The Tachinid Times

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A few months ago the 6th International Congress of Dipterology (ICD6) was held in Fukuoka, Japan. These Congresses, held every four years, provide an excellent forum for communicating the results of recent research and for meeting with colleagues who share similar interests. In this issue of **The Tachinid Times**, the abstracts of oral and poster presentations on tachinid flies given at the Congress are reprinted. The topics spanned a variety of subdisciplines from morphological and molecular systematics to behavior, ecology and faunistics, illustrating the vast potential of the Tachinidae as subjects for investigative research. Anyone wishing to view the entire Abstracts Volume from ICD6 can do so by visiting the International Congresses of Dipterology website.

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, except that the figures are in colour in the online version and in black and white in the printed version. The online version of this issue is available as a PDF file (ca. 2.2 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 2008. 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.

The Tachinid Times is purposely not peer-reviewed to retain its status as a newsletter and avoid attracting articles that are more properly published in recognized journals. However, I personally review and edit all submissions, and the newsletter as a whole is reviewed internally within my organization before it is posted on the Internet and distributed in hardcopy. Articles in **The Tachinid Times** are cited in *Zoological Record*.

I would like to thank Shannon Mahony for her assistance with the tachinid bibliography in this issue. She recently converted my entire database of tachinid references (>3000) from ProCite® to EndNote® and performed the online searches of literature databases that produced most of the references listed in the Tachinid Bibliography section of this issue. My online Tachinid Bibliography 1980 – Present will be updated from the EndNote database in a few months. I also thank all authors who sent me their reprints or lists of recent publications. I am also grateful to the authors of the articles in this issue for their support of this newsletter.

Early season parasitic flies (Diptera: Tachinidae) visiting sap runs on birch trees in eastern Finland (by Jaakko Pohjoismäki)

Abstract

The succession of spring is fast and sudden in high latitudes like in Finland. Many of the spring species of parasitic flies start their flight period when the snow is still on the ground and the food sources for adults are scarce. These facts together with varying spring weather and relatively short flight periods of the flies make the observing of early season tachinids difficult and lead easily

to the conclusion that many of the spring species are rare. However, a persistent observer can be surprised by the variety and number of tachinids when conditions are suitable. The author reports on his observations at the sap runs of birch trees (*Betula pubescens* L.) during two sunny days of April 2006 in Kerimäki, Finland (62°1.59'N 29°9.784'E, 115m).

Introduction

Spring 2006 was delayed in eastern Finland. Upon my arrival in Kerimäki on April 29th, the ground was still barren and there were patches of snow, especially along forest edges. Willows (*Salix* spp.) and coltsfoot (*Tussilago farfara*) had not yet started blooming. The weather was relatively calm and sunny, and daytime temperatures reached 17–19°C. The author and friends were concentrated on finding early season moths such as *Archiearis parthenias* (L.) (Geometridae), *Brachionycha nubeculosa* (Esper) (Noctuidae) and *Achlya flavicornis* (L.) (Thyatiridae/Drepanidae) for research purposes. Day active *A. parthenias* is known to be easily found among birch tree sap runs and we concentrated our attention on a sunny southward facing slope with sparse birch trees (*Betula pubescens*). The study area biotope is typical for south-eastern Finland: patches of fields surrounded by managed mixed forest of mainly spruce (*Picea abies*) and a few deciduous trees like *Betula* and *Alnus*.

We quickly discovered that birch trees with sap runs were full of life. Besides moths and hymenopterans, the author was struck by the diversity of flies. Among numerous *Pollenia* (Calliphoridae), the sap runs were visited by a number of tachinid flies as listed below, some new to the author.

Results

Cyzenis albicans (Fallén)

This small tachinid fly was the most numerous species observed by the author (Fig. 1). The reported hosts include *Operophtera brumata* (L.) (Geometridae) (Belshaw 1993, Tschorsnig and Herting 1994). Mentioned host has recently had good years in Finland and may contribute to the numbers of the flies as well.

Figure 1. *Cyzenis albicans*, the most common tachinid visiting the sap runs.

Gonia divisa (Meigen)

Gonia divisa was the only representative of this genus seen during the two days of observing. One female and one male were collected of the three flies sighted. The species has been reported fairly recently (2004) from Finland (C. Bergström, pers. comm.) and is apparently expanding its range northwards. It is now fairly common but local especially along the south coast of Finland (J. Kahanpää, A. Haarto and K. Winqvist, pers. comm.). It is possible that *G. divisa* starts its flight a bit earlier than the more common *G. ornata* (Meigen) and *G. picea* (R-D.), which the author found in numbers a bit later in May visiting willow flowers and hilltopping on a small ruderate mound.

Figure 2. *Tachina ursina*. Ants (*Formica rufa* s. lat.) occupied some trunks in masses inhibiting flies from landing on them. Some were seen to capture and kill *Siphona ingerae* and other small insects feeding from the sap runs.

Tachina ursina (Meigen)

The author had only collected two of these impressive looking tachinids (Fig. 2) previously. In Kerimäki, one specimen was sighted sitting on bare ground, but more than ten individuals were observed visiting the sap runs. The host is unknown. This species was numerous in many locations in southern Finland during spring 2006 and the author saw individuals in various habitats: forest edges in agricultural areas, clear cuttings, in a wet *Alnus* grove, and even on open mire. The last specimen of the season that the author collected was from June 11th; this specimen was not *Tachina lurida* (Fabricius), which is usually seen a bit later than *T. ursina*. *Tachina lurida* resembles *T. ursina* but has not yet been recorded from Finland.

