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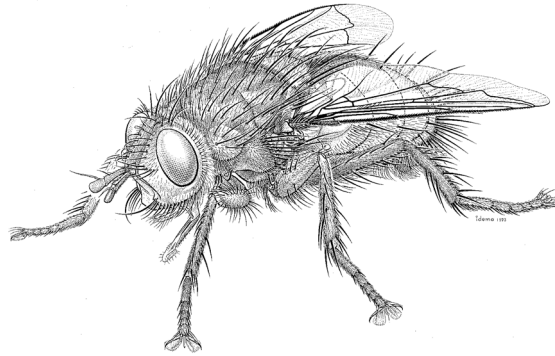
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The Tachinid Times

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Each year the bibliography section of this newsletter records upwards of 125 new references that relate to tachinid research in a small to big way, illustrating progress in such areas as host associations, behaviour, ecology, physiology, regional faunas, and systematics. I have a particular interest in the latter, and because of this I am looking forward to the rest of 2010 with greater than usual anticipation. One reason is the upcoming *International Congress of Dipterology*, the seventh since the congresses began in 1986 in Budapest. This year's congress will be held in Costa Rica in August (<http://www.inbio.ac.cr/icd7>). There will be a Calyptratae workshop chaired by Thomas Pape, and anyone wishing to give a talk on Tachinidae or other family of calyptrate flies should contact him (see mailing list).

One of the key events during ICD7 will be the official launch of the *Manual of Afrotropical Diptera* (<http://afrotropicalmanual.net/index.htm>), an international initiative led by Ashley Kirk-Spriggs (National Museum, Bloemfontein, South Africa) and Mike Mostovski (Natal Museum, Pietermaritzburg, South Africa). The Tachinidae are the largest family of Afrotropical Diptera with about 220 genera and about 1000 species. The lead author on the Tachinidae chapter will be Pierfilippo Cerretti (see mailing list), who has been actively researching Afrotropical Tachinidae in recent years. As a companion work to the Tachinidae chapter, I will be leading the preparation of a catalogue of the Tachinidae of the Afrotropical Region. More information about these Afrotropical Tachinidae projects will be given in next year's *The Tachinid Times*.

The concept of regional Diptera manuals began with the *Manual of Nearctic Diptera*, published in three volumes between 1981 and 1989. A special Festschrift will be published by *The Canadian Entomologist* to commemorate the coordinators of the *Manual*, as detailed in this issue (p. 13). The Tachinidae chapter of the *Manual*

was written by Monty Wood, who was also one of the coordinators of the project. Anyone wishing to contribute a paper honouring one (or all) of the coordinators of the *Manual* (and in particular Monty, given the focus of this newsletter on the Tachinidae) should contact Brad Sinclair (see mailing list), the leader of the Festschrift team.

Still on the topic of regional Diptera manuals, another milestone will be reached this year with the publication of volume 2 of the *Manual of Central American Diptera*. For tachinid enthusiasts, this means that the long-awaited Tachinidae chapter by Monty Wood will soon be available. There is no proper key to the genera of Neotropical Tachinidae, so this chapter will serve not only as a guide to Central American Tachinidae but will cover at least a portion of the huge Neotropical Tachinidae fauna.

I would like to further note that progress is being made on the systematics of Tachinidae at all levels. Dan Janzen (see mailing list) and collaborators are using "DNA barcoding" technology to reveal possibly hundreds of cryptic species of Tachinidae within Area de Conservacion Guanacaste in northwestern Costa Rica (e.g., Janzen *et al.* 2009, citation in bibliography section). Molecular techniques are also being employed to unravel higher level relationships within the Tachinidae, as evidenced by the recent paper on the Exoristinae by Tachi and Shima (2010, citation in bibliography section). Building on such successes, and recognizing that the time is ripe to assemble an international team to investigate tachinid phylogenetics on a global and family scale using combined molecular and morphological data sets, John Stireman has requested funding for such a study from the United States National Science Foundation (see p. 2).

The Tachinid Times is primarily an online newsletter but continues to be offered in hardcopy to provide a permanent record of all issues in a few libraries around the world, and to comply with the wishes of those persons who

prefer to receive a print copy for their own files. Both versions are based on the same PDF original and have the same pagination and appearance. The online version of this issue is available as a PDF file (ca. 5 MB in size) on the North American Dipterists Society (NADS) website at: <http://www.nadsdiptera.org/Tach/TTimes/TThome.htm>.

If you wish to contribute to *The Tachinid Times* next year, then please send me your article, note or announcement before the end of January 2011. This newsletter accepts submissions on all aspects of tachinid biology and systematics, but please keep in mind that this is not a peer-reviewed journal and is mainly intended for shorter news items that are of special interest to persons involved in tachinid research. Student submissions are particularly welcome, especially abstracts from theses and accounts of studies in progress or about to begin. I encourage authors to illustrate their articles with colour images, since these add to the visual appeal of the newsletter and are easily incorporated into the final PDF document. Please send images as separate files apart from the text.

A modest (?) proposal: the phylogeny and evolution of world Tachinidae (Diptera)

by J.O. Stireman III

I do not have to impress upon the readers of this newsletter the great taxonomic, morphological and ecological diversity of Tachinidae. It is well accepted that the family Tachinidae is among the most species rich families of Diptera and its members clearly possess a bewildering array of oviposition strategies and host associations (Stireman *et al.* 2006). I probably also do not need to impress upon this audience the taxonomic difficulties that tachinids pose and the current confusion regarding the composition and interrelationships of suprageneric (and some generic) groups. Although great advances have been made in the suprageneric classification of Tachinidae with consideration of female reproductive habits and male genitalia (e.g., Herting 1984; Tschorsnig 1985) and recent application of molecular phylogenetic tools (e.g., Tachi & Shima 2010), we still lack a consistent classification scheme for the family.

Recently, Jim O'Hara, J. Kevin Moulton (U. Tennessee) and I have submitted a proposal to the United States National Science Foundation to clarify phylogenetic relationships among world Tachinidae using molecular and morphological characters. The primary goals of the proposed research are:

1. Reconstruction of phylogenetic relationships among the major lineages (subfamilies and tribes) of Tachinidae.
2. Assessment and revision of current regional classifications of the family to produce a stable and predictive classification.

3. Reconstruction of relationships within two diverse and agronomically important groups, the tribe Blondelliini and the subfamily Phasiinae.
4. Analysis of the evolution of reproductive traits, oviposition strategy, host associations, and historical biogeography using phylogenetic reconstructions.

