinid fauna.

The Palaearctic Region has the next highest number of endemic genera with 144 (35% of total), but this is a little misleading because the total fauna is very large. In terms of the proportion of endemic genera to total number of genera, both the Australasian Region (with 124 endemic genera and 54% endemism) and the Afrotropical Region (with 95 endemic genera and 42% endemism) are higher than the Palaearctic Region.

## Genera shared between two regions

The greatest number of genera is shared between the Palaearctic–Oriental Regions and Nearctic–Neotropical Regions, with 178 and 175 shared genera, respectively (Fig. 4). It is not surprisingly that many genera are shared between the Palaearctic and Oriental Regions given that the boundary between them is long and in places (e.g., China) exceptionally transitional in nature. The boundary used here between the Nearctic and Neotropical Regions is an arbitrary one and may account in part for the high number of shared genera, but what is not shown by the numbers is the high number of genera that are shared between North and South America. I suspect that the “Great American Biotic Interchange” that is recognized for mammals and started with the emergence of the Panamanian land bridge a few million years ago was not so much a factor for tachinids; there must have been significant interchange prior to this time, perhaps over some sort of “filter bridge” (e.g., O’Hara 1989).

There is quite a significant sharing of genera (134) between the Nearctic and Palaearctic Regions. Since these regions are currently separated by a significant water barrier, periodic land connections across the Bering Strait and the North Atlantic during the Cenozoic Era are believed to have acted as faunal corridors for many organisms, including tachinids.

The Afrotropical Region shares genera mostly with the Palaearctic and Oriental Regions (114 and 104

genera, respectively). It may seem odd that the number of genera shared between the Afrotropics and each of these two regions is so similar. After all, the Palaearctic and Afrotropical Regions are broadly contiguous and the Sahara Desert did not begin development (and hence become a barrier) until the Pliocene, and continued to experience wet-dry cycles thereafter (Le Houérou 1997, Micheels *et al.* 2009). In contrast, the Oriental and Afrotropical Regions are barely joined and probably experienced less faunal interchange during the Neogene (but the timing and biogeographic effects of the Indian–Asian collision is still controversial, see Li *et al.* 2013). Yet, there is another factor that helps to explain the high relative similarity between the tachinid genera of the Oriental and Afrotropical Regions: 88 of 104 genera shared between them are also shared with the Palaearctic Region. Only 11 genera are uniquely shared between the Oriental and Afrotropical Regions compared with 21 genera uniquely shared between the Palaearctic and Afrotropical Regions.

The three southernmost regions, the Neotropical, Afrotropical and Australasian, have few genera shared between them and most are shared also with other regions. It is commonly assumed, but has yet to be corroborated by a well-supported phylogenetic tree, that this pattern does not support the existence of a noticeable tachinid fauna before the breakup of Gondwanaland.

## Genera of worldwide distributions

Assuming that genera are correctly recognized in the six biogeographic regions (which may not be true in all cases), there are only 25 genera (1.6% of the total) of Tachinidae recorded from all regions. Twelve belong to the Exoristinae:

*Apomyia* Robineau-Desvoidy, *Carcelia* Robineau-Desvoidy, *Ceracia* Rondani, *Chetogena* Rondani, *Drino* Robineau-Desvoidy, *Gonia* Meigen, *Lydella* Robineau-Desvoidy, *Nemorilla* Rondani, *Nilea* Robineau-Desvoidy, *Sisyropa* Brauer & Bergenstamm, *Trigonospila* Pokorný, and *Winthemia* Robineau-Desvoidy.

Six belong to the Tachininae:

*Actia* Robineau-Desvoidy, *Ceromya* Robineau-Desvoidy, *Leskia* Robineau-Desvoidy, *Linnaemya* Robineau-Desvoidy, *Microphthalma* Macquart, and *Siphona* Meigen.

Five belong to the Dexiinae:

*Billaea* Robineau-Desvoidy, *Campylocheta* Rondani, *Euthera* Loew, *Thelaira* Robineau-Desvoidy, and *Voria* Robineau-Desvoidy.

Two belong to the Phasiinae:

*Cylindromyia* Meigen and *Phasia* Latreille.



## ACKNOWLEDGEMENTS

I am grateful for the assistance of summer student Natasha MacDonald for adding data about the affinities of tachinid genera into an Excel spreadsheet containing the names of all valid genera, and for preparing preliminary versions of bar graphs and pie charts for my perusal. I thank Shannon Henderson for preparing Fig. 2 and completing my early draft of Fig. 3. Neal Evenhuis kindly reviewed this article and offered helpful suggestions, especially concerning the fossil record of Tachinidae.

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# DNA barcodes for north European Tachinidae: preliminary results and material request

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DNA barcodes based on the mitochondrial cytochrome c oxidase subunit I gene (COI) have proven to be practical and functional for Tachinidae in a number of studies (e.g., Stireman 2010 and references therein). To support the efforts to obtain a good coverage of tachinid sequences, we have initiated the DNA barcoding of north European Tachinidae as part of the Finnish Barcode Of Life (FinBOL, [http://www.finbol.org/eng/ENG\\_finbol.html](http://www.finbol.org/eng/ENG_finbol.html)) in 2011. So far the project has produced barcodes for 225 tachinid species, all of which are stored in the BOLD database (<http://www.boldsystems.org/>). We have recently secured more funding and are currently sequencing large numbers of additional specimens, consisting of a total of 380 species. About 75% of the specimens originally come from Jaakko Pohjoismäki's private collection, now stored in the Tampere Museum of Natural History, Tampere, Finland and the rest are located either in the Finnish Museum of Natural History in Helsinki, other museums or private collections.

The majority of the material has been collected post-2000 and stored as pinned dry specimens. The specimens have worked well, with sequencing success rate of 90%. Most failures have been due to age of the sample but sometimes for unknown, likely trivial reasons. For example some specimens from the same alcohol-preserved trap material gave good quality sequences while others did not. The oldest sample that so far has worked successfully using the standard approach is a pinned *Xylotachina diluta* (Meigen) from 1994. This is important to note as recent material for

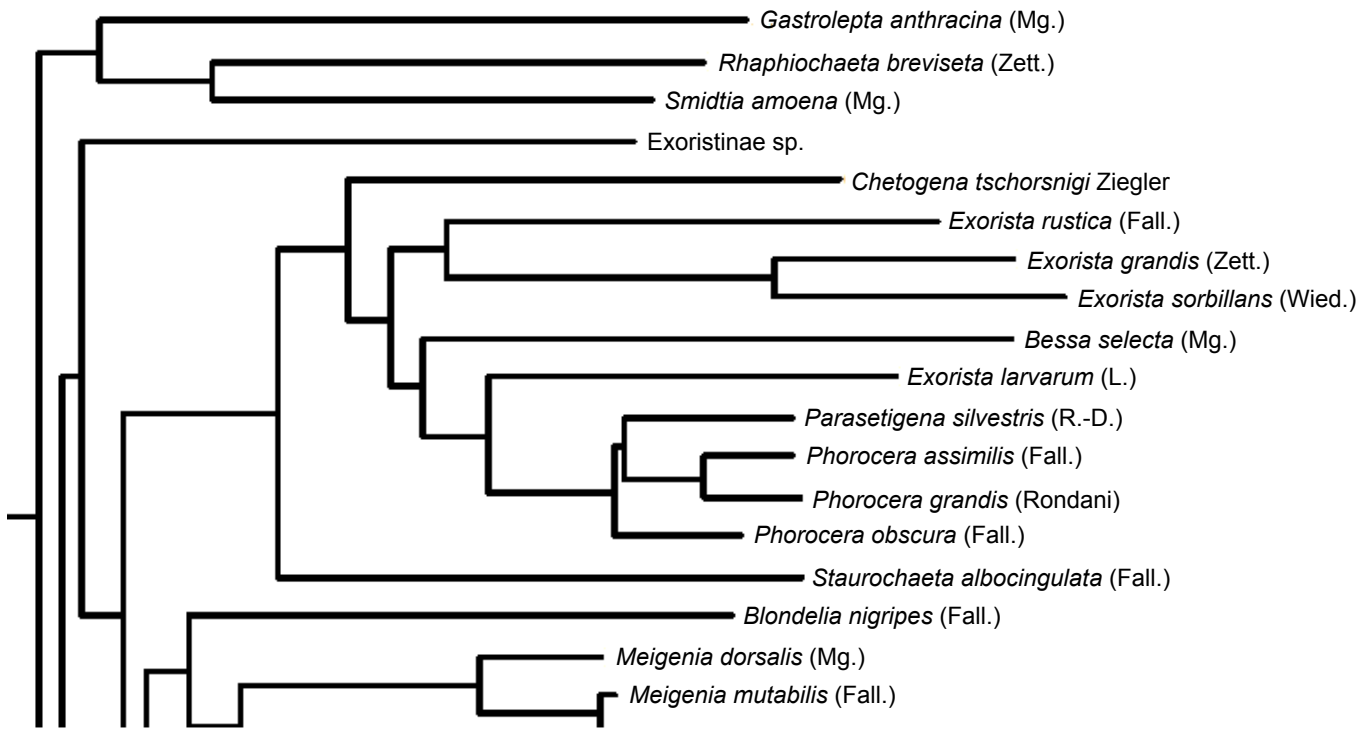
many of the rare species is difficult to find.

Although not being yet publicly available, the DNA barcodes stored in BOLD already serve as an identification tool for database searches against given sequences. Although COI is not in itself adequate for reconstructing phylogenies, it can provide important insight into species limits and genetic distances within closely related species. For example, *Parasetigena silvestris* (R.-D.) (formerly in *Phorocera* R.-D.) is clearly placed within the large *Phorocera*, whereas externally very similar *Exorista grandis* (Zetterstedt) and *E. sorbillans* (Wiedemann) are well separated (Fig. 1). Interestingly, *Microsoma exiguum* (Meigen) shows rather large genotypic variability from the Mediterranean to Finland, whereas COI sequences of *Triarthria setipennis* (Fallén) from these locations are identical (Fig. 2).

Similarly, COI data can also be used to identify Holarctic distribution patterns in cases where the Palaearctic and Nearctic populations have been described as distinct species. For example, the case of *Cyrtophloebe vernalis* (Kramer) and *C. nitida* (Curran) is intriguing; the sequenced Finnish *C. vernalis* is within 99.6% similarity embedded among Canadian sequences of *C. nitida* (BOLD Barcode Index Number BOLD:AAP3780). The two species, if distinct at all, are clearly closely related.

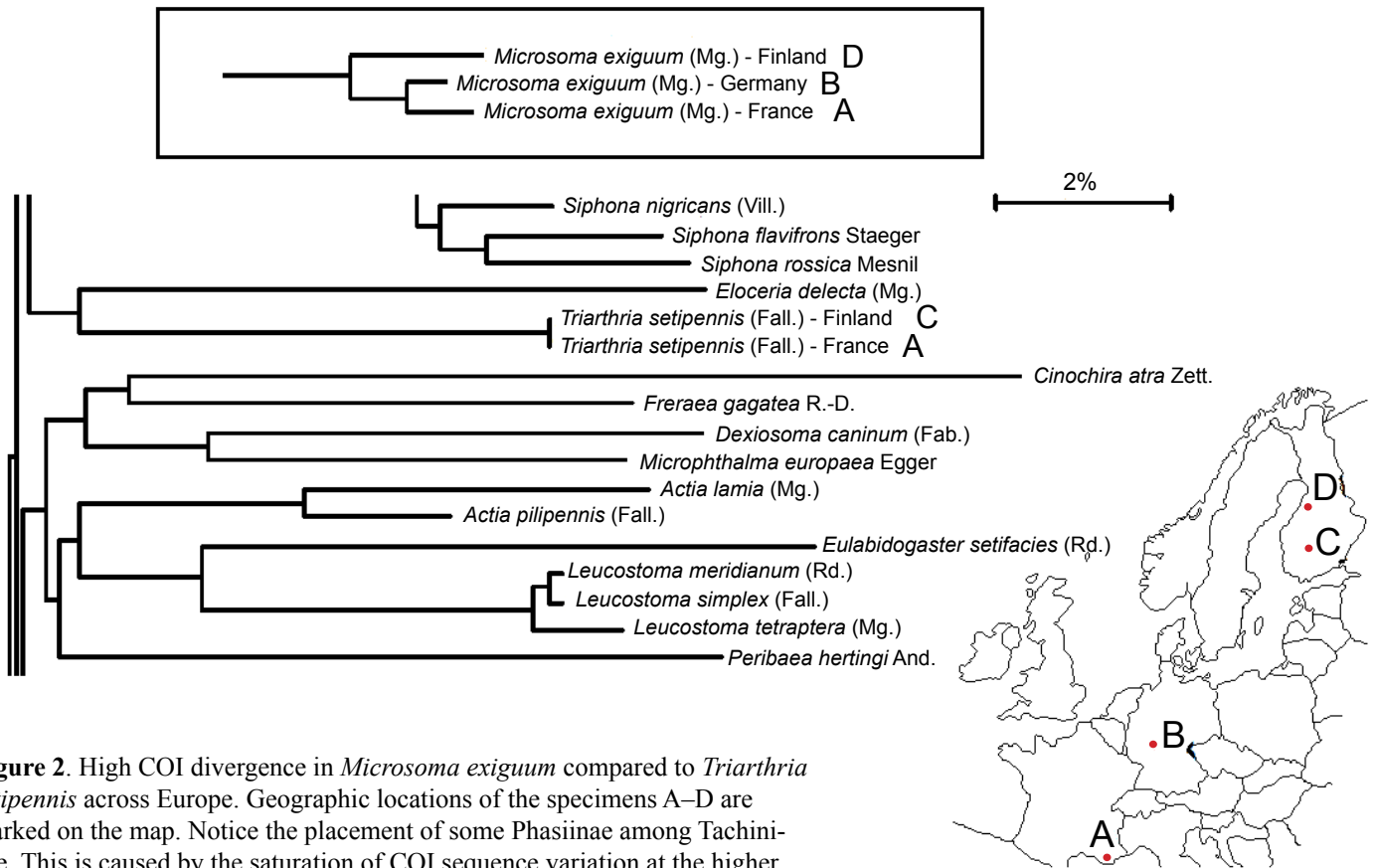
However, it is clear that many more samples from various locations need to be sequenced in order to get an impression of the intra- versus interspecific variability within such groups.