Ernestia puparum (Fabricius)

This large tachinid was new to the author. Both males and females visited the sap runs (Fig. 3), although many males were also observed sitting on the tips of branches close by, apparently on the lookout for females. Together with *T. ursina*, this species was an aggressive resource competitor chasing away other flies. Approximately a dozen individuals were observed in total. This species was recognized as new to Finland by K. Winqvist in 2005 (pers. comm.).

Figure 3. Male (left) and female (right) of *Ernestia puparum*.

Siphona ingerae Andersen

Together with *Cyrtophleba vernalis*, this was the most numerous tachinid on sap runs after *Cyzenis albicans*. One specimen was also recovered from one of the Malaise traps. This species is relatively easy to recognize as a *Siphona* from its characteristically high gena (Fig. 4) and apparently is together with *S. maculata* Staeger the only early season representative of the genus (Andersen 1996). Details of the biology of this species remain unknown. The author has encountered this species previously from Malaise material from Karjalohja in southern Finland; all specimens were females and from the surprisingly late dates of May 22nd to June 19th.

Figure 4. *Siphona ingerae* sitting on a collecting net.

Campylocheta fuscinervis (Stein)

This species belongs to the *C. fuscinervis* species complex as reviewed by Ziegler (1996). A total of four males were collected: two on sap runs, one sitting on a tree trunk nearby, and one from a yellow pan trap. The species is new to Finland and also the first confirmed record of it from a Nordic country (C. Bergström, pers. comm.).

Cyrtophleba vernalis (Kramer)

This species is also considered rare, but was extremely common on sap runs in Kerimäki (Fig. 5). It was also the only tachinid species observed in numbers away from the sap runs. Individuals were usually observed sitting on bare ground or on tree trunks.

The most active time for tachinids visiting the sap runs was soon after noon, congruently with the rising daytime temperature. Compared to calliphorids visiting sap runs, tachinid flies seemed much more timid. However, when sitting quietly and patiently, it was still possible to make careful observations and even take quite close range photos of the flies. Much of the successfulness of the field trip was also due to pure chance. We managed to time our expedition in the best possible phenological window; the weather warmed up considerably from the past weeks and the spring started to develop fast. On the third day of our field trip the willows and coltsfeet started their full bloom. As the plants began to flower, the flies began to disperse from the sap runs. A few individuals of *C. vernalis* and *T. ursina* were seen on willow flowers (*Salix phylicifolia* L.), but nowhere near the quantities as observed just a day earlier on sap runs.

One rarely encounters such a nice opportunity as this to make both important faunistic recordings and to follow the behaviour of tachinids in their natural surroundings. All photos © J. Pohjoismäki.

Figure 5. Feeding *Cyrtophleba vernalis*.

Acknowledgements

I would like to thank the field trip team of Pekka Pohjola and Jussi Petrelius for the nice weekend out. Pekka deserves additional acknowledgements for pointing out to the author that tachinids also visit the sap runs. I would also like to express my gratitude to Mr. Christer Bergström, Sweden, for confirming the *C. fuscinervis* record and inspiring me to write this article. He has also provided outstanding help in both species identification and background information about Tachinidae.

References

Andersen, S. 1996. The Siphonini (Diptera: Tachinidae) of Europe. Fauna Entomologica Scandinavica **33**. 148 pp.

Belshaw, R. 1993. Tachinid flies. Diptera: Tachinidae. Handbooks for the identification of British Insects. Royal Entomological Society of London 10, Part 4a(i). 170 pp.

Tschorsnig, H.-P. and Herting, B. 1994. Die Raupenfliegen

(Diptera: Tachinidae) Mitteleuropas: Bestimmungstabellen und Angaben zur Verbreitung und Ökologie der einzelnen Arten. Stuttgarter Beiträge zur Naturkunde (A) **506**. 170 pp.

Ziegler, J. 1996. *Campylocheta fuscinervis* auctorum – ein Artenkomplex (Diptera, Tachinidae). Studia dipterologica **3**: 311–322.

Preliminary notes on Tachinidae reared from Lepidoptera in the Ecuadorian Andes (by J.O. Stireman)

Introduction

Current estimates of the species richness of Tachinidae among geographical provinces suggest that the Neotropical Region harbors the largest number of species and represents a geographic epicenter of tachinid diversification (O'Hara 2006). The Neotropics boasts an impressive fauna consisting of 2864 described species belonging to 822 genera at the time of the Neotropical catalog (Guimarães 1971), making it almost twice as species rich as any other geographic realm (O'Hara 2006; Stireman *et al.* 2006). This diversity is most apparent at middle elevations (1000–2000m) along the mountain chains of tropical Central and South America, where tachinids are an abundant and conspicuous component of the diurnal insect fauna. Despite this large number of described species, it is generally thought that only a fraction of Neotropical Tachinidae have been described, and for most of those that have been described, nothing is known about their life history, host associations, or behavior (Guimarães 1977). Here, I provide a preliminary list of the genera and numbers of species that have been reared from a research program focused on rearing Lepidoptera in the Ecuadorian Andes. I also provide host–family affiliations for most taxa as well as notes concerning the species reared, their characteristics, and/or their host associations. A more complete analysis of species diversity patterns and host associations will be published in a forthcoming special issue of the Journal of Research on the Lepidoptera.

Methods

The tachinid taxa discussed here were reared as part of a collaborative project with the goal of surveying and inventorying larval Lepidoptera and their parasitoids in an Ecuadorian cloud forest. This project, led by ecologist Lee Dyer (Tulane University), involves sampling of caterpillars from cloud forest plants, rearing the caterpillars on their food-plants, and collecting and preserving adults of Lepidoptera and their parasitoids.