Given the large scale of the project, we have actively solicited the collaboration of tachinid and other Diptera researchers from around the world. For the larger phylogeny of Tachinidae as a whole, our goal is to obtain molecular (four genes) and morphological (>100 characters) for at least 200 tachinid genera, representing at least 50 of an estimated 65 tribes. In our own collecting efforts we have already amassed suitable material for molecular analysis for hundreds of North American tachinids (see Figure 1), and we are gaining access to vast numbers of additional taxa collected through large scale insect (largely Lepidoptera) rearing studies in Costa Rica (Janzen & Hallwachs 2009), Ecuador (Stireman *et al.* 2009), and Papua New Guinea (e.g., Novotny *et al.* 2006). In addition, we plan to make a number of collecting expeditions to other regions such as Africa and Australia. However, to achieve our goal of a broad phylogeny of Tachinidae, with representatives from all major biogeographic regions and a diversity of tribes, we will require the help of colleagues who are willing to share specimens suitable for molecular and potentially morphological analysis (although the latter work will focus primarily on museum specimens).

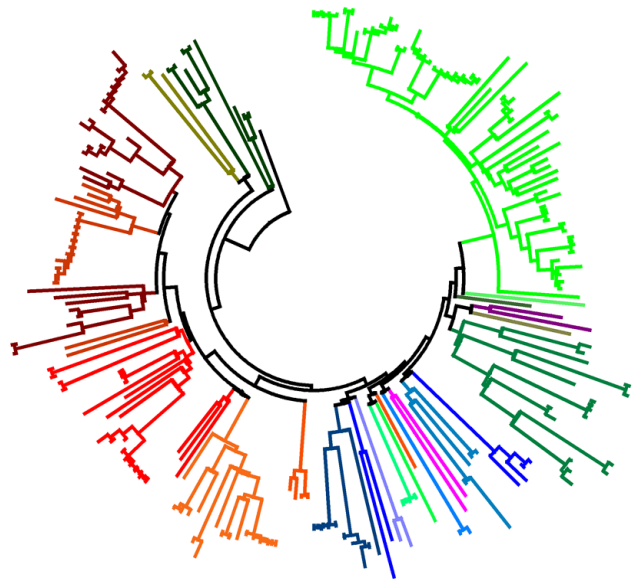


Figure 1. Neighbor joining phylogenetic tree of COI mtDNA sequence data (~700bp) for 207 tachinid taxa from 21 tribes (each a different shade). Tachininae: greens, Exoristinae: brown-red-orange, Dexiinae: blues, Phasiinae: pink-purple.

Thus, we ask the larger community of “tachinidophiles” to please consider collecting/saving specimens that can be used toward this larger goal of reconstructing the evolution and phylogeny of world Tachinidae (see “What you can do”, below).

To be certain, there is no guarantee that our proposal to the U.S. NSF will be funded. The current funding rate of proposals is probably less than 10%. However, we believe that the time is ripe to pursue this project and, with a network of collaborators, we believe it can be accomplished. Therefore, we plan to continue to accumulate material and pursue our proposed goals at a slow rate even if the proposal is not funded this time around. Given the diversity, taxonomic uncertainty, and ecological/agronomic importance of Tachinidae, we feel confident that we will eventually be able to obtain funding from the NSF or other institutions and scale up our efforts.

What you can do

Our primary request is that those of you who collect or have recently collected material appropriate for DNA analysis to please save specimens for us. In general, material that is preserved in 95–100% ethyl alcohol is best, although other preservatives may also be usable (e.g., isopropyl alcohol, acetone). It is best to store the ethanol preserved material in a freezer (-20 or -80°C).

We often remove one to three legs from a freshly killed or frozen specimen and put that in 100% EtOH while mounting the remainder of the specimen on a pin for identification (with, of course, matching codes or labels associated with each). This makes identification much easier.

We are potentially interested in Malaise trap samples as long as they are not too old (<5 years is ideal), or if there is too much material (effectively diluting the ethanol). However, it will be much easier for us if some preliminary sorting has been done. Also, if you know the fauna, any preliminary (or authoritative) identifications will be appreciated.

We are interested in virtually all taxa, but particularly groups that are not well represented in North America, belong to smaller tribes, and attack taxa other than Lepidoptera. Given that we could potentially accumulate far more specimens than needed for our primary goals, we would be glad to “redistribute” taxa to those interested in the taxonomy of particular groups. In fact, we would be greatly pleased if we could offer assistance or specimens to others in a truly collaborative arrangement.

If you might be able and willing to aid in our large-scale endeavor to reconstruct the phylogeny of Tachinidae by providing specimens (or advice), please let me know. We would also ask that you please pass this request on to others that you believe might be able to help us. And, please let me know if there is some way that you might be

able to use the resources we are accumulating. I look forward to hearing from you.

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Notes on the Tachinidae of Serbia and Montenegro by T. Zeegers

Abstract

An impression of the tachinid fauna of Serbia and Montenegro is given, based on a short field trip in June 2009. Seven species are recorded for the first time from Serbia and six from Montenegro (in total 12, due to overlap). The most interesting finds were males of *Hypovoria pilibasis* and *Plagiomima hilfi* from Serbia and a yet undescribed species of *Lydella* (*Lydelloxenis*) from Montenegro.

Introduction

The material was collected during a field trip during 12–21 June 2009. The visited areas were in Serbia Stara Planina and Suva Planina near Niš, Kopaonik National Park, and Obrez along the Sava river west of Beograd; in Montenegro Skadarsko Jezero south of Podgorica, Risan along the coast, and Durmitor Mountains.

I give the most interesting records, first for Serbia and then for Montenegro, in alphabetical order by genus. All

species first mentioned for Serbia and Montenegro are found in neighbouring countries according to Tschorsnig *et al.* (2007). Those authors still combined Montenegro with Serbia and included Kosovo in that area.

More information and figures are given for *Hypovoria pilibasis* and *Plagiomima hilfi*, which are very rare species with their type localities in the investigated region.

Records from Serbia

Besseria anthophila (Loew, 1871)

1♂, Serbia, east of Niš, Suva Planina, 43°17'N 22°07'E, 800m, 9.vi.2009. **First record** for Serbia (Tschorsnig *et al.*, 2007).

Billaea triangulifera (Zetterstedt, 1844)

1♀, Serbia, Obrez, border Sawa, 44°44'N 19°58'E, 18.vi.2009. **First record** for Serbia (Tschorsnig *et al.*, 2007).

Cylindromyia brevicornis (Loew, 1844)

1♀, Serbia, Kopaonik National Park, Lisina, 43°15'N 20°51'E, 12.vi.2009. **First record** for Serbia (Tschorsnig *et al.*, 2007).

Eriothrix prolixa (Meigen, 1824)

1♂, Serbia, east of Niš, 35 km ENE of Pirot, Stara Planina, 43°14'N 22°47'E, 1000m, 8.vi.2009; 1♂, Serbia, east of Niš, Suva Planina, 43°17'N 22°07'E, 800m, 9.vi.2009; 1♂, Serbia, Obrez, border Sawa, 44°44'N 19°58'E, 18.vi.2009. **First record** for Serbia (Tschorsnig *et al.*, 2007).