**Figure 1.** Neighbor-joining tree of some example Exoristinae based on COI sequence similarities. Notice the position of *Parasetigena* within *Phorocera*.

2%



**Figure 2.** High COI divergence in *Microsoma exiguum* compared to *Triarthria setipennis* across Europe. Geographic locations of the specimens A–D are marked on the map. Notice the placement of some Phasiinae among Tachiniinae. This is caused by the saturation of COI sequence variation at the higher taxonomic divergences. For this reason DNA barcodes alone are often not used in a phylogenetic context. However, this problem might be overcome by using increased taxon sampling (Wilson 2011).

2%

As mentioned earlier, many tachinid species are rarely collected, making it difficult to find specimens suitable for DNA sequencing. We are therefore very grateful for having received several rare specimens as donations from Dr. Hans-Peter Tschorsnig (Stuttgart, Germany), Dr. Joachim Ziegler (Berlin, Germany), Theo Zeegers (Soest, The Netherlands), Mr. Antti Haarto (Mietoinen, Finland), Mr. Kaj Winqvist (Turku, Finland), Mr. Kari Varpenius (Raahe, Finland) and Mr. Jussi Koistinen (Espoo, Finland). However, there is still a number of interesting species missing or needing additional specimens, for which we request assistance from other tachinid enthusiasts:

### Exoristinae

*Admontia seria* (Meigen)  
*Bessa parallela* (Meigen)  
*Carcelia puberula* Mesnil, *C. tibialis* (R.-D.)  
*Chetogena* apart from *C. tschorsnigi* Ziegler  
*Drino atropivora* (R.-D.), *D. bohémica* Mesnil, *D. gilva* (Hartig)  
*Erycia* apart from *E. fatua* (Meigen)  
All *Exorista* sg. *Adenia* apart from *E. rustica* (Fallén)  
*Exorista fasciata* (Fallén)  
All *Istocheta* spp.  
*Ligeriella aristata* (Villeneuve)  
*Medina luctuosa* (Meigen)  
*Myxexoristops arctica* (Zetterstedt), *M. bonsdorffi* (Zetterstedt)  
*Oswaldia eggeri* (B. & B.), *O. reducta* (Villeneuve)  
*Phebellia clavellariae* (B. & B.)  
*Policheta unicolor* (Fallén)  
*Senometopia confundens* (Rondani), *S. intermedia* (Herting), *S. lena* (Richter)  
*Thecocarcelia acutangulata* (Macquart)  
*Vibrissina turrata* (Meigen)  
*Winthemia erythrura* (Meigen), *W. venusta* (Meigen)

### Tachininae

*Actia infantula* (Zetterstedt), *A. maksymovi* Mesnil  
All *Anthomyiopsis* spp.  
All *Aphantorhaphopsis* spp.  
*Ceranthia pallida* Herting, *C. tristella* Herting, *C. vernerii* Andersen  
*Ceromya dorsigera* Herting, *C. flaviceps* (Ratzeburg), *C. flaviseta* (Villeneuve)  
*Cleonice keteli* Ziegler, *C. nitidiuscula* (Zetterstedt)  
All *Germaria* spp.  
All *Graphogaster* spp.  
*Linnaemya haemorrhoidalis* (Fallén), *L. olsuffjevi* Zimin, *L. rossica* Zimin

*Macroprosopa atrata* (Fallén)  
*Panzeria laevigata* (Meigen), *P. vagans* (Meigen)  
*Peleteria ferina* (Zetterstedt), *P. popelii* (Portshinsky)  
*Peribaea longirostris* Andersen, *P. setinervis* (Thomson)  
*Phytomyptera nigrina* (Meigen), *P. riedeli* (Villeneuve), *P. vaccinii* Sintenis  
*Siphona grandistylum* Pandellé, *S. hungarica* Andersen, *S. immaculata* Andersen, *S. variata* Andersen

### Dexiinae

*Billaea fortis* (Rondani)  
*Blepharomyia piliceps* (Zetterstedt)  
*Dexia vacua* (Fallén)  
All *Pandelleia* spp.  
All *Rondania* spp.  
*Stomina tachinoides* (Fallén)  
*Villanovia villicornis* (Zetterstedt)

### Phasiinae

*Besseria melanura* (Meigen)  
*Opesia cana* (Meigen)  
All *Strongygaster* spp.

The specimens should preferably be collected in the 2000s, but as noted earlier we welcome also older samples. Dry and ethanol-preserved material are both acceptable. Ideally, we would like to borrow the whole specimen for documentation purposes. If you do not wish to donate the specimen, then it will be returned after sampling (removing a leg) and documenting together with a label, which helps to connect the specimen with the barcode in the future. Please feel free to contact us with your thoughts and suggestions. We're hoping to hear from you!

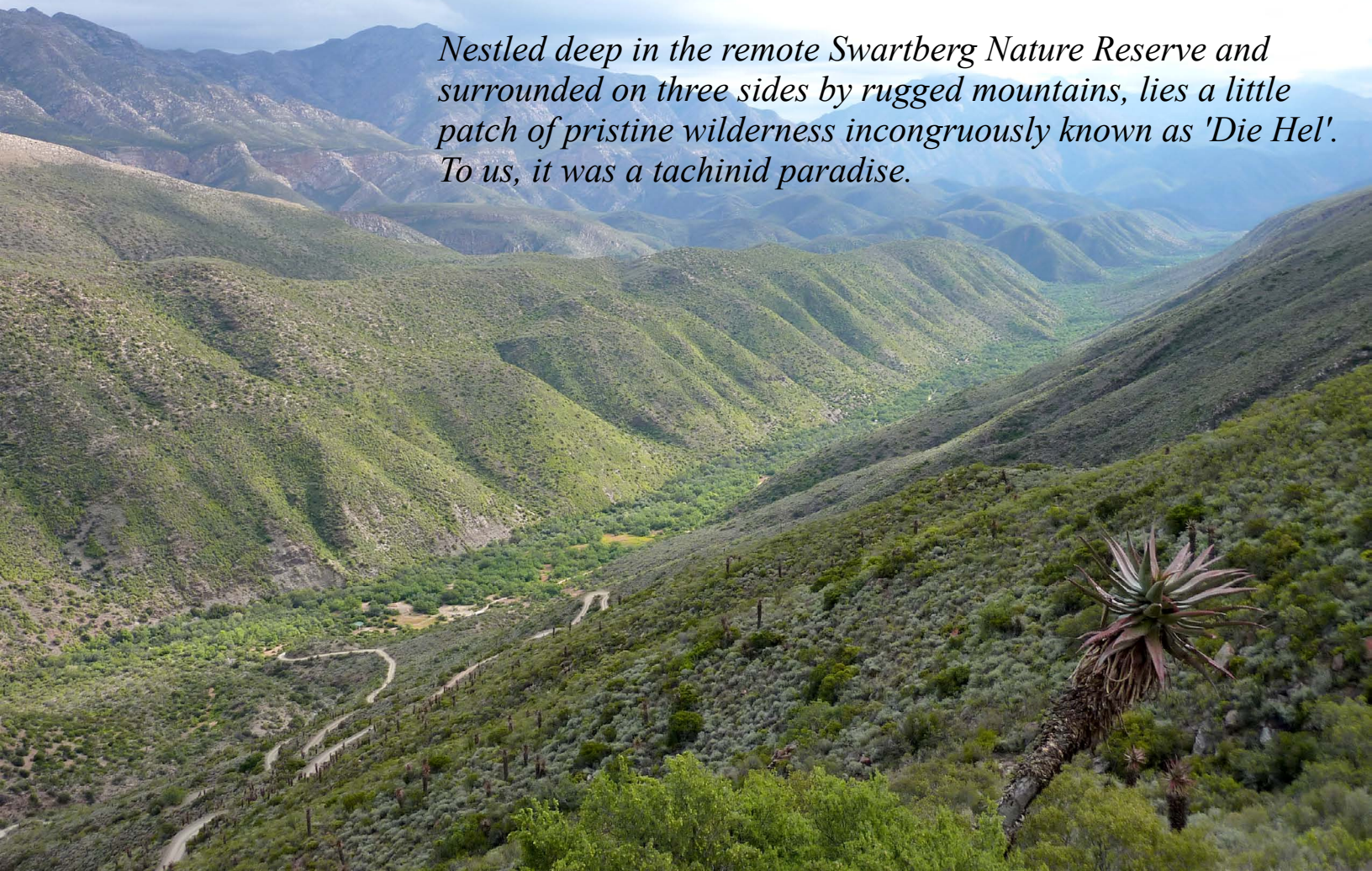
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# To 'Die Hel' and back

*Nestled deep in the remote Swartberg Nature Reserve and surrounded on three sides by rugged mountains, lies a little patch of pristine wilderness incongruously known as 'Die Hel'. To us, it was a tachinid paradise.*



## Expeditions of the phylogeny of World Tachinidae project

Part I: Western Cape,  
South Africa

The "Phylogeny of World Tachinidae" project kicked off with an operational meeting in June 2012 at the Canadian National Collection of Insects (CNC) in Ottawa. Goals were discussed, work plans prepared, and of course the destinations and timing of major field expeditions were debated. During our three years of National Science Foundation funding we hope to gather fresh material for molecular analysis from all biogeographic regions of the world.