The survey project is centered on Yanayacu Biological Station (YBS), located at 2200m in the Quijos Valley, Napo Province, in the eastern Ecuadorian Andes. Much of the 2000 hectares encompassed by the YBS is relatively level cloud forest, some of the only remaining habitat of this type in the Andes. Caterpillars were systematically sampled in 10m plots by visually scanning vegetation and collecting all individuals seen along with host plant material. Additional specimens were collected opportunistically as they were encountered along trails and streams. Caterpillars were reared individually in clear plastic bags hung in an open-walled rearing shed at ambient temperature and humidity. Every two days, bags were cleaned and foliage was replaced. All pupae were checked regularly to collect any adult Lepidoptera or parasitoids that emerged. Throughout this process life history data were recorded (e.g., host, host plant, collection date, pupation date, eclosion date).

Preliminary Results

Two hundred sixteen adults representing approximately 100 species of Tachinidae have been reared from caterpillars since the project was initiated. The exact number of species is difficult to ascertain because many "species" are represented by only one or a few individuals (often of one sex) making it difficult to determine where intraspecific morphological variation ends and interspecific variation begins. This is particularly difficult in several large genera in which there appear to be many undescribed species (e.g., *Siphona*, *Erythromelana*, *Calolydella*, *Leschenaultia*; Table 1). By examining morphospecies from both a "lumper" perspective (clustering individuals in which clear diagnosable traits cannot be found to separate them) and a "splitter" perspective (in which taxa are split based on more specific and perhaps more variable traits), it appears that we have reared as few as 87 distinct species, and as many as 103 species in 176 rearing events. An appreciable number of additional tachinid parasitism events have been recorded in which the adult tachinids have failed to eclose from puparia that emerged from hosts (or pupated within the host remains). Fewer than 10% of the reared species have been assigned a specific name at this point, and I would estimate that perhaps half have not been described in the literature. Probably 90–95% have never been reared before. This figure may be revised downward as we gain a better understanding of the overlap in taxa between this Ecuadorian site and other major Lepidoptera rearing efforts in Costa Rica by D.H. Janzen and W. Hallwachs (2006) and by Lee Dyer and Grant Gentry (Gentry and Dyer 2002). However, species accumulation curves (not shown) suggest that this represents a small fraction of the diversity of the total tachinid community. An online guide to the reared species of tachinids with close-up photos from a variety of angles as well as taxonomic notes and host life history information has been initiated. Pages for 37 species have been completed thus far (see http://www.wright.edu/~john.stireman/ [and click on the "Ecuador tachinids" link] or see the Ecuador pages on L.A. Dyer's www.caterpillars.org website).

Table 1. A preliminary list of the genera thus far reared from caterpillars from the Yanayacu Biological Station and surrounding areas. The number of rearing events (N), the number of species (Spp.; given as a range in cases of uncertainty), the host families from which they have been reared, and notes about particular taxa. Many identifications remain tentative pending more detailed examination and comparison with identified material.

Taxon	N	Spp.	Host Family	Notes
DEXIINAE	**23**	**10-13**		
CAMPYLOCHETINI				
Camplyocheta	12	3-5	Geometridae	One sp. is near *C. heteroneura* (Brauer & Berg.), most reared from hosts on *Diplazium costale.*
THELAIRINI				
Polygaster	2	1	Geometridae	
URAMYIINI				
Thelairaporia	6	3-4	Arctiidae (3), Limacodidae, Noctuidae	1 or 2 spp. appear to belong to the "*brasiliensis*" group (Guimarães). Distinction between this genus and *Uramya* appears blurred.
Uramya	2	2	Megalopygidae	
UNPLACED				
Argyromima	1	1	Nymphalidae (*Pedaliodes* sp.)	Possibly *A. mirabilis* Tnsd.
EXORISTINAE	**99**	**50-58**		
BLONDELIINI				
Anoxynops	1	1	Saturniidae	No prosternal setae.
Calolydella	13	4-6	Nymphalidae (5), Notodontidae (3), Arctiidae, Geometridae	One sp. is *C. geminata* Tnsd. and two others are quite close resulting in uncertainty in the number of species. *Actinote* is a common host genus.
Eribella	4	1?	Geometridae (3), Pyralidae	The pyralid record (on a different host plant) may represent a distinct species.
Erythromelana	16	7-9	Geometridae (14), Pyralidae, Megalopygidae	A diverse assemblage of species, probably all undescribed, including 2 that may belong to a separate genus.
Eucelatoria	7	7	Geometridae (2), Arctiidae, Pieridae, Noctuidae, Nymphalidae	Some quite large species, several small and similar in appearance (esp. males). One species may be *Vibrissina*.
Italispedia	3	1	Notodontidae	2 host species.
Leptostylum	2	2	Saturniidae	Different hosts. 7 reared from 1 *Gamelia* caterpillar.
Lixophaga	5	3	Nymphalidae, Pyralidae,	One species appears to be the same as an unnamed species from Costa Rica (D.M. Wood, pers. comm.).
Ptilodegeeria	1	1	Tenthredinidae (Hym.)	Unidentified species.
Leptomacquartia	1	1	Noctuidae	Probably *L. planifrons* Tnsd.
ERYCIINI				
Carcelia	10	4	Arctiidae	Includes species nr. *C. flavirostris-orellana*, and *C.* (*Chaetosisyrops*) *montanus* (Tnsd.).
Drino	1	1	Noctuidae	
Lespesia	7	2	Nymphalidae, Saturniidae	Robust species, largely black in coloration.
GONIINI				
Argyrochaetona	1	1	Pyralidae	
Chrysoexorista	2	1	Pyralidae	Very small in size for this genus.
Gaediopsis	1	1	Pyralidae	*G. punoenisis* Vim. & Souk. (?)