Estheria petiolata (Bonsdorff, 1866)

3♂♂, Serbia, east of Niš, 35 km ENE of Pirot, Stara Planina, 43°14'N 22°47'E, 1000m, 8.vi.2009.

Gaedia connexa (Meigen, 1824)

1♂, Serbia, east of Niš, 35 km ENE of Pirot, Stara Planina, 43°14'N 22°47'E, 1000m, 8.vi.2009.

Hypovoria pilibasis (Villeneuve, 1922)

1♂, Serbia, east of Niš, 35 km ENE of Pirot, Stara Planina, 43°14'N 22°47'E, 1000m, 8.vi.2009. This very rare species has only been recorded from Kosovo, Turkey, Israel and Morocco (Mückstein *et al.*, 2004; see note on type locality below). Since it is so rare and little known, I have provided some pictures of it (Figs. 1–3, 5). The male (which Mesnil had not seen) is very similar to the female; in contrast to *H. hilaris* Villeneuve, the male claws and pulvilli are not longer than the last tarsal segment of the first leg (Fig. 2).

Identification at the generic level is straightforward using the key by Tschorsnig & Richter (1998). However, identification is more troublesome with the key by Mesnil (1974). The proboscis is only slightly longer than in, for instance, *Voria ruralis* (Fallén) (Figs. 3–4) and also the difference in proportion of the face is not convincing. Contrary to Mesnil's (1974: 1257) key, but in agreement with his description (p. 1279), the length/width proportion of the face is distinctly below 2 and actually quite close to *Voria* in this respect (Figs. 5–6).



Figures 1–2. *Hypovoria pilibasis*, male. 1. (above) Head, lateral. 2. (below) Front tarsus.



Figures 3–4. Proboscis in lateral view. 3. (left) *Hypovoria pilibasis*. 4. (right) *Voria ruralis*. Both males.

Note on type locality of *Hypovoria pilibasis*: This species was described by Villeneuve (1922) from two specimens from the historical city of Prizren in the Balkans. Villeneuve (1922) and later Mesnil (1974) located Prizren

in Albania, whereas Herting (1984) cited Macedonia, Yugoslavia, and Tschornig *et al.* (2007) cited Macedonia. Prizren is located in Kosovo and without reviewing a century of history of the Balkans, it is currently not located in Macedonia nor in Albania, but in Kosovo.



Figures 5–6. Head in frontal view. 5. (top) *Hypovoria pilibasis*. 6. (bottom) *Voria ruralis*. Both males.

Linnaemya impudica (Rondani, 1859)

1 ♀, Serbia, east of Niš, 35 km ENE of Pirot, Stara Planina, 43°14'N 22°47'E, 1000m, 8.vi.2009; 3 ♂♂, Serbia, Kopaonik National Park, Raviska, 43°15'N 20°51'E, 1400m, 10.vi.2009. **First record** for Serbia (Tschorsnig *et al.*, 2007).

Macquartia viridana Robineau-Desvoidy, 1863

1 ♂, Serbia, Obrez, border Sawa, 44°44'N 19°58'E, 18.vi.2009.

Masicera pavoniae (Robineau-Desvoidy, 1830)

1 ♂, Serbia, east of Niš, 35 km ENE of Pirot, Stara Planina, 43°14'N 22°47'E, 1000m, 8.vi.2009. **First record** for Serbia (Tschorsnig *et al.*, 2007).

Masicera sphingivora (Robineau-Desvoidy, 1830)

1 ♂, Serbia, east of Niš, 35 km ENE of Pirot, Stara Planina, 43°14'N 22°47'E, 1000m, 8.vi.2009.

Meigenia grandigena (Pandellé, 1896)

2 ♂♂, Serbia, Kopaonik National Park, Raviska, 43°15'N 20°51'E, 1400m, 10.vi.2009. **First record** for Serbia (Tschorsnig *et al.*, 2007).



Figures 7–8. *Plagiomimi hilfi*, male. 7. (above) Head, lateral. 8. (below) Wing.

Plagiomima hilfi (Strobl, 1902)

1 ♂, Serbia, east of Niš, Suva Planina, 43°17'N 22°07'E, 800m, 9.vi.2009.

This very rare species was actually described on material from Niš. Herting (1973) reviewed its status in comparison with *P. sinaica* (Villeneuve) (both as species in

the genus *Nanoplagia* Villeneuve), which was followed by Mesnil (1974). My specimen differs from Mesnil's description in having more setulae on vein R_{4+5} : 3–4 setulae are placed outside of crossvein r-m. Since the species is so rare and little known, I have provided some pictures (Figs. 7–8).

Records from Montenegro

Bithia immaculata (Herting, 1971)

5♂♂, 2♀♀, Montenegro, Risan, Sv. Nikola, 42°32'N 18°48'E, 14.vi.2009.

Carcelia dubia (Brauer & Bergenstamm, 1891)

1♂, Montenegro, Risan, Sv. Nikola, 42°32'N 18°48'E, 14.vi.2009. **First record** for Montenegro (Tschorsnig *et al.*, 2007).

Clairvillia pniae Kugler, 1971

1♂, Montenegro, Skardarsko Jezero, Podhum, 42°18'N 19°20'E, 13.vi.2009. First record for Montenegro (Tschorsnig *et al.*, 2007).

Cylindromyia hermonensis Kugler, 1974

1♂, Montenegro, Skardarsko Jezero, Podhum, 42°18'N 19°20'E, 13.vi.2009. **First record** for Montenegro, though known from several Mediterranean countries (Tschorsnig *et al.*, 2007).

Eurithia gemina (Mesnil, 1972)

5♂♂, 2♀♀, Durmitor, Škrčko Ždrijelo, 43°09'N 19°06'E, 2210m, 16.vi.2009. Previously already recorded from Durmitor (Herting, 1984).

Linnaemya impudica (Rondani, 1859)

2♂♂, Durmitor, Bardo Jezero near Crno Jezero, 43°09'N 19°06'E, 15.vi.2009. **First record** for Montenegro (Tschorsnig *et al.*, 2007).

Lydella (Lydelloxenis) spec. nov.

1♂, Montenegro, Skardarsko Jezero, Vranjina, 42°17'N 19°08'E, 13.vi.2009. This species will be treated in the separate forthcoming publication.

Peleteria abdominalis Robineau-Desvoidy, 1830

1♀, Montenegro, Risan, Sv. Nikola, 42°32'N 18°48'E, 14.vi.2009. **First record** for Montenegro (Tschorsnig *et al.*, 2007).

Acknowledgements

My thanks to my fellow collectors D. Doczkal, K. Goudsmits, E. van den Heuvel, G. Pennards, A. Ssymank, J. & W. van Steenis and M. van Zuijlen for helping collecting and the group at Novi Sad (S. Radenković and others) for help with the permits.