Choosing between potential destinations for field work requires a careful balance between scientific requirements and practical possibilities. We are looking for places that are fairly accessible, have an abundance of endemic key species, and for which collecting and exporting permits can be obtained. We chose as our first destination the Western Cape Province of South Africa. This region is characterized by a great floral and faunal diversity, with high rates of endemism. With respect to the tachinid fauna, the



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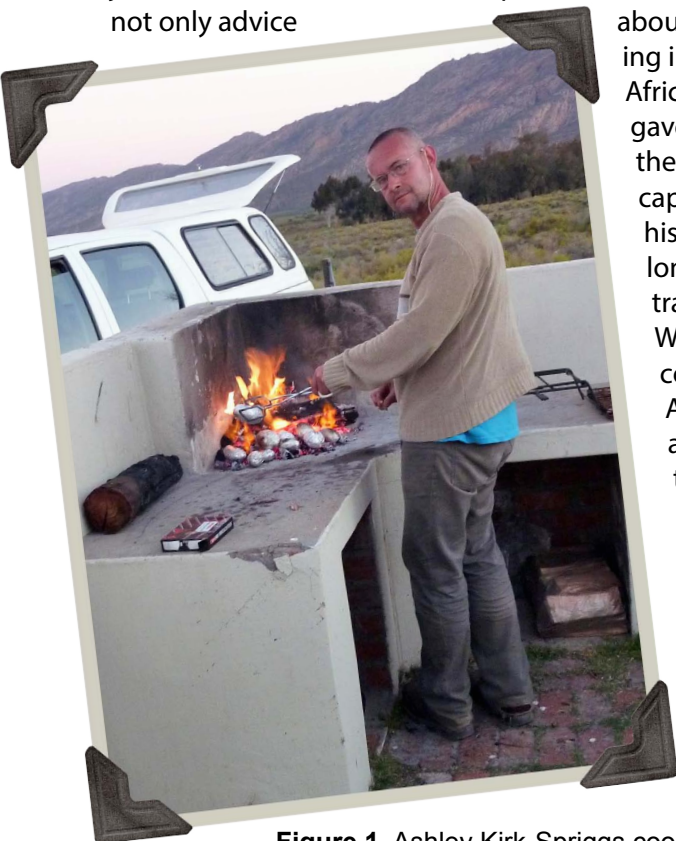
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Western Cape is one of the better known areas of Africa. It also has numerous nature reserves, a great road system, and is one of the safer places in Africa to embark on a lengthy road trip. We were able to entice Ashley Kirk-Spriggs from the National Museum in Bloemfontein to join us for the duration of our trip. He not only advice

contributed about collecting in South Africa but also gave us all the tachinids captured in his six-meter long Malaise traps (Fig. 2). We soon discovered that Ashley has a hidden talent as a braai master and we were treated to his cooking wherever



**Figure 1.** Ashley Kirk-Spriggs cooking a braai at our rented cottage in Anysberg Nature Reserve.

facilities were available (Fig. 1). (At the time of this writing, a news item about our trip from Ashley's perspective is online on the National Museum's website at: <http://www.nasmus.co.za/departments/entomology/news/>.)

*The Cape of Good Hope* was a frequent stop on early voyages of discovery and all manner of wildlife from rhinos to tachinid flies were eagerly skinned or pinned for return to the home country.



**Figure 2.** Ashley Kirk-Spriggs checking the catch in one of his six-meter long Malaise traps, Anysberg Nature Reserve.

For example, the Naturhistorisches Museum in Vienna houses a collection of natural history specimens from the voyage of the Austrian frigate *Novara* (1857–1859) that includes tachinids from the Cape of Good Hope. One such fly, named *Alophora capensis* by Rudolph Schiner in a report on the Diptera of the *Novara* voyage published in 1868, is shown in O'Hara's article on the Vienna Museum in this issue of *The Tachinid Times*. Similarly, Wiedemann and Brauer & Bergenstamm also named new species of Tachinidae from specimens originating from various expeditions to the Cape





**Figure 3.** Map of the southern portion of the Western Cape Province of South Africa showing where we collected. The numbers correspond to the numbered sites in the text.

in the 19th Century (see O'Hara's article). We were pleased to be following in this grand tradition of Cape collecting, albeit at a somewhat less adventurous time.

*South Africa* began to construct natural history museums in selected provinces starting early in the 20th Century. These museums encouraged the development of collections that would stay in South Africa and become part of the continent's natural heritage. Over time, generations of entomologists have increased the collections to an impressive degree. Without entering into details, the bulk of the material collected in the 1900s up to the 1970s was studied first by Villeneuve and Curran and later by Mesnil. Much of the type material of these authors that remains in South Africa is currently preserved in the three great South African collections: the South African National Collection of Insects in Pretoria, the KwaZulu-Natal Museum in Pietermaritzburg, and the Iziko South African Museum in Cape Town.

Our purpose in the Western Cape was to collect as many endemic species as we could while covering the most representative habitats of the province (i.e., Fynbos, Succulent Karoo and Afromontane forest). The scheduled stopovers and the sites where we collected the most significant material were: Anysberg Nature Reserve, Swartberg Nature Reserve, West Coast National Park, and the Silvermine area of Table Moun-

tain National Park. We had hoped to collect in the beautiful Afromontane forest near Knysna, but were rained out and could do no more than drive through it hoping for a break in the weather. We augmented our catch from reserves by stopping frequently along our route for roadside collecting in promising areas. A schematic map of our collecting sites is shown in Fig. 3.

Below are listed the taxa we collected at each location with a short description of the different habitats. The list of taxa is ordered mainly according to Crosskey (1980, 1984). Specimens destined for molecular analyses were either preserved whole in 95% ethanol or (more commonly) were pinned and the right legs removed and preserved in 95% ethanol. Specimens or legs of specimens in ethanol are currently stored in a -80°C freezer in the Stireman lab at Wright State University. Pinned specimens with right legs removed are or will be deposited in CNC.

### 1. Boland Mountain complex

Collection data: 34°4'35.44"S 19°4'1.10"E, 11.x.2012, 481 m.

*Exoristinae*  
*Chetogena* sp. [2 males]





**Figure 4.** Limietberg Nature Reserve, Western Cape.

## 2. Limietberg Nature Reserve (Fig. 4)

Collection data: 33°37'41.57"S 19°6'11.70"E, 12.x.2012, 670 m.

Internet site: <http://www.capenature.co.za/reserves.htm?reserve=Limietberg+Nature+Reserve>

From the website: "Limietberg Nature Reserve lies in the Du Toitskloof mountains near Paarl, forming a part of the greater Boland mountain range. ... The weather conditions in these mountains vary from very hot and dry in the summer months, to extremely cold and wet during the winter, with snow on the higher peaks. The vegetation is predominantly mountain fynbos with remnants of indigenous forest in some of the wetter kloofs. Alien trees, including black wattle, hakea and pine have invaded sections of the reserve."

Tachininae

*Linnaemya* sp. [1 male, 1 female]

*Peleteria* sp. [1 female]. This is an undescribed species of *Peleteria*, strongly resembling the Palaearctic species *P. meridionalis* (Robineau-Desvoidy). This species is unusually characterized by having a row of pro-medio-clinate setae on the parafacial, rather than the 2–3 usually present in this genus. There are several specimens recently collected by Jason Londt from the same locality preserved in the KwaZulu Natal Museum.

## 3. Ceres Bergfynbos Reserve

Collection data: 33°23'1.91"S 19°17'20.16"E, 12.x.2012, 459 m.

Exoristinae

*Gaedioxenis brevicornis* Villeneuve, 1939 [1 male, 2 females]

**Collecting sites 4–6** are all included in the Anysberg Nature Reserve.

Internet site: [http://www.capenature.co.za/reserves.htm?reserve=Anysberg+Nature+Reserve#reserve\\_tabs](http://www.capenature.co.za/reserves.htm?reserve=Anysberg+Nature+Reserve#reserve_tabs)

From the website: "Anysberg lies within the Cape fold mountains and the vegetation is transitional between mountain fynbos and typical Klein Karoo veld.

The plant life ranges from eye-catching succulents to impressive stands of proteas which occur at higher altitudes." Acacias dominate along the river bed.

## 4. Anysberg Nature Reserve (Fig. 5)

Collection data: 33°28'0.31"S 20°36'1.97"E, 13.x.2012, 725 m.

Phasiinae

*Cylindromyia* sp. [1 male]. This is a widespread and apparently undescribed South African species. Several conspecific specimens are preserved in the KwaZulu-Natal Museum.



**Figure 5.** Anysberg Nature Reserve, Western Cape.





## 6. Anysberg Nature Reserve

Collection data: 33°25'56.23"S  
20°47'24.56"E (hilltop), 14.x.2012, 747  
m.

### Exoristinae

Genus A sp. [1 male]. This is an apparently undescribed blondeliine genus. There are several well-preserved specimens belonging to the same taxon in the KwaZulu-Natal Museum.

*Gonia bimaculata* Wiedemann, 1819 [1 male]

### Tachininae

*Macquartia* cf. *tessellata* van Emden, 1960 [9 males]

**Collecting sites 7–12** were close around or included in the Swartberg Nature Reserve (Fig. 8).

Internet site: [http://www.capenature.co.za/reserves.htm?reserve=Swartberg+Nature+Reserve#reserve\\_tabs](http://www.capenature.co.za/reserves.htm?reserve=Swartberg+Nature+Reserve#reserve_tabs)

From the website: "The Swartberg mountains are part of the Cape fold mountain range. ... This is an area of climatic extremes, with very cold winters, often with snow on the mountains and temperatures well below zero, while summers can be uncomfortably hot with temperatures reaching 40°C and more! ... The reserve's vegetation is remarkably diverse, featuring renosterveld, mountain fynbos, Karoo-veld, spekboom veld, and numerous geophyte species. Some species will be in bloom virtually throughout the year."

The renosterveld vegetation type is one of the major plant communities of the Western and Eastern Cape Provinces, dominated by *Elytropappus rhinocerotis* (Rhinoceros bush, Asteraceae).

## 5. Anysberg Nature Reserve (Figs. 6–7)

Collection data: 33°26'37.76"S 20°47'29.25"E (hilltop), 14.x.2012, 840 m.

### Dexiinae

*Periscepsia* sp. [1 female]

*Piligena mackieae* van Emden, 1947 [1 female, 1 male]

*Pseudodinera* sp. [7 males, 2 females]

### Exoristinae

*Exorista* sp. 1 [1 male]. This specimen probably belongs to an undescribed species characterized by having the first postsutural supra-alar seta unusually long.

*Exorista* sp. 2 [1 male]

*Gaedioxis haematodes* Villeneuve, 1939 [1 male]

*Myxogaedia* undescribed sp. (near *M. setosa* Curran, 1938) [1 male]

*Pexopsis pyrrhaspis* Villeneuve, 1916 [1 female]

**Figure 7.** Hilltop, Anysberg Nature Reserve, Western Cape.





**Figure 8.** Swartberg Range, Swartberg Nature Reserve, Western Cape.



## 7. Calitzorp road, Matjiesrivier

Collection data: 33°24'21.92"S  
21°59'32.43"E, 15.x.2012, 672 m.

Dexiinae

*Periscepsia* sp. [1 male]

*Pretoriamyia* sp. [1 female]

Phasiinae

*Phasia* sp. [4 male, 3 females]

Tachininae

*Actia* sp. [1 male]

*Graphogaster* undescribed sp. [1 male]. First record of this genus for the Afrotropical Region. A female from Western Cape, probably conspecific to our male, is preserved at the KwaZulu-Natal Museum.

## 8. 8 km south of Prince Albert, Eerstewater (Figs. 9–10)

Collection data: 33°17'38.11"S 22°3'5.63"E,  
15–16.x.2012, 829 m.

Dexiinae

*Billaea* sp. [1 male]

Exoristinae

*Metacemyia* sp. [1 female]

*Paratrypha* undescribed sp. [2 females]

Tachininae

*Brachelia* sp. [4 males, 1 female]

*Microphthalma* sp. [1 female]

*Mintho* sp. [1 male]

*Rondaniooestrus apivorus* Villeneuve,  
1916 [1 male]

## 9. Gamkaskloof (Die Hel)

Collection data: 33°21'11.49"S  
21°44'36.57"E, 16.x.2012, 580 m.

Exoristinae

*Chaetoria* cf. *stylata* Becker, 1908  
[1 male]



**Figure 9.** Eerstewater area south of Prince Albert, Western Cape.





**Figure 10.**  
Eerstewater  
area south of  
Prince Albert,  
Western  
Cape.

[Malaise trap]

Exoristinae

*Rioteria* undescribed sp. [1 male]. First record of this genus for South Africa.

Genus B sp. [1 male]. There are two described South African species, currently assigned to genus *Myxogaedia* (*M. longirostris* Villeneuve and *M. majestica* (Curran, 1940)), which are closely related to the male we collected and should be removed from *Myxogaedia* and assigned to Genus B.

Phasiinae

*Besseria longicornis* Zeegers, 2007 [3 females, 1 male]. This recently described species was previously known only from the type locality in Yemen.

*Leucostoma engeddense* Kugler, 1966 [1 female]. First record for continental Afrotropical Africa. *Leucostoma engeddense* was described by Kugler from Israel (En Gedi). It is a widespread element in the southern Mediterranean Basin and was recently cited from U.A. Emirates, which up until now represented the southernmost locality for this species.

Tachininae

*Linnaemya* spp. [2 females]

*Peribaea* sp. [2 males]

*Siphona* (*Ceranthia*) sp. [1 male]

## 10. Gamkaskloof (Die Hel)

Collection data: 33°21'49.60"S  
21°37'40.97"E, 16–18.x.2012, 336 m.

[hand net]

Tachininae

*Macquartia* sp. [1 male]

*Rondanioestrus apivorus* Villeneuve, 1916 [1 male]. This specimen was collected in the early morning in a bathroom where the light was left on all night long.