Taxon	N	Spp.	Host Family	Notes
GONIINI (cont.)				
Hyphantrophaga	3	2		
Leschenaultia	7	5-6	Arctiidae (4), Apatelodidae, Noctuidae	One species is nr. *L. leucophrys* Wied., a few forms differ primarily in size and may represent a single species.
Mystacella	5	1-2	Pyralidae	May be a single species.
New genus	3	1	Nymphalidae	This is a new genus in the process of being described by N. Woodley (M. Wood, pers. comm.). I am uncertain if it is a goniine.
Patelloa	5	2-4	Arctiidae (2), Noctuidae, Geometridae	*P. andina*, (Tnsd.) and *P. xanthura-similis* (or nr.). Variation in size and color may be intraspecific.
WINTHEMIINI				
Winthemia	1	1	Nymphalidae	Similar to *W. floridensis* Guimarães.
TACHININAE	**54**	**27-32**		
ERNESTIINI				
Fasslomyia	2	1	Arctiidae, Apatelodidae	sp. nr. *F. fantastica* Tnsd.
GRAPHOGASTERINI				
Phytomyptera	2	2	Pyralidae	
LESKIINI				
Leskia	1	1	unknown	*L. leskiopalpus* group.
Micronychiops	1	1	unknown	I am uncertain of the current tribal placement of this genus.
NEMORAEINI				
Xanthophyto	2	1-2	Geometridae	Probably 2 species.
POLIDEINI				
Chlorohystricia	1	1	unknown	*C. cussirilis* Reinhard.
Chrysotachina	2	1	Hesperiidae	Sp. nr. *C. peruviana* (Tnsd.)
Hystricia	10	4	Arctiidae (5), Apatelodidae, Saturniidae	Including *H. laxa* Curran, *H.* nr. *micans* Wulp, and *H.* nr. *browni* Curran.
Unknown genus 1	1	1	Pyralidae	*Exoristoides*?
Unknown genus 2	1	1	Noctuidae	Similar to *Spilochaetosoma.*
SIPHONINI				
Actia	4	2-4	Pyralidae	All specimens are morphologically distinct but possible sexual variation.
Siphona	14	7-10	Pyralidae (7), Geometridae (5), Notodontidae	4 morphologically distinct forms reared from one host on one host plant probably represent only 1 or 2 species. Subgenera include *Actinocrocuta, Siphonopsis, Siphona, Pseudosiphona*.
TACHININI				
Rhachoepalpus	1	1	unknown	*R. immaculatus* (Macq.).
Trichophora	1	1	unknown	
TELOTHYRINI				
Telothyria	1	1	Pyralidae	Possibly *Eutelothyria.*
TOTAL	**176**	**87-103**		
SARCOPHAGIDAE				
BOETTCHERIINI				
Boettcheria	2	1	Saturniidae	(Larval parasitoids.)

The overall parasitism frequency of the caterpillars is approximately 27% (based on >18,000 individual caterpillar rearings), and a little over one quarter of this is due to Tachinidae. Many more tachinids likely died in hosts that succumbed to pathogens or other sources of mortality (e.g., less than 50% of collected Lepidoptera resulted in an adult insect, whether it be moth or parasitoid).

As can be seen in Table 1, some subfamilies and tribes are extremely well represented, and others poorly so. In part this is due to the focus on lepidopteran hosts, so such groups as Phasiinae and Dexiini that primarily attack non-lepidopteran hosts would not be expected to be well represented. However, frequencies of reared taxa are generally consistent with the observed frequencies of taxa hand netted in the same area. For example, I have not collected a single member of Phasiinae along roadside and trailside collecting spots that yielded impressive numbers of species in other subfamilies. Dexiini are also rare in my collections, despite frequent hand collecting from flowers (e.g., Asteraceae) where many dexiine genera (and Phasiinae) often take nectar and/or pollen in other regions. Voriini were also markedly absent in hand collecting and absent from reared taxa despite their general habit of using Lepidoptera as hosts (e.g., Geometridae).

Over half of all species reared (and half of all incidents of tachinid parasitism) belong to the subfamily Exoristinae. In general, Blondeliini were extremely well represented by a diverse assemblage of closely related species and genera (e.g., *Calolydella, Eucelatoria, Lixophaga, Erythromelana*), suggesting that the region is likely a cradle for their diversification. This tribe accounts for over 30% of both caterpillars parasitized by tachinids and of all tachinid species reared. Goniini and Eryciini are also responsible for a fairly large number of parasitism events, although certain taxa well represented in D.H. Janzen and W. Hallwach's (2006) caterpillar rearing database, such as *Drino, Lespesia,* and *Belvosia* are noticeable rare or absent (and the eryciine species that were reared belong to only a handful of genera). *Leschenaultia* and other morphologically similar Goniini (e.g., *Gaediopsis*) were particularly conspicuous in the Yanayacu fauna both in terms of reared and hand collected specimens.