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Malaise traps for Tachinidae on a shoestring budget by N.G. Wiman

Malaise traps have been relied upon by dipterists and other entomologists since this passive intercept trap was first presented in 1937 (Malaise 1937). While simple in principal, this trap is expensive (typically ranging from US\$100 for a smaller design to US\$300 for the Townes type from commercial sources), and requires a significant amount of skill and time to construct from raw materials. In biodiversity studies, or to simply collect in a number of sites concurrently, the cost of multiple Malaise traps can be limiting or prohibitive, particularly for students. Another limitation of traditional Malaise traps is that an overhead tree canopy may be required for suspending the trap, or poles must be arranged around the trap for support.



Figures 1–2. 1. (left) The trap frame. 2. (right) The assembled trap in the field.

Platt *et al.* (1999) presented a simplified stand-alone design that used wooden legs joined by bolts into a tripod shape with a crossbar at the open end. The trap was then covered with spunbonded polyester (a tough translucent material) on the two lateral sides of the tripod and down to the crossbar on the front, where an inverted milk jug with a kill strip was mounted as the collection vessel. The total cost for the trap was estimated at \$5.15, and the authors reported collecting a good sample of natural enemies, particularly Tachinidae.

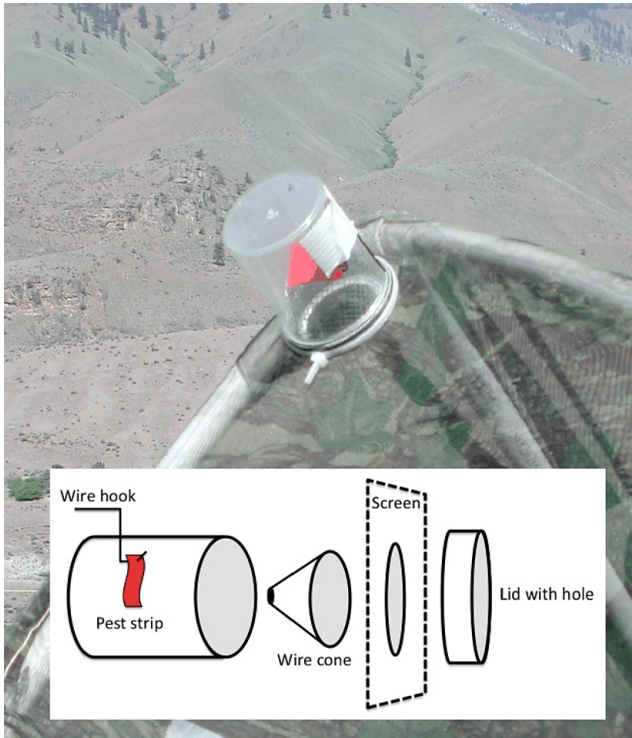


Figure 3. The collection jar, and details of the collection system (inset).

For my own studies, I wished to collect Tachinidae in five relatively remote natural habitats (all of which lack a tree canopy) throughout the season on a shoestring budget. Thus, I modified the design of Platt *et al.* (1999) to meet my own needs. Rather than bolting rigid wooden legs together, I made the frames from 0.5in PVC pipe (1.27cm) with PVC joints (Fig. 1). This frame stands 1.8m high, which in the interest of stability, should not be heightened without using a greater diameter pipe. At each leg position, a 25cm length of rebar was hammered into the ground at the appropriate angle to a depth of approximately 15cm, and each of the three legs was placed over one of these stakes. I found surplus military (camouflage!) poly mosquito netting (\$3.00 per yard, or ca. \$2.75 per m) to use for the screen and this was stitched together using a stitching awl (Speedy Stitcher; <http://www.speedystitcher.com>).

to form a rough pyramid shape to fit and conform to the frame (Fig. 2). Various methods of collection were tested, and I settled on a simple clear plastic screw-top jar (300ml; 6.5cm diameter) fitted with an entrance cone made from steel screen, and a kill strip suspended by a wire within the jar (Fig. 3). The center of the lid was cut out (4.5cm diameter) and screwed into the jar through the screen from inside, and then a hole was cut in the screen (Fig. 3; inset). The collection jar was attached to the trap in the position facing toward the trajectory of the sun near the apex of the trap to ensure that the collection jar would appear to be lighted from within the trap, and that intercepted insects might perceive it as an escape route. Traps were placed in habitats of interest, and as is standard practice with Malaise traps, they were oriented with the opening perpendicular to probable flyways. The extra screen around the base of each trap was covered with soil and rocks to anchor the traps. The total cost of the trap is estimated at \$18 in materials.



Figure 4. Typical trap sample from a week in the field, showing diversity of natural enemies, pollinators, and Tachinidae (inset).

Trap performance was better than expected. The PVC allowed the frame to flex in the wind, which prevented it from flying away or tearing. A large variety of flying insects were captured, particularly Diptera, including a diverse assemblage of Tachinidae, but Hymenoptera and Neuroptera were also collected in large numbers (Fig. 4). The Malaise traps performed far better than yellow sticky

cards, large plastic delta (LPD) traps baited with herbivore induced plant volatiles (HIPVs), and clear sticky pane traps, which were placed nearby. Collection jars were emptied weekly, and would have overflowed if not cleared at this interval. Specimens required relaxation treatment to be pinned after intense sun exposure in the vials but otherwise were found in good condition. In the heat of summer, kill strips lost their efficacy after approximately one week so these were also changed weekly during hot weather.

One shortcoming of this trap design compared to the Townes and other Malaise designs for general collecting is that it is unidirectional. However, this could be perceived as an advantage in studies where insect movement between habitats is of interest. Clearly, the area of intercept is much smaller than a traditional Malaise trap and therefore fewer insects are captured. However, the distinct advantage of a relatively cheap Malaise trap is that it can be left in remote areas with the security of knowing that it can easily be replaced if vandalized or stolen.

Acknowledgements

I would like to acknowledge partial support from a Western Agriculture Research and Extension (WSARE) graduate student grant for this project.

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A few interesting new host records for European Tachinidae

by C. Bystrowski

Our knowledge of the interrelationships between parasitoids and their hosts is still incomplete and in some cases erroneously recorded (Kara & Tschorsnig 2004: 465; Vaňhara *et al.* 2009: 24), even in an area as relatively well investigated as Europe. There is virtually nothing known about the hosts of more than 30% of tachinid species known from Central Europe (Tschorsnig & Herting 1994). Knowledge about the hosts of rare tachinid species is especially poor. I would like to present some interesting host records for some tachinid species based on material from my private collection.

Phorocera grandis (Rondani)

A very rare species in Europe, recorded from southern part of the continent. It is known as a parasitoid of *Euproctis chrysorrhoea* (L.) (Lymantriidae) (Herting 1960: 43) and *Thaumetopoea processionea* (L.) (Thaumetopoeidae) (Tschorsnig & Herting 1994: 128). New host record: *Eriogaster lanestris* (L.) (Lasiocampidae), collected

from *Crataegus* sp. Caterpillar collected on 04.vii.2005 from Haute-Marne, Langres [UTM:FP70], France, (leg. M. Show); a male fly emerged on 19.iv.2006.