Phasiinae

*Cylindromyia* sp. [3 females]

[pan traps]

Phasiinae

*Litophasia* sp. (cf. *L. sulcifacies* Dear, 1980)

## 11. Gamkaskloof (Die Hel) (Fig. 11)

Collection data: 33°22'5.90"S 21°37'19.43"E (hilltop),  
17–18.x.2012, 336 m.



**Figure 11.** View of hill visited for hilltopping tachinids, Gamkaskloof Die Hel, Swartberg Nature Reserve, Western Cape.



Dexiinae

*Pseudodinera* sp. [1 male]

Exoristinae

*Aplomya* sp. [3 males]

*Dolichocolon paravicinum* Cerretti & Shima, 2011 [1 male]. New record for South Africa.

*Drino (Palexorista)* sp. [1 female]

*Exorista* sp. 3 [11 males, 2 female]

*Exorista* sp. 4 [1 male]

*Gonia bimaculata* Wiedemann, 1819 [2 males]

*Myxarchiclops* cf. *caffer* Villeneuve, 1916 [1 female]

*Pseudogonia ruffrons* (Wiedemann, 1830) [1 female]

*Smidtia capensis* (Schiner, 1868) [12 males, 1 female] (Fig. 12)

Genus C sp. [1 male, 1 female]. These specimens were



**Figure 12.** *Smidtia capensis* (Schiner) on hilltop shown in Fig. 11.

collected on the slope close to the hilltop. They are strongly characterized by a wide parafacial, covered with short setulae, and very short antennae. At a first glance they resemble *Pseudalsomyia* Mesnil, and in fact they may belong to this genus, but the male abdominal tergites 3 and 4 do not have sexual patches. The tip of tergite 5 of both sexes is red.

Tachininae

*Rossimylops* undescribed sp. [1 female]

## 12. Calitzdorp, 10 km E (R62)

Collection data: 33°32'27.90"S 21°48'2.84"E, 21.x.2012, 362 m.

Exoristinae

*Drino (Palexorista)* sp. [4 males]

*Pexopsis pyrhaspis* Villeneuve, 1916 [1 male]

Phasiinae

*Phasia* sp. [1 male]

## 13. Ladismith, 30 km SW (R62)

Collection data: 33°37'44.50"S 21°2'58.04"E, 21.x.2012, 385 m.

Dexiinae

*Pretoriomyia* sp. [1 female]

Exoristinae

*Exorista* spp. [9 males]

*Pexopsis pyrhaspis* Villeneuve, 1916 [1 female]

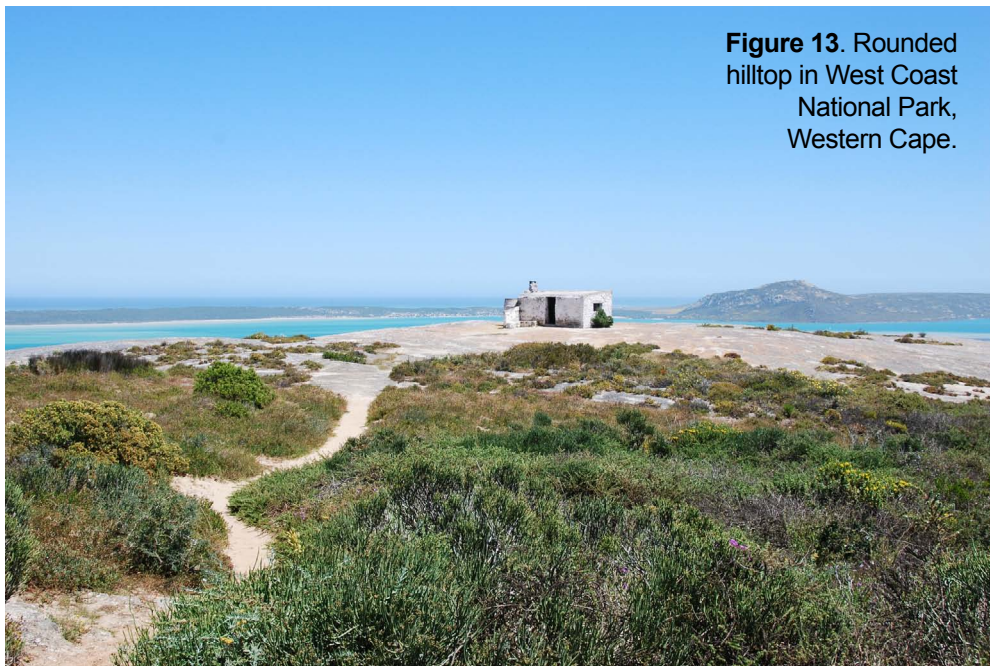
*Smidtia capensis* (Schiner, 1868) [3 males]

Phasiinae

*Besseria zonaria* (Loew, 1847) [1 male]

**Collecting sites 14 and 15 (Figs. 13–14)** were in the Langebaan Fynbos/Thicket habitat of the West Coast National Park. The area is almost flat and sandy.

Internet site: [http://www.sanparks.org/parks/west\\_coast/](http://www.sanparks.org/parks/west_coast/)



**Figure 13.** Rounded hilltop in West Coast National Park, Western Cape.





**Figure 14.** Same hill as in Fig. 13, West Coast National Park, Western Cape.

#### 14. West Coast National Park, Duinepos

Collection data: 33°7'20.57"S 18°4'41.12"E, 22.x.2012, 125 m.

Exoristinae

?*Cestonia* sp. [1 female]

*Chetogena* sp [2 males]

*Chlorolydella* sp. [1 female]

*Chlorolydella* undescribed sp. [1 female]

*Pseudogonia* cf. *fasciata* (Wiedemann, 1819) [1 male]

*Peleteria* sp. [1 female]

cf. *Porphyromus* undescribed sp. [4 males]

*Siphona* (*Aphantorhaphopsis*) sp. [1 male]

#### 16. Table Mountain N.P., Clovelly (Fig. 15)

Collection data: 34°07.465'S, 18°26.094"E, 24.x.2012, 64 m.

Dexiinae

*Dinera* sp. [5 males]

*Periscepsia* sp. [1 female]

Exoristinae

*Nemorilloides flaviventris* Brauer & Bergenstamm, 1891 [1 female]

Tachininae

*Brachelia westermanni* (Wiedemann, 1819) [1 male, 4 females]

*Mintho* sp. [1 female]

*Phytomyptera* sp.1 [1 male]

#### 15. West Coast National Park, Duinepos

Collection data: 33°12'13.89"S 18°8'24.91"E, 23.x.2012, 10 m.

Dexiinae

Genus D sp. [1 male]. This specimen belongs to an undescribed dufouriine genus. It is about 3 mm long and strongly characterized by long and geniculate mouthparts recalling those of *Siphona*. The fresh specimen was dissected revealing a membranous dorsal connection between basiphallus and distiphallus, which is the groundplan trait of the Dexiinae.

Exoristinae

*Drino* (*Palexorista*) sp. [10 males]

*Medina* sp. [1 male]

*Myxarchiclops* sp. [1 male]

*Paratryphera* sp.2 [1 male]

Tachininae

*Mintho* sp. [1 male]



**Figure 15.** Trail near Clovelly, Table Mountain National Park, Western Cape.

## 17. Table Mountain N.P., near Echo Valley (Fig. 16)

Collection data: 34°04.539'S, 18°23.872"E, 24.x.2012, 454 m.

### Dexiinae

*Dinera* sp. [1 female]

*Periscepsia* sp. [1 male]

### Exoristinae

*Winthemia quadrata* (Wiedemann, 1830) [1 male]

Genus E (near *Drino*) sp. [1 male]. The specimen has reduced ocelli and remarkably, tergite 5 is strongly conically pointed.

*Pales* sp. [1 male]

*Myxarchiclops caffer* Villeneuve, 1916 [1 male, 1 female]

### Tachininae

*Brachelia westermanni* (Wiedemann, 1819) [1 female]

*Leskia* sp. [1 female]

*Phytomyptera* sp. [1 female]

*Rondanioestrus apivorus* Villeneuve, 1916 [1 female]

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**Figure 16.** Near Echo Valley, Table Mountain National Park, Western Cape.





Figure 1. Naturhistorisches Museum, Vienna

# A visit to the Vienna Museum with a brief history of the tachinid collection

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## INTRODUCTION

Emperor Franz Josef I of Austria signed a decree on 20 December 1857 ordering the demolition of the old fortifications around the inner city of Vienna. The empty space created would be developed into the *Ringstrasse*, a grand boulevard along which troops could be moved quickly, if the need arose. The Emperor envisioned the *Ringstrasse* to be lined with the finest buildings imaginable, built in the Historicist style. He authorized the construction of museums and palaces, the Rathaus (City Hall), Parlament, Staatsoper (Opera House), and other famous buildings, interspersed with parks, statues, and fountains.

Today in a prominent position along the *Ringstrasse* is Maria-Theresien-Platz, a large square with two magnificent museums facing each across its manicured expanse. The museums are mirror images of each other: on the east side is the Kunsthistorisches Museum (Art History Museum) and on the west side is the Naturhistorisches Museum (Natural History Museum). The latter of these was my destination when I traveled to Vienna in late August 2012. But before I get to the purpose of my trip, I will give a brief history of the museum and its Tachinidae collection.

## NATURHISTORISCHES MUSEUM

Construction of the Naturhistorisches Museum (Fig. 1) was overseen by famous German architect Gottfried Semper and lesser known Viennese architect Carl von Hasenauer. Work began in 1871 and conflict soon developed between the architects. This stressed relationship continued until the death of Semper in 1879, after which Hasenauer took over completion of the museum on his own. The exterior was finished in 1881 and then the interior in 1884. For another five years the museum remained closed as collections and displays were moved into their new quarters. Finally, on 10th August 1889, the Emperor himself presided over the grand opening of the Naturhistorisches Museum. Coincidentally and with less fanfare (at least outside the dipterological community), Friedrich Brauer and J. Edler von Bergenstamm of Vienna had just published a few months earlier the first of four parts on the Muscaria Schizometopa in their series *Die Zweiflügler des Kaiserlichen Museums zu Wien* (“Diptera of the Imperial Museum in Vienna”). Quite possibly the two dipterists were in attendance on that day in August when the Emperor officially opened the museum. Brauer had waited many years to move into his new office and continue his Diptera research within such grand surroundings. There could be no doubt as to the purpose of the museum for this was indelibly inscribed over the main entrance: “Dem Reiche der Natur und seiner Erforschung” (“For the Realm of Nature and its Exploration” – Emperor Franz Josef I, 1881).

## DIPTERA COLLECTION OF NHMW

The scientific collections now housed in the Naturhistorisches Museum (hereafter NHMW, regardless of the physical location of the insect collection through history) were started in the mid 1700s by Emperor Franz I Stephan, who had a keen interest in natural history. The insect collection grew slowly through the purchase of private collections and the funding of expeditions to distant lands. In 1848 a fire in the Imperial Library of the Hofburg Palace, where the insect collection was then kept, was started during the bombardment of Vienna in the Revolution of that year and much of the collection was destroyed. Among the Diptera lost were some specimens Meigen had borrowed, described, and returned (Herting 1972, Pont 1986). Fortunately, a large collection of insects accumulated during a long expedition to Brazil (1817–1836)

was housed elsewhere and is still extant.

The insect collection of Wilhelm von Winthem (b.1799–d.1847) was purchased by NHMW in 1852. Winthem was a wealthy businessman and amateur entomologist who lived in Hamburg, Germany. He bought specimens from all over the world and built up the finest Diptera collection then in existence (Hagen 1844, Pont 1986, 1995). Both Johann W. Meigen (b.1764–d.1845) and Christian R.W. Wiedemann (b.1770–d.1840) described species from the Winthem material, with Meigen publishing on European Diptera (e.g., Meigen 1818–1838) and Wiedemann on exotic Diptera (e.g., Wiedemann 1828–1830). Meigen’s collection was later sold to the Paris Museum but some types also stayed in the Winthem and Wiedemann collections. After Wiedemann’s death his insect collection was purchased by Winthem. Winthem’s collection was subsequently sold to NHMW after the death of its owner. The well-known tachinid genus *Winthemia* was named in Winthem’s honour by Robineau-Desvoidy (1830: 173) when Winthem was still a young man.

Aldrich (1924, 1925a, 1925b, 1927) redescribed some of Wiedemann’s New World species in his series on the “American muscoid Diptera in the collection of the Vienna Natural History Museum”. Herting (1972) reported on the Meigen types of European Tachinidae in NHMW and Paris Museum.