The subfamily Tachininae is fairly well represented, but in this case there seems to be a disconnect between the set of taxa that has been reared and what I have observed and collected by hand. From observations and hand-netting there appears to be an inordinate diversity of Tachinini, especially the "big fuzzy" taxa such as *Epalpus* and allied genera (e.g., *Lindigepalpus, Parepalpus, Eulasiopalpus*), yet very few Tachinini have been reared. This may be due to bias in the caterpillar hosts that were reared (e.g., perhaps few large caterpillar species were reared that were capable of hosting these bulky tachinids), or, perhaps more likely, a bias in the noticeability of these large and active tachinids (i.e., their abundance is overestimated due to their conspicuousness). In contrast, Siphonini are common and diverse in both the reared and my netted collections.

Figure 1. An unusual tachinid, *Telothyria* sp. (Telothyriini), reared from an unidentified pyralid feeding on *Hoffmannia* sp. (Rubiaceae).

Future Directions

Considerably more caterpillar sampling and rearing is needed before we can achieve a more complete picture of the richness of the community of caterpillar-attacking tachinids in this region and its composition. Although we have already reared many species, it is clear that we have sampled only a small fraction of tachinid species in this hyperdiverse community. Thus, we plan to continue our caterpillar rearing project as long as we can maintain funding. We plan to accompany this rearing with hand netting (in progress), pan trapping, and Malaise trapping in order to collect tachinids that attack hosts other than Lepidoptera for further taxonomic, ecological, and molecular study.

It is hoped that much of the material reared from this project will contribute to future taxonomic revisions and species descriptions. Many of the taxa listed here need to be examined in more depth to differentiate species and to determine identifications for those that have been named. One benefit of the rearing approach to collecting specimens employed in our study is that the host associations may provide ecological clues as to species limits and/or relationships. Another benefit is that for gregarious species, sexes can be associated preventing unnecessary and faulty descriptions of different sexes as distinct species. Ecological data can also help in this regard. DNA sequence data can also aid in delineating taxa and samples (mid-legs) are now being gathered for mtDNA sequencing of the reared tachinids. Altogether, it is clear that the great diversity of Tachinidae in the Ecuadorian Andes and their myriad associations with hosts will continue to provide new taxonomic specimens, new ecological data, and new hypotheses for many years to come.

Acknowledgements

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References

Gentry, G. and Dyer, L.A. 2002. On the conditional nature of Neotropical caterpillar defenses against their natural enemies. Ecology **83**: 3108–3119.

Guimarães, J.H. 1971. Family Tachinidae (Larvaevoridae). *In*: A catalogue of the Diptera of the Americas south of the United States. Vol. 104. São Paulo: Museu de Zoologia, Universidade de São Paulo. 333 pp.

Guimarães, J.H. 1977. Host-parasite and parasite-host catalogue of South American Tachinidae (Diptera). Arquivos de Zoologia **28**(3). 131 pp.

Janzen, D.H. and Hallwachs, W. 2006. Dynamic database for an inventory of the macrocaterpillar fauna, and its food plants and parasitoids, of the Area de Conservacion Guanacaste (ACG), northwestern Costa Rica. http://janzen.sas.upenn.edu

O'Hara, J.E. 2006. World genera of the Tachinidae (Diptera) and their regional occurrence. Version 2. PDF document, 70 pp. Available from: http://www.nadsdiptera.org/Tach/Genera/Gentach ver2.pdf (accessed 17-Jan-2007).

Stireman, J.O. III, O'Hara, J.E. and Wood, D.M. 2006. Tachinidae: evolution, behavior, and ecology. Annual Review of Entomology **51**: 525–555.

Artificial neural networks for insect identification (by J. Vaňhara[1*], N. Muráriková[2], I. Malenovský[3] and J. Havel[4])

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In contrast to wide applications in other sciences, e.g. chemistry, the use of artificial neural networks (ANN) in zoological taxonomy has been rather rare; e.g., in chemotaxonomic identification of limpets (Hernández-Borges *et al.* 2004), bioacoustic identification of Orthoptera (Chesmore 2004), or optically sensed aphids (Moore and Miller 2002), even despite the visionary review by Weeks *et al.* (1997) and the case spider study by Do *et al.* (1999) pointed out their great potential. Perhaps the first real dipterological application was used for the sandfly family Psychodidae (Marcondes and Borges 2000).

The ANN approach in model species from Diptera (Tachinidae) were tested and applied. We have examined possibilities of a supervised ANN methodology based on morphometric data for semi-automated insect identification (Havel and Vaňhara 2006, Vaňhara *et al.* 2006, Vaňhara *et al.* in press). We then tested the insect orders Thysanoptera (Fedor *et al.* in press) and Hemiptera (Psylloidea) (unpublished).

At first, appropriate diagnostic characters (variables) have to be selected and recorded for individual species of all specimens which are correctly identified by a taxonomist (expert). This is necessary to create a training database. Secondly, an ANN model is designed to find a relation between the characters (=*input*) and species (=*output*) (Fig. 1).

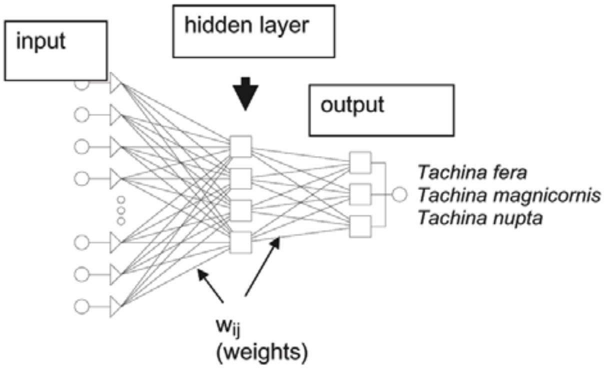

Figure 1. Optimal Artificial Neural Network architecture for classification of 3 species of *Tachina*.