Peleteria popelii (Portschinsky)

This species is known from almost all of Europe but is rather rarely collected (Tschorsnig & Herting 1994: 145). It generally inhabits dry, sandy habitats and is known only as a parasitoid of *Coscinia striata* (L.) (Arctiidae) (Herting 1960: 108 following Lundbeck 1927: 434). I have reared this species from another closely related arctiid moth. New host record: *Coscinia cribaria* (L.), collected by sweeping grasses with an insect net. Caterpillar collected on 05.vi.2004 from “Leszczynowe” near Gugny village (Biebrza National Park), Poland; caterpillar did not pupate in cocoon but “mummified” in the prepupal stage (Fig. 1). A female fly emerged on 07.vii.2004.



Figure 1. Remains of the prepupa of *Coscinia cribaria* (L.), host of *Peleteria popelii* (Portschinsky).

Winthemia venusta (Meigen)

A very rare Palaearctic species, from Europe known only as a parasitoid of *Thaumetopoea processionea* L. (Thaumetopoeidae) (Tschorsnig & Herting 1994: 133). New host record: *Catocala sponsa* (L.), collected from *Quercus robur* L. Caterpillar collected on 23.v.2008 from an oak stand, Dąbrowa Białostocka [UTM: FE53] (Czarna Białostocka Forest Distr.), Poland (leg. C. Bystrowski). Tachinid pupated about 20.vi.2008; a male fly emerged on 27.vii.2008. This record is interesting because it suggests the occurrence of a second generation of the species.

Peteina erinaceus (Fabricius)

A rare species recorded in all of Europe, so far reared from *Cucullia asteris* (Denis & Schiff.) and *Plusia gamma* (L.) (both Noctuidae) (Herting 1960: 131; Vaňhara *et al.* 2009: 38). New host record: *Ceramica pisi* (L.) (Noctuidae) collected from *Calluna vulgaris* (L.). Caterpillar collected on 22.viii.1997 from Wąsewo [UTM:ED55] (Ostrów Mazowiecka Forest Distr.), Poland (leg. C. Bystrowski); a male fly emerged on 20.vi.1998.

Ceranthia lichtwardiana (Villeneuve)

A rare species known from north and middle Europe. The host range is probably broad, with published records from *Eupithecia* spp. (Geometridae), *Acasis* spp. and *Acasis viretata* (Hübner) (Geometridae), *Oxyptilus pilosellae* (Zeller) (Pterophoridae) (Tschorsnig & Herting 1994: 152). New host records: *Geina didactyla* (L.) (Pterophoridae); caterpillar collected on 18.v.1975 from Toruń [UTM: CD37], Poland (leg. J. Buszko); a male fly was reared (date of emergence was not recorded). *Stenoptilia pterodactyla* (L.) (Pterophoridae); caterpillar collected on 25.v.1975, Toruń [UTM: CD37], Poland (leg. J. Buszko); a female fly was reared (date of emergence was not recorded).

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Artificial Neural Networks (ANN) in entomology
by J. Vaňhara*, J. Havel and P. Fedor

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Introduction

Identification of biota is fundamental in systematic biology and plays an important role in many practical fields. For more than 250 years of modern taxonomy, the number of known species has been continually increasing, but our knowledge of biodiversity is far from being complete. To transform the taxonomic process it is necessary to increase the productivity of identification of biodiversity, including searching for new species, using new tools. Among such methods, the Artificial Neural

Networks (ANN) methodology belonging to a class of artificial intelligence methods has been used by us, as a new challenge for modern taxonomy.

Artificial Neural Networks

Until now, the use of ANN has spread to many branches of science but in entomology and arachnology it is rather infrequent. If applied they are probably most commonly used in insect taxonomy, but very often based on different and in many cases non-traditional characters. ANNs offer a new innovation and more rapid approach to routine identification of biota than traditionally dichotomous or pictorial keys and some statistical methods. Much effort is required to create the training data set with sufficient number of specimens correctly identified by specialists. Because of variation the more correctly identified specimens included in training the better. On the other hand, if suitable diagnostic characters are selected, the ANN identification might be possible with fewer specimens of a certain species. However, once created this method shows many advantages.

Use of ANN

Compared to traditional statistics, ANNs are non-linear and can describe highly complex systems such as those found in biology. The ANN system is based on a supervised ANN classifier. From the biological point of view, ANNs are analogues to biological neural networks and can simulate learning and solving of problems. The ANN system requires a good trained database, an essential prerequisite to obtain reliable identification, in which specimens are rigorously identified largely on the basis of appropriate characters. An ANN model is designed to model relationships between characters (*input*) and species (*output*). An advantage is that it combines an ability to learn from examples with generalization of patterns that have been previously observed.

Characters

Different types of characters have been used for ANN in taxonomy of insects (and spiders), e.g., qualitative characters, colour, presence or absence of different body structures, together with quantitative characters, e.g., meristic, morphometric or sexual characters as well as digital images. In the framework of a particular insect group, species-specific sounds, wing flaps by registration with an optic sensor, etc., were analyzed.

How an entomologist uses ANN

ANNs used for identification and taxonomy require first of all a carefully built and verified database. Each specimen has to be characterized by a set of assorted characters that are adequate for the classification (not for identification only) of the species, genus or higher taxon. Once such a database exists, a model is designed to find a relationship between characters (*input*) and species

(output). The next phase is called learning or training. During training, the outputs approximate the target values that are given as the inputs in the training set. Among various learning methods in ANN, computing the *Back Propagation* algorithm is the most popular. The reliability of the database and the species identification must be checked using so-called *Cross Validation*.

Database creation as a fundamental step

A database is built on identified specimens and of characters which are used for identification or any other purpose. These characters are based on various types of data and do not have to be related to identification. Our ANN approach is based on measurements of morphological characters, structural shapes or colour. Quantitative characters were measured as linear distances on digital images taken from pinned and/or slide mounted specimens. Morphometric access used by us is a non-destructive tool and is suitable also for type material and permanently preserved material.

Many insect species exhibit a pronounced sexual dimorphism. To distinguish males and females, the sex was included as another two-state input character into the ANN insect model (Table 1).

No	Character										sex	spp.
	1	2	3	4	5	6	7	8	9	10		
1	66.3	284.7	140.4	62.4	37.05	25.35	148.20	Y	N	0	m	xyz
2	66.3	284.7	140.4	62.4	39.0	25.35	148.20	N	Y	0	m	xyz
3	68.25	280.8	136.5	64.35	35.1	27.30	144.30	N	Y	0	m	xyz
4	68.25	288.6	138.45	66.3	35.1	25.35	150.15	Y	N	0	m	xyz
5	70.2	292.5	138.45	60.45	37.05	25.35	150.15	Y	N	0	f	xyz

Table 1. An example of the form of database (Y, yes; N, no; 0, zero; m, male; f, female).