A famous Austrian expedition to circumnavigate the world in the frigate *Novara* began in 1857. By the time the ship returned in 1859 it had visited such places as Brazil, Chile, South Africa, India, China, Australia, New Zealand, and Tahiti. The vessel returned with about 26,000 zoological specimens and these added considerable research value and national prestige to the expanding collection. Schiner (1868) published on the Diptera collected during the *Novara* voyage.

Two valuable collections containing Tachinidae were bequeathed to the Museum upon the deaths of Austrian dipterists Johann N.G. Egger (b.1804–d.1866) and J. Rudolph Schiner (b.1813–d.1873). Egger described about 40 nominal species of Tachinidae, all from Europe and primarily from Austria. Schiner published a number of important works but is best remembered for his Diptera contributions to *Fauna Austriaca* (Schiner 1860–1864) and his descriptions of exotic Diptera collected during the *Novara* voyage (Schiner 1868). Schiner described about 60 nominal species of Tachinidae. Aldrich (1925a, 1925b, 1927) redescribed a few of Schiner’s New World species and Herting (1974) reported on the European tachinid types of both Egger and Schiner.



Friedrich M. Brauer (b.1832–d.1904, Fig. 2) was born in Vienna and lived most of his life there (Handlirsch 1905). He was interested in natural history at a young age and first became acquainted with professional entomologists as a teenager. He was hired by the Museum in 1861 as curator of the Mollusca collection, a position he held for 16 years. During this time he also studied insects, especially Neuroptera and Oestridae. In the early 1870s he completed studies towards a medical degree in order to qualify for a University appointment. He subsequently became a University professor and taught insect courses. He was appointed curator of the Museum's insect collection in 1876 and began devoting more time to the study of the rich Diptera collection (e.g., Brauer 1880). Brauer (1863) is credited with the division of the Diptera into Orthorrhapha and Cyclorrhapha (e.g., McAlpine 1989), and his detailed study of insect classification (Brauer 1885) has been hailed recently as a “substantial pioneering application of evolutionary thought to hexapod classification” (Engel & Kristensen 2013: 603). Interestingly, Brauer's contemporary, C.R. Osten Sacken, was no more enamoured with Brauer's ideas on classification than was Brauer

with Osten Sacken's system of chaetotaxy (Osten Sacken 1903, Alexander 1969).

Brauer began publishing his most ambitious work, *Die Zweiflügler des Kaiserlichen Museums zu Wien*, in 1880. This series eventually ran to seven volumes, the last four involving the Tachinidae and co-authored with J. Edler von Bergenstamm (b.1837–d.1896) (Brauer & Bergenstamm 1889–1895). Bergenstamm had an interest in entomology and developed a particular fondness for Diptera through his friendship with Schiner and Brauer (Brauer 1896). Bergenstamm was freed from the necessity of working for a living after receiving a generous inheritance. With time on his hands, he began to seriously pursue the collection and identification of flies. Thus began the collaboration between Brauer and Bergenstamm to coauthor four volumes of *Die Zweiflügler des Kaiserlichen Museums zu Wien* on the “Muscaria Schizometopa (exclusive Anthomyidae)” (Brauer 1896). Bergenstamm died the year after publication of the last volume of this large work and his collection was bequeathed to the Museum. Brauer was appointed head of the Museum's Zoological Department in 1898 and became director of the Museum sometime before his death in 1904.

Brauer and Bergenstamm's (1889–1895) *magnum opus* was met with mixed reviews. As a world treatment of a large and taxonomically difficult group, it was a tremendous achievement. It was well received by Townsend (1908), in part because the authors favoured a restricted view of genera as did Townsend. However, Wainwright's (1928: 140) view of the work was more popular among dipterists:

“Unfortunately it has proved extremely difficult to utilise much of the information contained in this important work, owing to the complicated and confused manner in which it has been presented. It has, however, revolutionised the study of the group, owing to the attention called to many characters previously overlooked, and in particular those afforded by the head, its shape, and the relationship of the different parts, and its chaetotaxy. ... They, however, failed lamentably in their attempts to arrange the genera into larger groups, and never seem to have had any real grasp of the main lines upon which the classification of the family should proceed. In fact, although they added greatly to our knowledge, they failed to reduce that knowledge to order.”

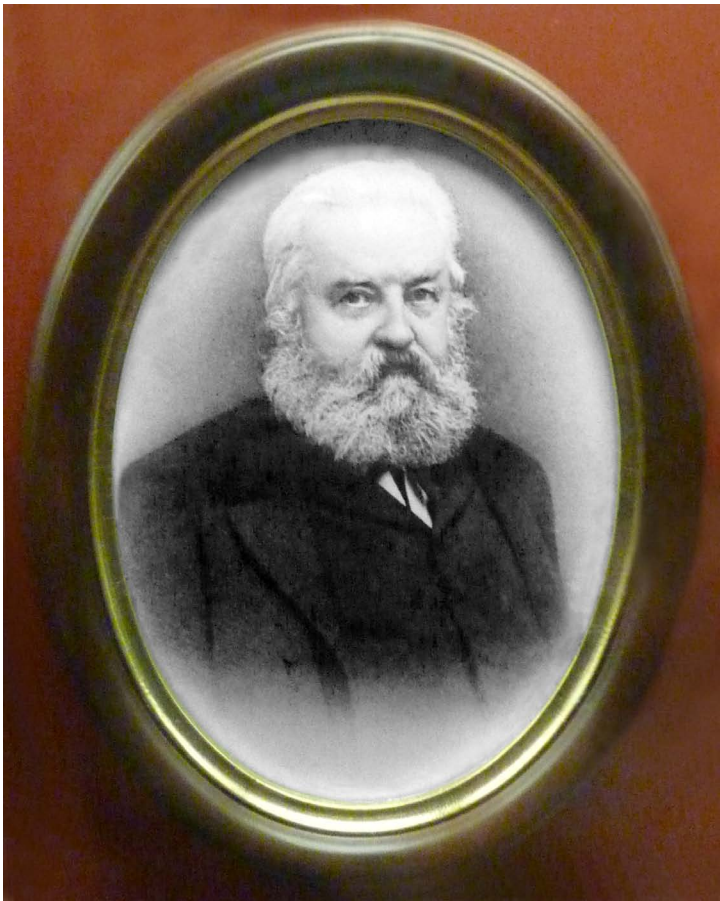


Figure 2. Portrait of Friedrich M. Brauer on display in NHMW.



Villeneuve (1907) and Herting (1974) reported on the Brauer and Bergenstamm types of European Tachinidae in NHMW. Aldrich (1924, 1925a, 1925b, 1927) redescribed a number of Brauer and Bergenstamm's New World species. Brauer, or Brauer and Bergenstamm, described close to 250 nominal species of Tachinidae, with about 140 still valid today.

Josef Mik (b.1839–d.1900) was a teacher and respected dipterist leaving in Vienna. He described only about a dozen tachinid species but he amassed a considerable Diptera collection. This collection, consisting of 40,000 specimens, was purchased by NHMW after Mik's death (Contreras-Lichtenberg 2003).

French medical doctor Joseph Villeneuve (b.1868–d.1944) also has tachinid types in NHMW. Villeneuve was a prolific amateur dipterist who described close to 500 nominal species of Tachinidae (most still valid today) over a span of 45 years. He published a couple of influential papers on relationships among Oestroidea (Villeneuve 1924, 1933), but most of his papers were short and consisted of isolated species descriptions. He rarely published keys and even in an age when holotypes were routinely designated, he was lax in the recording of type data and depositories. Villeneuve's types are spread among many museums throughout the world. He visited NHMW at least once (Mesnil 1950) and very likely borrowed material and worked on it at his home in Rambouillet, France.



**Figure 4.**  
Portion of  
Diptera collection.

## MY VISIT TO NHMW

The current Diptera curator at NHMW is Peter Sehnal (Fig. 3). He kindly arranged accommodation for me in one of the Museum's guest rooms in the MuseumsQuartier across the street from the Kunsthistorisches and Naturhistorisches Museums. I was given space in an office next to the Diptera collection, a microscope, and an internet connection via the Museum's network. The Diptera collection is housed in a long room with a high painted ceiling and intricate crown mouldings. This ornate setting is in contrast to the modern compactor system that fills the room with row upon row of open shelving and glass-topped insect drawers (Fig. 4). Opening into this room are staff offices with high windows facing northward, offering natural light and a view of the Vienna skyline.

The Diptera collection is in various states of curation depending upon the family. The Tachinidae have been moved into foam-bottomed trays and neatly arranged by region and taxon. There are about 150 drawers, with about



**Figure 3.** Peter Sehnal, current curator of Diptera.



2/3 devoted to the Palaearctic Region. Drawer numbers for the other regions are as follows: Neotropical, 20; Nearctic, 7; Afrotropical, 5; Australasian, 3; Oriental, 2; and unsorted about 10. In total this Tachinidae collection is not huge, but what it lacks in size is made for by its historical value and especially its abundance of name-bearing types.

Early authors (and even some later ones!) did not always mark their type specimens in collections in a manner that would permit their easy recognition later on. Thus, it has often fallen on resident curators and visiting specialists to sort out the types in a collection. Some years ago Peter Sehnal worked through the Neotropical tachinids in NHMW, determining the type status of specimens and drafting an unpublished document on the name-bearing types. This tedious work remains to be done for much of the rest of the tachinid collection.

My goals in visiting NHMW were twofold: (1) to locate, photograph and take data from name-bearing types of Afrotropical species for a catalogue of the Tachinidae of the Afrotropical Region that I am preparing with Pierfilippo Cerretti and Monty Wood, and (2) to do the same for as many additional tachinid types as possible, especially for New World species that are possibly misidentified. This second goal was in support of an ongoing project to database the names, types and distributions of world Tachinidae. I had from August 27th to September 7th to accomplish these goals. Little did I realize that the first goal would take most of my time.

I will confine myself here to the types of Afrotropical Tachinidae. I had a list of what I expected to find in NHMW: the name-bearing types of close to 40 nominal species. With only five drawers of Afrotropical Tachinidae to check, I thought I could work through my list in a matter of days – or the first week at most.

I began by working through the trays one by one. For each potential type I would check the specimen data against the information given in the original description. Ideally, one likes to see a data label with locality, date, and collector and a separate type label. Not surprising, older specimens usually bear a more cryptic combination of the desired information. There can be non-type specimens labelled as types and types without type labels. An hour can quickly slip by just deciding upon the status of a specimen; another hour might pass if an explanation about a tricky type situation must be written. After I verified each type I would photograph the labels as a group and take pictures of the specimen from several angles. I used the same lighting system as described for my online TachImage Gallery (<http://www.nadsdiptera.org/Tach/Tachgallery/Tachgallerymethods.htm>). The camera was a Sony NEX-C3 with a 30mm

macro lens mounted on a mini tripod; not a professional camera but very portable. Images were then transferred to my computer and renamed according to species, author and type status. Copies of all images were left with Peter Sehnal.

My search for types of Afrotropical Tachinidae in NHMW can be summarized as follows by author and number of species (in brackets): Villeneuve (14), Wiedemann (7), Brauer and Bergenstamm (7), Bischof (3), Schiner (3), Curran (1), and Karsch (1). Names are not given here but all of them and associated type information will be published in the upcoming catalogue of Afrotropical Tachinidae (2014?).

I will conclude with some information about the labelling of types. Some labels were at first somewhat perplexing but with help from Peter and by reading through original descriptions I began to make sense of them. The old labels are undated but understanding the information on them can often set a date, or sometimes a minimum date, and thus help in determining whether a specimen is a type. I missed some types on my first pass through the Afrotropical drawers that I found on a second pass when I looked more carefully at all labels.