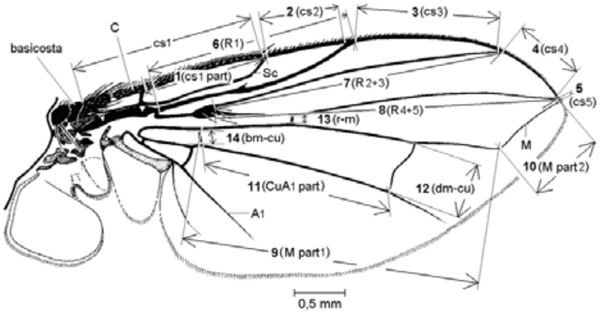

Figure 2. Measured wing characters in Tachinidae.

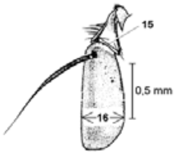

Figure 3. Measured antennal characters in Tachinidae.

We tested ANN for species identification of Diptera on several Central European species of Tachinidae (3 spp. of the genus *Tachina* Meigen: *T. fera* (Linnaeus), *T. magnicornis* (Zetterstedt), and *T. nupta* (Rondani); 2 spp. of the genus *Ectophasia* Townsend: *E. crassipennis* (Fabricius) and *E. oblonga* (Robineau-Desvoidy)), for which we examined altogether 113 specimens. The input data consisted of 17 morphometric characters for each specimen measured on wing and antenna (Figs. 2–3). Wings were digitally imaged, scaled and measured by means of an image analyser. Male and female (sex were recorded and included in input), and right and left wing data were partly analyzed separately. As the final step before ANN computation, we explored the data structure by factor and correlation analysis and checked it for errors. In both genera, a simple ANN architecture (multilayer perceptrons with 3 layers, Fig. 1) enabled a highly reliable classification with 95–100% of correctly identified specimens. The reliability of identification depended especially on the number of specimens available for the ANN training.

Conclusions

Provided the ANN are trained on a sufficiently extensive and reliable database, they represent a powerful tool for identification of insects and open new possibilities for taxonomy. A methodology similar to the above mentioned examples can be applied for any biological objects for which it is possible to select adequate diagnostic characters. Once designed and trained, the ANN enable fast and semi-automatic classification which is based on all the characters in the multivariate data set. Advantages of ANN methodology include the possibility to: (i) speed up the determination, (ii) lighten and partly automate the tedious routine work of an expert, and (iii) identify otherwise hardly distinguishable species or to indicate new, undescribed taxa.

Acknowledgements

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References

Chesmore, D. 2004. Automated bioacoustic identification of species. Anais da Academia Brasileira de Cięncias **76**: 435–440.

Do, M.T., Harp, J.M. and Norris, K.C. 1999. A test of a pattern recognition system for identification of spiders. Bulletin of Entomological Research **89**: 217–224.

Fedor, P., Malenovský, I., Vaňhara, J., Sierka, W. and Havel, J. In press. Thrips (Thysanoptera) identification using artificial neural networks. Agricultural and Forest Entomology.

Havel, J. and Vaňhara, J. 2006. Evaluation of the use of artificial neural networks in taxonomy: towards automating insect identification. *In*: 10th International Conference on Chemometrics in Analytical Chemistry: Chemometrics in the tropics: Nature, Medicine and Industry CAC-2006. Águas de Lindóia, Brasil, 10–15 September 2006, OP 01.

Hernández-Borges, J., Corbella-Tena, R., Rodriguez-Delgado, M.A., Garcia-Montelongo, F.J., and Havel, J. 2004. Content of aliphatic hydrocarbons in limpets (*Patella*) as a new way for classification of species using artificial neural networks. Chemosphere **54**: 1059–1069.

Marcondes, C.B. and Borges, P.S. 2000. Distinction of males of the *Lutzomyia intermedia* (Lutz & Neiva, 1912) species complex by ratios between dimensions and by an ANN (Diptera: Psychodidae, Phlebotominae). Memórias do Instituto Oswaldo Cruz **95**: 685–688.

Moore, A. and Miller, R.H. 2002. Automated identification of optically sensed aphid (Homoptera: Aphidae) wingbeat waveforms. Annals of the Entomological Society of America **95**: 1–8.

Vaňhara, J., Muráriková, N., Fedor, P., Malenovský, I. and Havel, J. 2006. Artificial neural networks for insect identification. Pp. 289–290. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Vaňhara, J., Muráriková, N., and Havel, J. In press. Artificial neural networks for identification of Diptera. Biologia.

Weeks, P.J.D., Gauld, I.D., Gaston, K.J., and O'Neill, M.A. 1997. Automating the identification of insects: a new solution to an old problem. Bulletin of Entomological Research **87**: 203–211.

Rearing of *Nemorilla pyste* (Walker) and *Nilea erecta* (Coquillett), parasitoids of leafrollers in Washington tree fruit (by N.G. Wiman and V.P. Jones[1])

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Introduction

The obliquebanded leafroller (OBLR), *Choristoneura rosaceana* (Harris), and *Pandemis* leafroller (PLR), *Pandemis pyrusana* (Kearfott) are important tortricid pests of pome and stone fruits in the Columbia River Basin of central Washington (Fig. 1). At least five tachinid species are known to attack larvae of these native bivoltine defoliators in orchards. In a recent regional survey of leafroller parasitism in unsprayed apples, tachinid parasitism accounted for 56% of all parasitism of OBLR and PLR over a three-year period (V.P. Jones, unpublished data). Tachinid parasitism was predominantly attributed to two native species, *Nemorilla pyste* and *Nilea erecta*, which are the focus of this dissertation research. The ecological interactions of these tachinids with leafrollers in orchards are poorly understood.