Search for the optimal architecture

ANN architecture should be conventionally the simplest, according to the number of taxa. *Multilayer Perceptrons Networks* (MLP) is mostly constructed as three or four-layered (xx, n/nn, spp.) structure (Fig. 1).

A small number of samples were randomly removed from the original data to compose the test set. These samples were reserved for a single unrepeated testing of the final ANN model, which had been selected and optimized using the learning and verification sets. The test set did not play any role in the search of the model and ensured that the results of the training and verification sets were real and not artefacts of the training process. The remaining samples were used to search for a suitable and optimal ANN architecture and for corresponding network training. Optimal ANN architecture is independent of the number of

samples in the training set. Even when 50% of the available data was used in the training set, the effect of *n* on the RMS error (see further) value remained very similar.

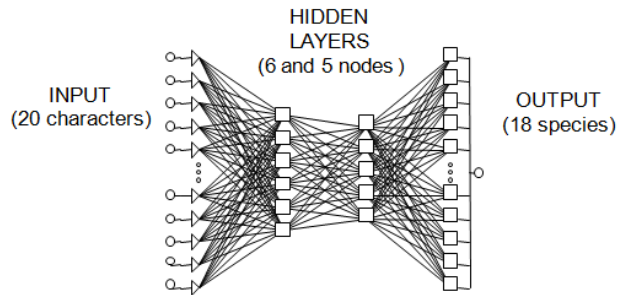


Figure 1. Possible four-layered ANN architecture (see Fedor *et al.* 2008).

Number of nodes

The minimal value of *Root Mean Square* (RMS) was achieved according $RMS = f/n$, (= number of nodes in the hidden layer) estimates optimal value of *n*. As usually recommended we chose the number of nodes *n* slightly higher (one or two nodes) than the minimum (optimum) value found. For further computations use only such *n*, where nearly or 100% correct classification of samples in the training process was achieved in most of the runs. As mentioned above, another suitable architecture found in the training experiments was composed of two hidden layers, again with reliable results and a 100% prediction. However, we preferred the simpler three-layered architecture, which was more resistant and robust in performance.

Training

In the first stage the ANN software was used to analyse the data of all the taxa chosen. Training of ANN should be successful if all the data appear suitable. Training the MLP network can be performed by different algorithms. We used the *Back Propagation*, which is the best-known one and has relatively low memory requirements. We ran the training algorithm up to some hundreds of thousands of iterations (epochs) until convergency was achieved.

Verification

After obtaining the optimal architecture and minimal RMS, a number of randomly selected specimens from the learning set were excluded to form the verification set. They were used as a check for cross-validation of the training procedure to prevent over-training – the situation when the model is too complex and training achieves a low error but has a poor generalization when new samples are processed. The verification is a test of predictive power of the model; its efficiency is in identifying unknown specimens. However, unlike the test set, the verification set does actually play a role in selecting the final ANN model.

Species identification (our own examples only)

A properly trained and validated model can be applied for identification of unknown specimens and is even able to draw attention to new species, as demonstrated in our *Tachina* project (see Muráriková *et al.* submitted). Real description requires a specialist. Model species of *Tachina* and *Ectophasia* were used for the first application of ANN methodology by us to the well known genera. Based on two databases with 3 and 2 model species, and 17 characters, ANN identifications were fully successful (Vaňhara *et al.* 2007a,b). The further methodological paper (Fedor *et al.* 2008) undertaken by us has been on more advanced application of ANN for morphometric identification (18 common European thrips species from 4 genera). The developed methodology is then applicable for any insect group (for tachinids, see Muráriková *et al.* submitted). Our experiences show that identification is possible even if only a few specimens of a species are included in the training data set and if correctly measured data are included (the lowest number of specimens was 9). The same is valid for the basic principle of how to select and prepare data, how to select an appropriate network and how to interpret the results

Species monitoring

Precise and prompt identification is essential for effective species monitoring. Semi-automated ANN data evaluation has offered a new tool for easy and rapid monitoring of any insects (see Fedor *et al.* 2009). ANN approach enables identification of numerous and uniform samples by technical staff, without the risk that some aberrant specimens or new taxa would be overlooked (ANN can indicate them as errors). Specialist's (expert's) time thus could be saved for really expert tasks.

Polyphasic taxonomy

The identification of *Tachina* species is generally considered difficult because diagnostic characters often overlap among species (colour, different length ratios, etc.). In spite of these difficulties, our *Tachina* project used ANN methodology successfully, not only for identification but also for solving several taxonomic problems. The correct identification and conclusions on the systematics were based on ANN methodology, while the results were also tested by molecular analyses and by comparative morphological examinations, incl. cladistics. In all cases, the same results were obtained. Such a polyphasic approach takes into account all known phenotypic and genotypic information and integrates them not only for the purpose of taxonomy and identification, but also for the full reciprocal validation of methods used and for the results obtained. The multidimensional combination of ANN and two alternative methods is homologous to polyphasic taxonomy which is common in microbiology,

or in phylogenetics, which terms it "total evidence". We are convinced, this is the first time that the reliability of the ANN methodology has been demonstrated against other more traditional methods (see Muráriková *et al.* submitted). Molecular and morphological background for Muráriková *et al.* (submitted) was published separately, see Novotná *et al.* (2009). Molecular analyses were based on four mitochondrial markers COI, Cyt b, 12S and 16S rDNA for subgeneric level and two markers 12S and 16S rDNA for the species analyses. West Palaearctic species of the genus *Tachina* comprises 12 valid species (plus a proposed new one). A new identification key was also prepared, based on male postabdominal structures. All characters were illustrated by original pen drawings and deep focus micrographs, some of them for the first time.

ANN – why and how?

- ANNs represent a powerful tool for fast and semi- or automated identification of tachinids (and for other insects as well) and open great possibilities for taxonomy.
- ANN methodology can be applied to any objects for which it is possible to determine characters (= variables) with sufficient information content to enable their resolution and correct identification.
- Identification of species is possible across different taxa levels.
- ANNs are able to determine even hardly distinguishable species or to indicate new species.
- ANNs are able to solve taxonomic problems.
- Higher number of specimens for ANN training improves the quality of identification.
- It is better to use a principle of sub-databases instead of a great one.
- Sex has some effect on the input parameters and should be included.
- ANNs are able to take all the input characters simultaneously (similar to multivariate statistics) into account.
- ANNs can eliminate the use of destructive analytic methods if the material must not be destroyed (e.g., types, material mounted on slides).
- ANNs enable identification of numerous and uniform samples (e.g., insect pests) by technical staff. Specialist's time could thus be saved for really expert tasks.
- Rare taxon specialists are often alone in their studies and they need some independent opinion which ANNs are able to provide.