*Alophora capensis* Schiner, 1868 [currently *Phasia nasuta* (Loew)] (Fig. 5). Schiner (1868: 337) described this species from “Ein Männchen vom Cap der guten Hoffnung” [“One male from Cape of Good Hope”]. The work of Schiner (1868) dealt with specimens collected during the voyage of the frigate *Novara*, 1857–1859. Although the specimen in Fig. 5 does not bear a type label (which in similar cases was

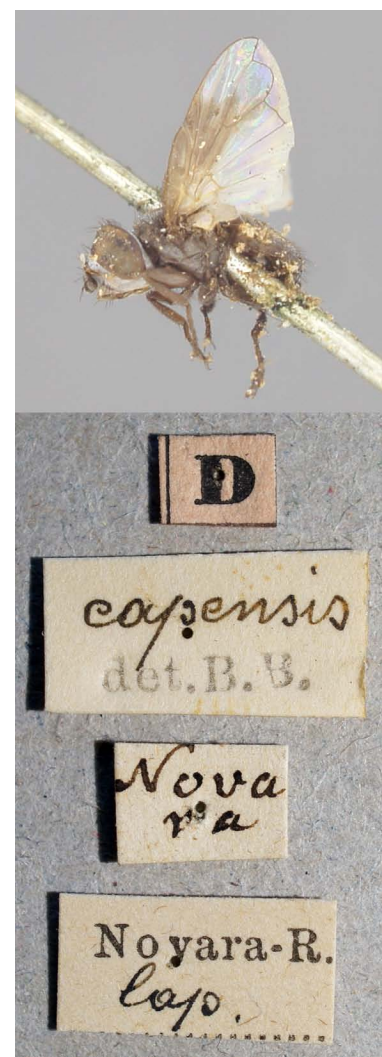


Figure 5. *Alophora capensis* Schiner.

often added years later by someone else anyway), all data is consistent with this specimen being the holotype: the description fits the specimen, it has been labelled as *capensis* by Brauer and Bergenstamm, it was collected on the *Novara* voyage, and the locality is “Cap” (short for “Cap. b. sp.” or “Cap Bonae Spei” = Cape of Good Hope, South Africa). Neither Peter nor I could determine with certainty the meaning of the capital “D” on the pink label; a similar label accompanies the other two Schiner (1868) types I examined. Perhaps it simply stands for “Diptera”.

***Gonia bimaculata* Wiedemann, 1819** [currently valid] (Fig. 6). Wiedemann (1819: 25) described this species from an unspecified number of females from “Prom. bon sp. Decbr.” (Latin for “Promontorium Bonae Spei [= Cape of Good Hope, SA], December”). Bernt W. Westermann collected at Cape of Good Hope prior to 1817. Most of the Westermann material studied by Wiedemann is in the Natural History Museum of Denmark in Copenhagen but this specimen must have stayed in the Wiedemann collection (which was purchased by Winthem, whose collection in turn was purchased by NHMW, as explained above). The “Typus” label is written in Villeneuve’s hand on his distinctive blue paper and thus was added much later. The specimen is properly regarded as a syntype because there is a possibility that other type specimens exist.



Figure 6. *Gonia bimaculata* Wiedemann.



Figure 7. *Tachinomima expetens* Brauer & Bergenstamm.

***Tachinomima expetens* Brauer & Bergenstamm, 1891** [currently *Linnaemya longirostris* (Macquart)] (Fig. 7). This species was described by Brauer & Bergenstamm (1891: 79) from at least one male and one female from “Cap. b. sp.” (“Cap Bonae Spei” = Cape of Good Hope, SA). This male from “Cap.” appears to be an original syntype. There is also one female in NHMW that appears to be an original syntype. They are both from “Coll. Winthem”, meaning they belonged to the Winthem Collection that was purchased in 1852. Townsend (1939: 215) cited a “Ht male” from Cape of Good Hope in NHMW and I regard this statement as a lectotype fixation for the male specimen shown here.





**Figure 8.**  
*Eupododexia*  
*festiva*  
Villeneuve.

*Eupododexia festiva* Villeneuve, 1915 [currently valid] (Fig. 8). Villeneuve (1915: 201) described this species from two males collected by Sikora from Andrangoloaka (Madagascar). The single male in NHMW bears Villeneuve's blue label with neatly handwritten data. Villeneuve would frequently label some but not all syntypes as "Typ."; he did not use "Typ." in the same sense as a holotype (or at least not consistently). Townsend (1938: 335) cited a "Ht male" from Andrangoloaka in NHMW and I regard this statement as a lectotype fixation for the male specimen in Fig. 8. The other male in the type series is in the Canadian National Collection of Insects in Ottawa.

## FINAL NOTE

I was advised by colleagues to sample an original Sacher-Torte before leaving Vienna. I accepted this advice (Fig. 9) and here pass it along to other visitors. It is written on the Hotel Sacher website that the "Original Sacher-Torte has been the most famous cake in the world since 1832". I wonder if Egger, Schiner, Brauer and Bergenstamm all partook of this delicacy at Hotel Sacher more than one hundred years before I did?

## ACKNOWLEDGEMENTS

I am especially grateful to Peter Sehnal for helping me with my travel arrangements, providing full access to the NHMW tachinid collection, and otherwise making my visit as memorable and successful as possible. Monty Wood passed along information and advice about the collection and its holdings based on his prior visits, and kindly commented on a draft of this article. Shannon Henderson also read and commented on an earlier draft.

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**Figure 9.** The author enjoys a Sacher-Torte and glass of Austrian beer at Hotel Sacher after a day at the Museum.

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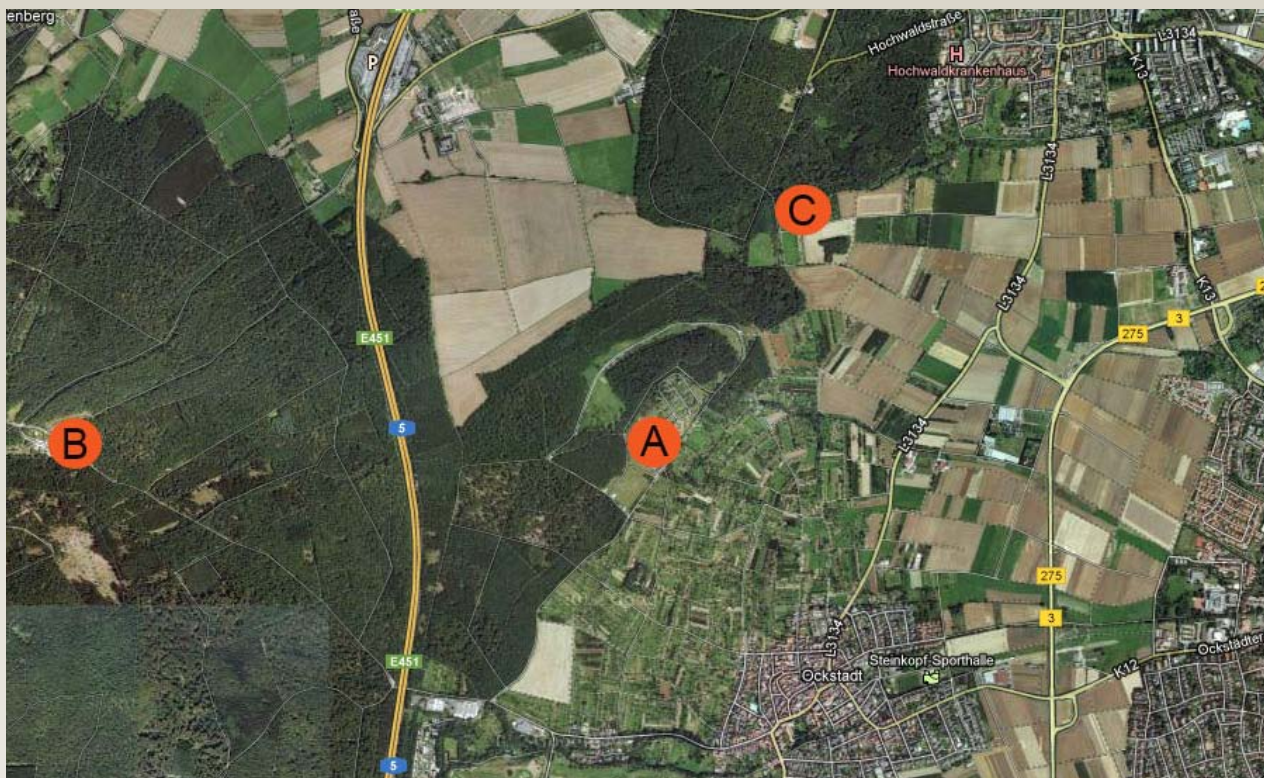


Figure 1. Collection locations around Friedberg, Hessen, Germany.

# Observations of Tachinidae (Diptera) in the surroundings of Friedberg (Hessen, Germany) with notes on some interesting species

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In this essay I give a brief impression of the local tachinid fauna in the Friedberg region with an introduction to some interesting collecting locations. Besides a listing the tachinid species observed during the collecting seasons 2010–2012, I make an estimate of their abundances and highlight some interesting observations.

## Collecting in and around Friedberg

Because of work reasons I lived in the village of Ockstadt in Friedberg of Hessen, Germany in 2010–2012. Friedberg is situated some 35 km north from Frankfurt am Main in the typical agricultural landscape of the Hessen highlands (140–600 m). Ockstadt (50.333°N 8.721°E) is a separate village some 3 km west from the town center of Friedberg. The surroundings of the vil-

lage are dominated by cherry orchards and flanked on its northern edge by the Taunus Nature Park. This park is characterized by hilly terrain with oak (*Quercus robur*) and beech (*Fagus sylvatica*) dominated woods with a network of small roads and hiking paths.

During my stay I had the opportunity to do some unsystematic collecting and observing of tachinids in and around Friedberg, mainly in the terrain surrounding Ockstadt itself but also in the nearby areas of the Taunus Nature Park and in some recreational parks in the neighboring Bad Nauheim (Fig. 1). The season typically started in the end of March with early spring species such as *Kirbya moerens* (Meigen) and continued until the end of October, with some *Phasia aurigera* (Egger) and *Blondelia nigripes* (Fallén) observed in the first week of November in 2011.



## Ockstadt (Location A)

Despite the rather forcefully managed cherry plantations, there are numerous landstrips and roadsides with wild flora, bushes and meadows. One of the most interesting locations is a 200x500 m wide old building waste landfill area just a kilometer northwest of the village (Fig. 2). The area is enveloped by a *Fagus-Carpinus-Quercus* forest, has rolling sandy hills with low meadow vegetation as well as *Salix*, *Populus* and *Rosa* bushes. In places the ground water is seeping through and forming small ponds with reeds and sedges. In the northern edge of the area *Calluna*, *Cytisus scoparius* and *Juniperus* dominate the moor-like landscape (Fig. 3). Of the locally noteworthy insects, the blue-winged large grasshopper *Oedipoda caerulescens* (L.) is rather abundant in areas with open sand and the clearwing moth *Bembecia ichneumoniformis* (D. & S.) seems common and widespread throughout the area.



**Figure 2.** Parasite paradise: early August blossom at location A in Ockstadt. Meadows, bushes and forest margins support a diversity of insects.



**Figure 3.** *Calluna* and *Cytisus scoparius* dominated heath at the margins of location A.

## Winterstein, Ober-Mörlen (Location B)

Winterstein is part of the Taunus Nature Park, typically oak and beech woods with small roads and paths. The contour is rather steep, with the highest peak at Winterstein around 600 m. At these higher elevations also some spruce (*Picea abies*) and scattered pine (*Pinus sylvestica*) trees are present. Despite managed forestry there are also plentiful of dead and decaying trees. Although the habitats are dominated by the rather cool forest margins, there is also a small old army training ground with disturbed soils, open low vegetation and dry meadows (Fig. 4). The area has a rich butterfly and moth fauna, including *Saturnia pavonia* (L.), *Agria tau* (L.), *Limenitis camilla* (L.), *Nymphalis polychloros* (L.) and *Araschnia levana* (L.) to name but a few. The grasshopper *Oedipoda caerulescens* is also present in the open areas, but is not as numerous as in the landfill area in Ockstadt.





**Figure 4.** Former army training grounds at Winterstein surrounded by beech and oak forests.

## Waldteich and others, Bad Nauheim (eg. Location C)

My collecting in the locations in Bad Nauheim was opportunistic and mostly restricted to some of the bigger parks, which with their ponds and semi-managed surroundings are also popular picnic locations. As expected, the tachinid fauna in these locations is not too impressive. However, the early spring species *Kirbya moerens* was very abundant in the parks, often observed sunning on the oak leaf litter. Characteristically these places are shady during the summer. Of the other insects, the old trees with hollow trunks seem to support impressive beetles such as *Lucanus cervus* (L.) and a number of xylophagous syrphids like the large *Temnostoma* spp.

## Notes on the Tachinid fauna

During the three collecting seasons I was able to record 109 species (Table 1). Intensified collecting effort and use of Malaise traps would perhaps have doubled the number of species. I give in the table also my personal impression of the abundance of the different species:

- 1 = single specimen observed
- 2 = 2–4 specimens observed. Many of these as well as most species recorded only once include small species that are not easily

collected by net. Therefore the number should not be taken as an indicator of rarity.