The goals of this research can be summarized by three main objectives. The first is to determine the potential for the parasitoids to limit host population growth (primarily OBLR). Data will be collected to complete a life table for each tachinid species, which will be used to model parasitoid population growth and project impacts on host populations (Carey 1993). These data will be extracted from laboratory and field studies of longevity and reproduction (fecundity, fertility, and parasitism success). The second objective is to evaluate how tachinid parasitism of leafrollers occurs in the field. This will entail experiments that examine over-wintering (seasonal synchronization), host finding, and mate finding of the parasitoids. In the third objective, impacts of pest management on tachinid populations will be examined. Of particular interest are the effects of insect growth regulators, which are predicted to have pronounced effects on the endoparasitic life stages of the tachinids because of potential interaction with the host endocrine dynamics (Baronio and Sehnal 1980, Plantevin *et al.* 1986). Clearly, these objectives cannot be accomplished without establishment of colonies of the model organisms in the laboratory. This paper summarizes my efforts to rear *N. pyste* and *N. erecta*, and briefly discusses some of the significant findings from these experiments.

Figure 1. The Columbia River Basin in Washington is a diverse agricultural region known for its tree fruit. Native habitat is characterized by shrub steppe at the lower elevations. Riparian habitat occurs along waterways that drain the Cascade Mts. and irrigation canals, and coniferous forest dominates the higher elevations.

Materials and Methods

In 2006, 308 tachinid-parasitized leafrollers were recovered from six conventionally managed, and two organically managed, apple or cherry orchards. The geographic spread of sites was approximately 180 km from north to south. Parasitoids were collected from field populations of leafroller larvae, and from colony-reared sentinel OBLR larvae placed in the field (OBLR colony is maintained at WSU-TFREC). Parasitized larvae were distinguished by the presence of tachinid eggs on the larval body, or on the cast cuticle or head capsule of larvae and pupae.

Figure 2. *Nemorilla pyste* attacking a colony-reared OBLR in an artificial diet cup. Note tip of ovipositor under antennae of parasitoid and white eggs behind head of host.

Field exposure to insecticides in both conventional and organic orchards is thought to be the cause of high mortality among the collected parasitized larvae; just 50 male and 45 female *N. pyste*, and 14 male and 6 female *N. erecta* were successfully reared to the adult stage. Field-parasitized larvae were placed individually on pinto-bean diet in small cups. After leafroller pupation and the subsequent emergence of the tachinid from the host, puparia were removed from diet cups and placed in small Petri dishes (5 cm diam.) where flies were reared to the adult stage. Species identifications were made using puparial and adult characters described in a recent taxonomic paper (O’Hara 2005), and by comparison with voucher specimens (det. Jim O’Hara). Adult flies were sexed using morphology of genitalia, and were placed in 1 m^3 cages consisting of wood frames with clear vinyl walls, screen floors, and fitted with mesh nylon tops that can be tied, which allowed cage contents to be accessed without risking escape of flies. No more than 10 mating pairs of adult flies were placed in each cage at any time. Dispensers for water and honey-water were provided in each cage. Small tubes (100 ml) filled with water were used to provide a growing medium for clipped apple foliage, and fourth through sixth instar colony-reared OBLR were placed on leaves. These artificial “trees” were placed through the tops of cages, and were removed daily so that leafroller larvae could be checked for parasitism. Rearing cages were exposed to sunlight (or natural light) through a window for part of each day to encourage mating, and then placed in an incubator (22°C, 70% RH, 16L: 8D). Because of concern that the flicker frequency of magnetic ballast fluorescent lighting in the incubator was well below the level detectable by the flies, it was supplemented with electronic ballast fluorescent lighting, which has a flicker speed (≈ 40,000 Hz) above the flicker fusion rate of higher Diptera (≈ 350 Hz) (Autrum 1958). Anecdotally, reproduction did not occur when magnetic ballast lighting was used exclusively. While this rearing method was highly successful with *N. pyste*, it was less so with *N. erecta* (though for other reasons, see Results). However, with the approach of winter, apple foliage became unavailable because of tree senescence, the photoperiod decreased, and it became clear that another method would be necessary to sustain the colonies through the winter months.

Foliage ultimately proved to be unnecessary for rearing *N. pyste*; flies easily recognize and parasitize their hosts feeding on artificial diet in plastic cups (Fig. 2). This species is now reared in growth rooms under the same photoperiod (delivered via electronic ballast fluorescent lighting) and humidity, but with the addition of a direct halogen light source for several hours a day to simulate direct sunlight. Mating is typically observed during the period when the halogen light is on. All cage-parasitized OBLR larvae were placed on artificial diet in small cups, where their head capsule width was measured to determine larval instar. Host development was monitored daily until tachinids emerged, typically from pupae, or in cases where parasitism was not successful, the adult leafroller emerged.

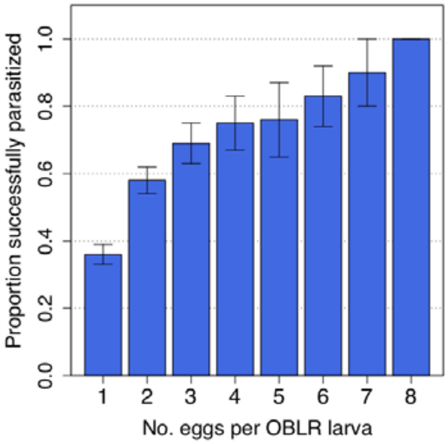

Figure 3. Parasitism success of *Nemorilla pyste* as a function of the number of eggs per host larva (n=126).