Future

Further research on ANN corresponds with better understanding the taxonomic character selection and its wide applications in order to increase practical use of this non-traditional species identification method. In tachinid taxonomy this requires correctly identified species and sufficient quantity of specimens for constructing the effective database. For many tachinid groups (e.g., on genus or tribe levels) it is possible to build free web species

databases (being based on morphometric and other characters) within worldwide cooperation. Any expert may include his or her own material and computational sets to make the source more complete. The system could be available for others, who can use some of the specialized ANN software (Trajan, Matlab, Statistica) to identify own species. Obviously, the system should start with a simple model and well-distinguished taxa and will be accompanied by intensive help of experts to select appropriate characters. Such applications could be applied by the wider community of entomologists (not only by tachinologists). Is there anybody worldwide to join us?

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Tachinidae (Diptera) parasitizing Lepidoptera defoliators on alfalfa and soybean crops, in central Argentina

by S. Avalos

The following is an expanded abstract of a Ph.D. thesis by Susana Avalos entitled, “Food webs of Lepidoptera defoliators and their parasitoids on alfalfa and soybean crops, in Córdoba (Argentina)” [in Spanish].

The agricultural systems of alfalfa (*Medicago sativa*) and soybean (*Glycine max*) share among their pests a complex of defoliator caterpillars, whose impacts differ depending on the season of the attack and the particular characteristics of the cultivar species (Igarzabal *et al.* 1997; Fichetti 2003). These caterpillars have an important number of natural enemies that are present on both species of plants, including parasitoids belonging to the orders Hymenoptera and Diptera (Tachinidae) (Aragon *et al.* 1997; Luna & Sanchez 1999; Avalos *et al.* 2004; Sanchez & Luna 2004). This study focussed on determining patterns in the structure and diversity of the food webs of defoliator caterpillars and their parasitoids in cultivars of both alfalfa and soybean. The defoliator larvae were collected weekly at two localities in Córdoba province, Argentina (Manfredi and Capilla de los Remedios, Instituto Nacional de Tecnología Agropecuaria [INTA]) in plots of alfalfa and soybean, from 1997 to 2001. Parasitoids were reared from a sub-sample of 100 caterpillars selected on each sampling date (care was taken to conserve the proportions of species present in the total sample). Based on these samples the distributions and taxonomic composition of the populations of caterpillars and parasitoids were determined, and the different statistical parameters of food webs were calculated: abundance, species richness, parasitoid/host species ratio, parasitoid host range, parasitic species load, percentage of parasitism, number of realized trophic unions, connectance, link density, and strength of the interactions. Larvae of 11 species of Lepidoptera were present in the cultivars and localities in some of the years of this study: *Spilosoma virginica* (Fabricius) (Arctiidae), *Achyra bifidalis* (Fabricius) (Crambidae), *Anticarsia gemmatalis* (Hübner), *Heliothis* sp., *Peridroma saucia* (Hübner), *Pseudaletia unipuncta* (Haworth), *Rachiplusia nu* (Guenée), *Spodoptera frugiperda* (Smith), *S. latifascia* (Walker) (last seven all Noctuidae), *Colias lesbia* (Fabricius) (Pieridae) and Geometridae sp. In alfalfa the most abundant species was *C. lesbia*. In soybean the most abundant species was *Rachiplusia nu* or *Anticarsia gemmatalis*, depending on locality.

The caterpillars were parasitized by 32 species of parasitoids, comprising 22 Hymenoptera (Ichneumonidae, Braconidae, Chalcididae, Encyrtidae and Eulophidae) and 10 Diptera (Tachinidae). All species (except *Euplectrus* sp., Hymenoptera) were primary endoparasitoid koinobionts. In

those caterpillars sampled from the alfalfa cultivar a total of 29 species of parasitoids were recorded, among which were 8 species of Tachinidae: *Archytas* sp., *Blepharipa* sp., *Chetogena haywardi* (Blanchard), *Chetogena* sp., *Incamiya chilensis* (Aldrich), *Lespesia* spp., *Patelloa* sp. and *Voria ruralis* (Fallén). Ten parasitoid species were recorded from the soybean cultivar, including 5 species of Tachinidae: *Actinoplusia koehleri* Blanchard, *Incamiya chilensis* (Aldrich), *Lespesia* sp. *Patelloa* spp. and *Winthemia* sp. The different species of parasitoids, including those in the Tachinidae, were not found each year; the majority appeared in one or two of the sampling years. In alfalfa, *Colias lesbia* displayed the richest parasitic complex (eight Hymenoptera and four Diptera), while in soybean *Rachiplusia nu* displayed the richest parasitoid complex (five Hymenoptera and five Diptera). The species richness was higher in alfalfa than in soybean; furthermore within the alfalfa cultivar species richness was higher in the Manfredi cultivar than in the Capilla de los Remedios cultivar. This showed that both the species of the cultivar and the locality of the crop plot were important factors affecting the diversity and composition of the food web. The observed food webs were characterized by the noticeable dominance of one or two species and interactions. This is characteristic of agricultural systems, in contrast to natural or less disturbed habitats where the species are more evenly distributed (Valladares & Salvo 1999; Tylianakis *et al.* 2007). In the Manfredi alfalfa plot seven parasitoid guilds were recorded, while in the alfalfa plot of Capilla de los Remedios and in both of the soybean plots only four parasitoid guilds were observed. The species of Tachinidae were observed to be associated with the guilds (*sensu* Mills 1992) of early larval endoparasitoids (*Actinoplusia koehleri* and *Incamiya chilensis*), larval-pupal endoparasitoids (*Archytas* sp., *Blepharipa* sp., *Chetogena haywardi*, *Lespesia* spp., *Patelloa* sp. and *Winthemia* sp.) and late larval endoparasitoids (*Chetogena* sp. and *Voria ruralis*). The percentage of total parasitism was low, fluctuating between 14% and 26% in alfalfa depending on the sampling year, 2% to 6% of which were Tachinidae. While in the soybean system total parasitism varied between 7% and 20%, the contribution of the Tachinidae was around 2%. Despite the difference in species richness encountered within the different systems, statistical comparisons between the percentage of parasitization revealed no significant difference, indicating that the rate of parasitization is not species dependent. This study presents a novel approach to the analysis of the magnitude and diversity of the interactions between cultivars, defoliating caterpillars and parasitoids, as well as the relative effects of the basal resource species and the local conditions on the aforementioned interactions. It is hoped that these results will pave the way for new studies

and approaches concerning management strategies in these agricultural systems, and to the incorporation of food web statistics as tools to obtain data relevant to this management.