- 3 = not rare but rather locally distributed
- 4 = common and abundant but seasonal
- 5 = common and abundant throughout most of the season

Apart from some peculiarities the tachinid fauna around Friedberg is obviously rather similar to the Finnish fauna, with which I have the most experience. As expected, many species uncommon in the north are more abundant in central Europe, and the contrary is true for some of the mainly boreomontane taxa such as *Eurithia*, which seem to be widely replaced by ecologically similar *Linnaemya* species in central Europe. The following records deserve special mention.

### ***Phorocera grandis* (Rondani)**

I collected two male specimens on 30 April 2012 from the Winterstein region that I assign to this species based on the characters mentioned in the central European key (Tschorsnig & Herting 1994) and by comparison with specimens kindly donated to me by Dr. Tschorsnig. During 2011–2012 the Friedberg region witnessed an outbreak of the oak processionary moth (*Thaumetopoea processionea* (L.)) and it is likely that my *P. grandis*



(a known parasitoid of the caterpillars of this moth, see Tschorsnig & Wagenhoff 2012) observations were related to this outbreak. *Phorocera grandis* cannot be separated in the field from the highly abundant *P. assimilis* (Fallén). Although the latter species flies earlier than *P. grandis*, the flight periods of both species overlap at the end of April. As I did not collect all large *Phorocera* that I saw, it may well be that *P. grandis* was more common in the region in spring 2012. Coincidentally, the nun moth (*Lymantria dispar* (L.)) was also very numerous in the Winterstein area in 2011–2012 and I was able to collect several specimens of its parasitoids *Parasetigena silvestris* (R.-D.) and *Blepharipa pratensis* (Meigen). All the species mentioned above were observed mainly when sitting on oak leaves, sometimes quite high on the trees.

#### ***Meigenia majuscula* (Rondani)**

This *Meigenia* species with hairy eyes was listed as a mainly southern European species in Tschorsnig and Herting (1994). One male was caught sitting on ground vegetation on a roadside in Winterstein on 18 May 2012.

#### ***Acemya rufitibia* (von Roser)**

Two males and one female were collected on 10 June 2012 by sweeping low grass on bare sand on an old military training ground. *Acemya* species are rare, warm loving parasitoids of grasshoppers and the habitat in Winterstein seems more than adequate for such species. Interestingly *A. rufitibia* is mainly present in bogs in Finland (Pohjoismäki 2011). It will be interesting to compare the DNA barcodes from these specimens (see my other article in this same issue of this newsletter).

#### ***Tachina nupta* (Rondani)**

One male and two uncertain females were collected on 17 May 2012 from flowers of *Ribes* in an overgrown clearing in a forest in Winterstein. The specimens are similar to *Tachina magnicornis* (Zetterstedt), but differ by the characters given in Tschorsnig and Herting (1994). The lone *Ribes* bush was also highly attractive to *Tachina lurida* (Fab.), *Phasia hemiptera* (Fab.) and a number of syrphids.

#### ***Eulabidogaster setifacies* (Rondani)**

One male was collected on 14 August 2011 by sweeping Apiaceae in the cherry orchards in Ockstadt. This was considered as a southern spe-

cies and not recorded from Hessen in Tschorsnig and Herting (1994).

#### ***Leucostoma meridianum* (Rondani)**

This species is easily distinguishable from the other European *Leucostoma* by its hairy parafacials. Two specimens were caught from flowers of Apiaceae in meadows in Winterstein and Ockstadt in mid-August 2011 and 2012. This mainly southern European species was not yet recorded from Germany in Tschorsnig and Herting (1994), but recently was also collected in Baden-Württemberg (in 2008 and 2010, pers. comm. H.-P. Tschorsnig, D. Doczkal).

#### ***Cylindromyia bicolor* (Olivier)**

This is another mainly southern European species that has been extending its range towards the north in Germany for about three decades (pers. comm. H.-P. Tschorsnig). It seems locally common in Ockstadt orchards, with one specimen collected in 2011 and two from the same location in 2012. It is likely that these, as well as the other observed southern species, are part of the increasing trend of many insects to expand their range northwards as a result of the ongoing global warming.

## Acknowledgements

I am grateful to Dr. H.-P. Tschorsnig for information on the central European fauna as well as for critically reviewing the manuscript and making some helpful suggestions to improve the content.

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**Table 1.** List of tachinid species collected during three collecting seasons 2010–2012 in the Friedberg region of Hessen, Germany.

Subfamily and species	Ockstadt	Ober-Mörlen	Bad Nauheim
<b>EXORISTINAE</b>			
<i>Acemya rufitibia</i> (von Roser)		2	
<i>Admontia grandicornis</i> (Zetterstedt)		1	
<i>Aplomya confinis</i> (Fallén)	3	3	
<i>Bessa selecta</i> (Meigen)	1		
<i>Blepharipa pratensis</i> (Meigen)		3	
<i>Blondelia nigripes</i> (Fallén)	5	5	5
<i>Carcelia lucorum</i> (Meigen)		3	
<i>Clemelis pullata</i> (Meigen)		1	
<i>Cyzenis jucunda</i> (Meigen)		1	
<i>Drino vicina</i> (Zetterstedt)	1		
<i>Epicampocera succincta</i> (Meigen)	4		
<i>Eumea linearicornis</i> (Zetterstedt)	1	2	
<i>Exorista larvarum</i> (Linnaeus)	3		
<i>Exorista rustica</i> (Fallén)	3	3	
<i>Gastrolepta anthracina</i> (Meigen)	2	1	
<i>Hebia flavipes</i> Robineau-Desvoidy	1		
<i>Hubneria affinis</i> (Fallén)		2	
<i>Leiophora innoxia</i> (Meigen)	2	1	
<i>Lydella grisescens</i> Robineau-Desvoidy	4		
<i>Medina collaris</i> (Fallén)	3	3	
<i>Meigenia dorsalis</i> (Meigen)	4	3	1
<i>Meigenia majuscula</i> (Rondani)		1	
<i>Meigenia mutabilis</i> (Fallén)	3	2	1
<i>Myxexoristops blondeli</i> (Robineau-Desvoidy)		2	
<i>Ocytata pallipes</i> (Fallén)	4	3	
<i>Pales pavidata</i> (Meigen)	2		
<i>Paracraspedothrix montivaga</i> (Villeneuve)	2		
<i>Parasetigena silvestris</i> (Robineau-Desvoidy)		2	
<i>Phebellia nigripalpis</i> (Robineau-Desvoidy)		1	
<i>Phorocera assimilis</i> (Fallén)		4	1
<i>Phorocera grandis</i> (Rondani)		2	
<i>Phorocera obscura</i> (Fallén)	4	4	4
<i>Phryno vetula</i> (Meigen)		3	
<i>Phryxe heraclei</i> (Meigen)		3	
<i>Phryxe vulgaris</i> (Fallén)	5	5	5
<i>Platymya fimbriata</i> (Meigen)	1	1	
<i>Winthemia quadripustulata</i> (Fabricius)	1		



Subfamily and species	Ockstadt	Ober-Mörlen	Bad Nauheim
<b>TACHININAE</b>			
<i>Actia lamia</i> (Meigen)	4	4	1
<i>Dexiosoma caninum</i> (Fabricius)	3		
<i>Gymnocheta viridis</i> (Fallén)		4	
<i>Leskia aurea</i> (Fallén)	1		
<i>Linnaemya picta</i> (Meigen)	4	4	
<i>Linnaemya tessellans</i> (Robineau-Desvoidy)	4	4	
<i>Loewia pheoptera</i> (Meigen)	1		
<i>Lydina aenea</i> (Meigen)	1	1	
<i>Lypha dubia</i> (Fallén)	3	4	
<i>Macquartia tenebricosa</i> (Meigen)	2	1	
<i>Mintho rufiventris</i> (Fallén)	3		
<i>Panzeria puparum</i> (Fabricius)		2	
<i>Panzeria rudis</i> (Fallén)		4	
<i>Peribaea tibialis</i> (Robineau-Desvoidy)	2	2	
<i>Phytomyptera cingulata</i> (Robineau-Desvoidy)	2		
<i>Phytomyptera minutissima</i> (Zetterstedt)	2		
<i>Siphona confusa</i> Mesnil	1		
<i>Siphona cristata</i> (Fabricius)	3	3	
<i>Siphona flavifrons</i> Staeger		2	
<i>Siphona geniculata</i> (De Geer)	4	4	4
<i>Solieria pacifica</i> (Meigen)	4	4	4
<i>Synactia parvula</i> (Rondani)	2		
<i>Tachina fera</i> (Linnaeus)	5	5	5
<i>Tachina lurida</i> (Fabricius)		4	
<i>Tachina magnicornis</i> (Zetterstedt)	4	4	4
<i>Tachina nupta</i> (Rondani)		2	
<i>Triarthria setipennis</i> (Fallén)		3	
<i>Zophomyia temula</i> (Scopoli)	2		
<b>DEXIINAE</b>			
<i>Athrycia trepida</i> (Meigen)		2	
<i>Billaea triangulifera</i> (Zetterstedt)		2	
<i>Campylocheta praecox</i> (Meigen)		2	
<i>Cyrtophloeoba ruricola</i> (Meigen)		2	
<i>Dinera carinifrons</i> (Fallén)	1	4	
<i>Dinera ferina</i> (Fallén)	2	4	
<i>Dinera grisescens</i> (Fallén)	4		
<i>Eriothrix rufomaculata</i> (De Geer)	4	4	4
<i>Kirbya moerens</i> (Meigen)	4	2	4
<i>Microsoma exiguum</i> (Meigen)	3		1
<i>Phyllomya volvulus</i> (Fabricius)		1	
<i>Prosenia siberita</i> (Fabricius)	1		

Subfamily and species	Ockstadt	Ober-Mörlen	Bad Nauheim
<i>Ramonda spathulata</i> (Fallén)		2	
<i>Trixa caerulescens</i> Meigen	1		
<i>Trixa conspersa</i> (Harris)	3	3	
<i>Voria ruralis</i> (Fallén)	4	4	4
PHASIINAE			
<i>Cistogaster globosa</i> (Fabricius)	4	4	3
<i>Clairvillia biguttata</i> (Meigen)	1		
<i>Cylindromyia auriceps</i> (Meigen)	2	3	
<i>Cylindromyia bicolor</i> (Olivier)	2		
<i>Cylindromyia brassicaria</i> (Fabricius)		1	
<i>Cylindromyia interrupta</i> (Meigen)		2	
<i>Ectophasia crassipennis</i> (Fabricius)	4	4	3
<i>Eulabidogaster setifacies</i> (Rondani)	1		
<i>Gymnosoma clavatum</i> (Rohdendorf)	3	4	
<i>Gymnosoma dolycoridis</i> Dupuis		2	
<i>Gymnosoma nudifrons</i> Herting	3	3	3
<i>Gymnosoma rotundatum</i> (Linnaeus)	1		
<i>Hemyda obscuripennis</i> (Meigen)		1	
<i>Hemyda vittata</i> (Meigen)	1		
<i>Labigastera forcipata</i> (Meigen)	3	3	
<i>Leucostoma meridianum</i> (Rondani)	1	1	
<i>Leucostoma simplex</i> (Fallén)	3	3	
<i>Lophosia fasciata</i> Meigen	2		
<i>Opesia descendens</i> Herting		2	
<i>Phania funesta</i> (Meigen)	4	4	4
<i>Phasia aurigera</i> (Egger)	4	4	3
<i>Phasia aurulans</i> Meigen	3	2	
<i>Phasia barbifrons</i> (Girschner)	4	4	4
<i>Phasia hemiptera</i> (Fabricius)	5	5	5
<i>Phasia mesnili</i> (Draber-Mońko)		2	
<i>Phasia obesa</i> (Fabricius)	3	3	
<i>Phasia pusilla</i> Meigen	2		
<i>Subclytia rotundiventris</i> (Fallén)	2	1	





**Figure 1.** The Ramanagara cocoon market, one of the largest cocoon markets in Asia. It is situated 40 km from Bangalore towards Mysore. In this market an average of 40,000 to 50,000 kg of cocoons are sold each day.

# Metapopulation biology of the Indian uzifly, *Exorista sorbillans* (Wiedemann) (Diptera: Tachinidae)

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## INTRODUCTION

The study of metapopulation biology is an important aspect of monitoring insect populations in agricultural as well as forest ecosystems. It concerns the study of spatially separated populations of a species that are sometimes connected by a process of dispersion or migration (Hanski 1998). Here we briefly discuss the metapopulation biology of the Indian uzifly, *Exorista sorbillans* (Wiedemann), an endoparasitoid of the silkworm *Bombyx mori* (L.), which accounts for significant loss to the silk growing farmers around the world (Sengupta *et al.* 1990).

Before 1980, uziflies were found only in northeastern India in places like West Bengal and other neighboring areas. These flies entered South India around 1980 through anthropogenic means by the unauthorized transport of infested silkworm seed cocoons from West Bengal to Karnataka. Since that time the fly has spread throughout all of the southern silk producing states. The flight range of the uzifly is around 3 km (Narayanaswamy & Devaiah, 1998).



Karnataka is the major silk producing state in India, followed by Andhra Pradesh and Tamil Nadu. Silk is produced throughout the year in these states and comes under uzifly attack year-round. Cocoons are transported about 500 km from the silk-producing places to be sold at the Ramanagara cocoon market, one of the biggest cocoon markets in Asia, which is situated on the Bangalore Mysore highway in Karnataka (Figs. 1–2). Here infested silkworm cocoons arrive at the market along with good cocoons. The maggots emerge from cocoons and crawl here and there searching for suitable places for pupariation (Figs. 3–4). Furthermore, seed cocoons grown near Bangalore are transported to different parts of Karnataka and adjacent areas along with infested cocoons for seed production and thereby contribute to



**Figure 2.** Inside the cocoon market. Farmers have filled cages with their cocoons and are awaiting a transaction.



**Figure 3.** Uzifly maggots that fell from infested silkworm cocoons are being collecting by a farmer in the market. After emerging from the cocoons, these maggots search for suitable places for pupariation, such as crevices or sand.

potential anthropogenic means of dispersion of uziflies in South India. This dispersion helps to maintain a stable metapopulation of uziflies in South India.

Over the years since 1980, uzifly populations have declined drastically; during the 1980s there were reports that uziflies caused crop losses of about 50%. Crop losses are now estimated at about 8–10% annually. This reduction is largely due to control measures taken by farming communities in South India, which directly affects the dynamics of uziflies and their abundance.

Spatial structuring of population cycles across generations, seasons and years has important implications for modeling strategies to combat uziflies and other economically important insect pests of silkworms. Temperature, humidity and rainfall patterns have strong influences on uzifly populations (Narayanaswamy & Devaiah 1998); however, food/host availability is also equally important in forecasting population abundance.





**Figure 4.** Close-up of maggots that were crawling on the market floor. These will be collected and disposed of. House sparrows will also eat the maggots that emerge from the cocoons in the market.

## FACTORS AFFECTING UZIFLY POPULATION DYNAMICS

There are a number of extrinsic and intrinsic factors that influence uzifly population dynamics. The extrinsic factors include temperature, humidity, rainfall, host availability and altitude. The intrinsic factors include *Wolbachia* load/density and number of individual uzi maggots that develop per host silkworm.

## HOW *WOLBACHIA* INFLUENCES POPULATION DYNAMICS OF UZIFLIES

*Wolbachia* can influence uzifly populations by inducing fluctuations in population cycles. *Wolbachia* is a reproductive manipulator of arthropods and has various strategies for transovarial transmission. The uzifly harbors A and B supergroup *Wolbachia* (Prakash & Puttaraju 2007) and these have positive effects that influence oogenesis and increase fecundity by 20% (Puttaraju & Prakash 2009). The fluctuations in fecundity and hatchability has been observed in nature with varying temperatures, humidity and rainfall (Prakash 2006). During summer months between the middle of March and the second week of June the temperature climbs to 32–40°C and this has a negative effect on the growth rate of uziflies. In these months less than 20% egg hatchability was observed in natural populations (Prakash 2006). This could be due to high temperatures affecting differentially the A and B group *Wolbachia*, leading to the expression of different levels of bidirectional cytoplasmic incompatibility (Prakash 2006) or some other physiological mechanism. However, this needs further study for confirmation.

## POTENTIALITIES OF UZIFLY CONTROL

Other important aspects of metapopulation biology involve the study of patterns of the extinction process. In patchy local/subpopulations extinctions are prevented by high levels of migration or dispersion. By understanding the process of migration and local population extinction, we may be able to bring about the eradication of uzifly populations from silkworm rearing environments.

In conclusion, studies on uzifly metapopulation biology are illuminating various aspects of population growth and extinction rates, which will help in managing uziflies that attack the silkworm *Bombyx mori* (Fig. 5).



**Figure 5.** Female uziflies one day after emergence from their puparia. They search for silkworms and lay one or two eggs on the body of each caterpillar.

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# STUDENT NEWS

## Jeremy D. Blaschke

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As a Masters student in the Moulton Lab at the University of Tennessee, I am studying the phylogenetic relationships within the agronomically important tachinid subfamily Phasiinae (Fig. 1). I am contributing to the larger “Phylogeny and Evolution of the Tachinidae” project by providing sequence data for the phasiines and several specific outgroup taxa. Phasiinae are the smallest tachinid subfamily but include a remarkable degree of diversity within the various tribes and genera. They mostly attack hemipteran hosts and that preference remains one of the few unifying characteristics of this subfamily. My research has three main goals: 1) determine if Phasiinae are a monophyletic group, 2) resolve basal relationships within the Phasiinae, and 3) resolve intertribal relationships within the Phasiinae. I also hope to confidently resolve the position of the enigmatic genera *Strongygaster*, *Euthera*, *Epigrimyia*, and *Catharosia* within (or outside of) Phasiinae. I will be using over 8kb of sequence data from four single copy nuclear coding genes (MAC, MCS, CAD and LGL). As many worldwide genera as possible will be analyzed, with representative genera from each tribe included. I am hoping for at least 50 genera (we currently have 38). At least 35 intra- and interfamilial outgroup taxa will also be included. Maximum parsimony and maximum likelihood inference methods will be used to reconstruct phylogenies in separate analyses of each gene and all data together as a combined dataset.

The more genera that are represented the more robust and trustworthy the analysis will be. So if you have any extra phasiines in ethanol you could send my way then that would be greatly appreciated. As I have worked with tachinids, I have discovered many more questions than answers, especially in regard to cryptic species and host specificity. I would like to continue studying tachinids for my PhD, but will need an advisor and funding. So if anyone has some extra money lying around, I am interested!



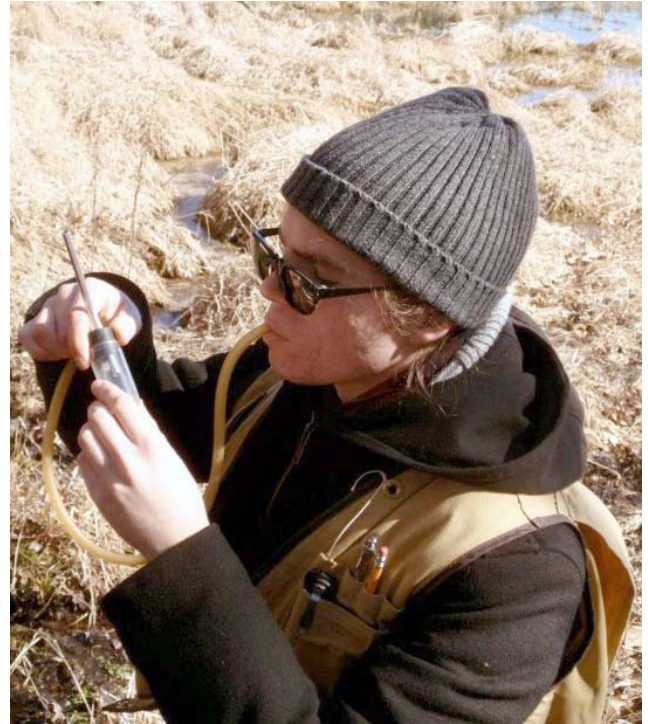
Figure 1. Jeremy Blaschke

# STUDENT NEWS

**Zachary L. Burington**

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I am a PhD student at Wright State University working under Dr. John Stireman on the “Phylogeny and Evolution of the Tachinidae” project (Fig. 1). My background is mainly in the taxonomy of Trichoptera and other aquatic insects, but following my M.Sc. at Clemson University in 2011 I became interested in true flies. I had plans to work on fungus gnats for my Ph.D., but when I saw this opportunity at WSU I eagerly applied. My focus in the phylogeny project will be the tribe Blondeliini, especially looking at the relationships of those members with keeled abdomens and piercing ovipositors. This complex of genera, including *Eucelatoria* Townsend (Fig. 2), *Blondelia* Robineau-Desvoidy, *Compsilura* Bouché, *Vibrissina* Rondani, and others, has been treated as a natural group based on morphological characters. I plan to infer a rough phylogeny of the tribe and determine the singular or multiple origin of the “keeled piercer” character. I also (tentatively) plan to revise the large and difficult New World genus *Eucelatoria*. This will include a redescription and key for the Nearctic species, as well as descriptions of new species from Central and South



**Figure 1.** Zach Burington collecting early spring chironomids.



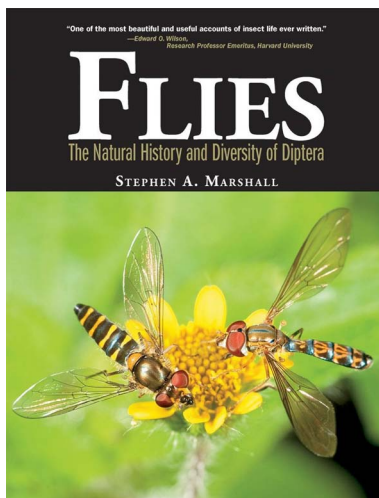
**Figure 2.** *Eucelatoria texana* (Reinhard), female. Note the long and curved piercing ovipositor under the abdomen.

America. The rough Blondeliini phylogeny will be used to determine the scope of the tribe and any genera that clearly do not belong in relation to the core group. The third portion of my dissertation will be devoted to a longitudinal comparison of tachinid diversity between the Neotropics and the Nearctic temperate region. This will use a year length time series of species and morphospecies from tropical, subtropical and temperate sites, including Yanayacu Biological Preserve in Ecuador and the Wright State University Forest.

In light of this, I would be grateful for frozen legs or ethanol stored samples from any of the exclusively Old World blondeliine genera. As of now, I have only the South African genus *Rioteria* Herting. Also, any *Eucelatoria* specimens would be greatly appreciated. My long term goal is to continue taxonomic and systematic research in Diptera after my Ph.D., especially in association with a large natural history collection.



# BOOK ANNOUNCEMENT



Marshall, S.A. 2012. Flies: the natural history and diversity of Diptera. Firefly Books, Richmond Hill. 616 pp.  
 ISBN-10: 1770851003  
 Published on 30 August 2012

Available from:  
 Amazon: <http://www.amazon.com>, US\$78.75  
 Firefly Books: <http://www.fireflybooks.com>, US/CDN \$125.00.

**“Stephen A. Marshall has delivered one of the most beautiful and useful accounts of insect life ever written.”**  
 – Edward O. Wilson, Research Professor Emeritus, Harvard University

From the dust cover:

“Flies is broken up into three parts: Life Histories, Habits and Habitats of Flies; Diversity; and Identifying and Studying Flies. The 20 pages of profusely illustrated keys linked to the unprecedented photographic coverage of the world’s fly families and subfamilies enable the reader to ... readily access information about each family as well as hundreds of distinctive genera and species.”



The Tachinidae are nicely reviewed in the text on pages 386–390.

What sets this book apart from other general insect books is the focus on flies (it is simply the best available on the subject) and the 130 colour images of live tachinids on pages 516–530. The author is well known as a master photographer of Diptera and these pictures of tachinids in nature will not disappoint the readers of this newsletter. Tachinids from all over the world are represented. Most of the identifications were performed by Monty Wood and Pierfilippo Cerretti.

– Jim O’Hara

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Included here are references on the Tachinidae that have been found during the past year and have not appeared in past issues of this newsletter. This list has been generated from an EndNote 'library' and is based on online searches of literature databases, perusal of journals, and reprints or citations sent to me by colleagues. The complete bibliography, incorporating all the references published in past issues of *The Tachinid Times* and covering the period from 1980 to the present is available online at: <http://www.nadsdiptera.org/Tach/Bib/biblio.htm>. I would be grateful if omissions or errors could be brought to my attention.

Please note that citations in the online Tachinid Bibliography are updated when errors are found or new information becomes available, whereas citations in this newsletter are never changed. Therefore, the most reliable source for citations is the online Tachinid Bibliography.

I am grateful to Shannon Henderson for performing the online searches that contributed most of the titles given below and for preparing the EndNote records for this issue of *The Tachinid Times*.

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