All species of parasitoids were identified by Drs. Jim O'Hara and Monty Wood (Agriculture and Agri-Food Canada, Ottawa). A reference collection is deposited in the CIEC (Cordoba Center for Entomological Investigations, Cordoba, Argentina).

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Ottawa dipterology (1937–1989): Festschrift commemorating the coordinators of the *Manual of Nearctic Diptera* and their contributions to building the Canadian National Collection of Insects
by B.J. Sinclair, J.M. Cumming, S.E. Brooks, J.H. Skevington & J.E. O'Hara

The following is reproduced from the October 2009 issue of Fly Times (issue 43: 17–18), with the exception of Fig.1.

Health finally forced Richard (Dick) Vockeroth to retire from research and curation in the Canadian National Collection of Insects (CNC) in 2008, and this has prompted us to consider how to celebrate his career and achieve-

ments. As we discussed this, it became clear that we could not celebrate his career alone. Other Diptera curators in Ottawa of his generation have not received such an honour despite their legacy of building the CNC fly collection to its present two million plus specimens and their global leadership as coordinators of the *Manual of Nearctic Diptera* (Fig. 1). Each of the curators and coordinators of the *Manual* (Drs Frank McAlpine, Bob Peterson, Guy Shewell, Herb Teskey, Dick Vockeroth and Monty Wood) have left a lasting legacy, and it is time to celebrate them as a group.

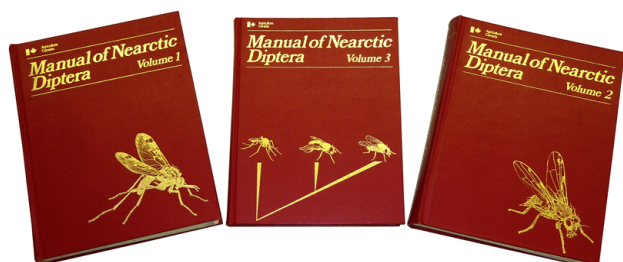


Figure 1. The three volumes of the *Manual of Nearctic Diptera* (1981– 1989).

The influence of the *Manual of Nearctic Diptera* on the dipterological community is enormous. The keys and illustrations have expanded the ability of biologists to identify specimens encountered in their projects and have been reproduced in numerous publications. The coordinators of this 25-year project spent considerable time not only writing chapters (sometimes outside of their focus groups), but also editing and proofing the contributions of other authors. The *Manual* has received many accolades, but the efforts of the entire editorial group have largely been overlooked.

The coordinators of the *Manual* also spent a great amount of their time amassing and curating an enormous collection of Diptera in Ottawa. These specimens continue to be used in revisions worldwide, often representing the only material available from certain regions. From a quick search of catalogues we have found some 145 species names dedicated to these curators, which is the ultimate statement of their influence on other dipterists and their contributions to the CNC Diptera collection.

We are planning a commemorative volume celebrating the careers of these six dipterists. The dates in the title of this announcement cover the period beginning with the arrival of the first of the *Manual* coordinators at the CNC (Guy Shewell) until the publication of the third volume of the *Manual*. This commemorative volume will celebrate the careers of these dipterists, their contributions as coordinators of the *Manual of Nearctic Diptera*, and their role in building the CNC. At this time we would like to solicit authors interested in contributing to this volume.

The volume will appear as a special issue of *The Canadian Entomologist* (<http://www.esc-sec.ca/journal.html>), and all submissions will be peer reviewed. Papers in all fields of entomology are encouraged. The Festschrift is planned to appear in early 2011. Deadline for manuscripts is December 1, 2010. All enquiries and manuscripts should be directed to Bradley Sinclair (bradley.sinclair@inspection.gc.ca).

PERSONAL NOTE

Seeking a Ph.D. position in systematics of Diptera by Diego Inclan

I am currently pursuing a Master's degree in biological sciences under the supervision of Dr. John Stireman at Wright State University (Ohio), with the assistance of Dr. Greg Dahlem (Northern Kentucky University, Kentucky) and Dr. Jim O'Hara (Agriculture & Agri-Food Canada, Ottawa). My thesis is focussed on the Tachinidae and consists of two primary objectives. First, I am conducting a taxonomic revision of the Neotropical tachinid genus *Erythromelana*; identifying, describing, and assessing the phylogenetic relationships of the species belonging to this genus. Second, I am assessing the local diversity of a community of Neotropical tachinids, evaluating their temporal distribution and seasonal turnover at one site in the eastern Andes of Ecuador.

My goal is to continue my studies in entomology and to obtain a Ph.D. so that I can teach and conduct research. I am currently looking for a Ph.D. position where I can pursue systematics of Diptera, preferably studying tachinids. I am also interested in applied entomology in agricultural sciences, such as biological control. I would greatly appreciate any information regarding Ph.D. research opportunities. Please contact me at one of the e-mail addresses provided in the mailing list of this newsletter.

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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>. Articles from *The Tachinid Times* are now included in this tachinid bibliography. 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 Alan Fleming 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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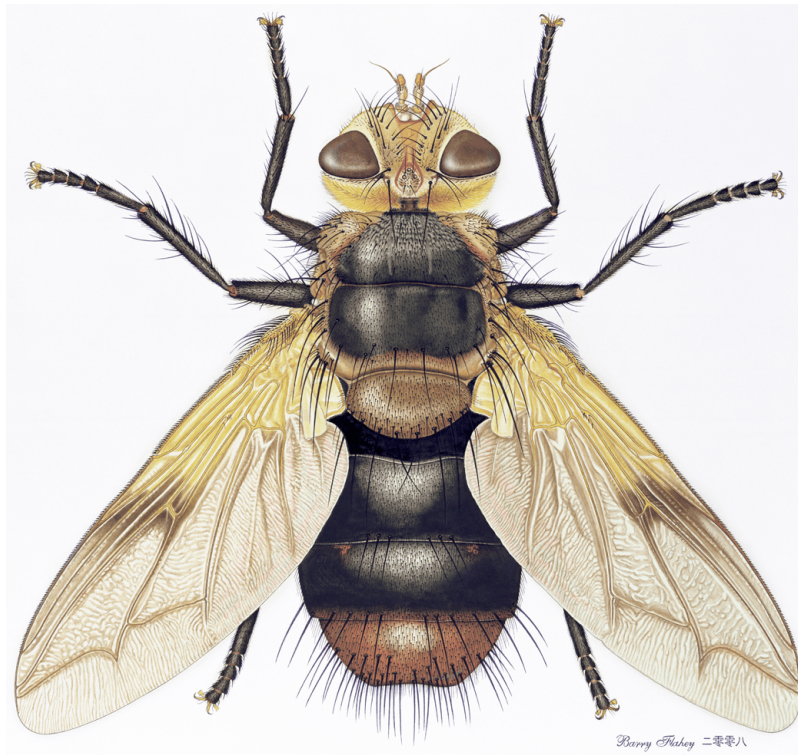
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