Results and Discussion

<u>Nemorilla pyste</u>: Mating in cages was observed frequently two days after adult emergence, and parasitized larvae began to appear roughly 3 days later. The sex of emerging *N. pyste* adults was not related to the number of eggs per host larva, or the size of larvae attacked (ANOVA). The maximum number of eggs per leafroller was 12, although the average was 2.09 (± 1.68) eggs among all larvae attacked (n = 567). The maximum number of eggs per larva from wild and sentinel *N. pyste* collections was 8, and the mean was 1.12 (± 1.01). Eggs were typically oviposited dorsally on or near the host pronotum or head, presumably a location where host disturbance is unlikely, but eggs also occurred on the ventral surface and abdominal body regions. The success of *N. pyste* parasitism increased as a function of the number of eggs oviposited on hosts (Fig. 3), possibly indicating low egg fertility or survival. Under this hypothesis, higher numbers of eggs on hosts may simply increase the likelihood that one or more first instar maggots will survive and enter the host. However, this relationship could also reflect host vulnerability. Caged females have been observed to congregate around, and alternately oviposit on, individual host larvae (Fig. 4). Of the larvae presented to caged flies, certain individuals are never attacked, while others are attacked repeatedly. Perhaps certain host larvae are more attractive than others because *N. pyste* are more successful in parasitizing them.

Figure 4. Two *Nemorilla pyste* females taking turns attacking an OBLR larva. Arrow points to ovipositor that has been brought forward under the body to lay an egg on the host.

Host vulnerability is largely determined by the schedule of host molting, and may be the most important factor determining parasitism success for *N. pyste* targeting OBLR. *Nemorilla pyste*, like other Winthemiini, are at a disadvantage relative to more derived Tachinidae in terms of host molting (Wood 1987). Parasitism success, as discussed here, entails the death of the host and subsequent emergence of at least one parasitoid from the host body. The percentage of successful attacks of *N. pyste* on fourth through sixth instar OBLR was low (51%). Preliminary results from dissection of parasitized larvae over a time gradient from oviposition indicate that eggs must survive on the host for 6 days before hatching can occur. At constant 22°C, OBLR larvae spend an average of 4 and 9 days as fourth and fifth instar larvae, respectively. Similar data are not available for sixth instars, but a longer interval is expected. Therefore, the likelihood of *N. pyste* eggs surviving the entire development period on the host without being cast with the host exoskeleton during a molt is lower on fourth compared to fifth and sixth instar OBLR. This result suggests there should be selection pressure on adult females to choose larvae at the time when the inter-molt interval is the longest. In the field, fifth and sixth instars were the most targeted stages of OBLR (V.P. Jones, unpublished data). The preference of *N. pyste* for later instar larvae, which molt at longer intervals than earlier instars, seems to support the idea that females can determine host suitability at least at a rudimentary level. The question then, is whether the mechanism goes beyond simply assessing the size of host larvae. Because the molt history of individual larvae was not tracked in this experiment, and egg fertility rates have not yet been determined, it is impossible to rule out either of these hypotheses at this time.

Adult *N. pyste* were remarkably long-lived under laboratory conditions (Fig. 5), and egg production occurred over most of adult female life. Females lived longer than males. Future experiments will address survival of the tachinids in the field, as lab-derived longevity estimates are typically not realistic assessments of field survival due to constant temperatures, provision of nutritional supplements, and lack of factors that cause mortality in the field. Survival will be monitored in field cages that cover entire trees in the field in the coming field season.

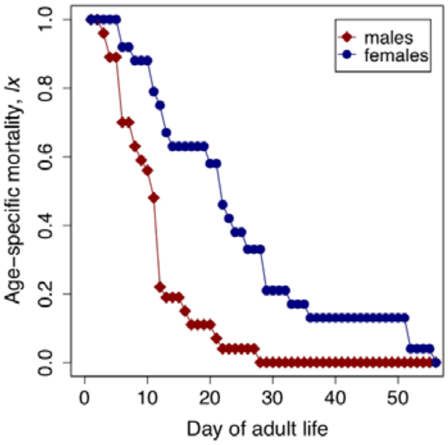

Figure 5. Longevity of 27 male and 24 female *Nemorilla pyste* adults in rearing cages.

<u>*Nilea erecta*</u>: Although mating of *N. erecta* was observed in rearing cages, host larvae were not visibly parasitized and therefore most larvae were not reared. This later proved to be a mistake when *N. erecta* were found emerging from some OBLR that had been exposed to the adult flies in cages. While oviposition of *N. erecta* has not been documented, the assumption was that eggs would be external (O'Hara 2005). However, egg chorion has not been found on the cuticle of OBLR exposed to *N. erecta* in cages. This is not to discount the possibility that the thin chorion to be expected of an eryciine egg was not missed due to inexperience, or rapid detachment from the host. Although the ovipositor of *N. erecta* is of the tubular telescoping type, the mode of attack remains unclear. This finding does explain why so few of this species were collected in 2006. Because larvae associated with obvious external tachinid eggs were the only wild and sentinel larvae that were reared, larvae that yielded *N. erecta* had also been parasitized by externally ovipositing tachinid species (multiparasitism). With no clear external physical indication of *N. erecta* parasitism on host larvae (at least until the appearance of respiratory funnels approximately 5–7 days after exposure to female flies), future experiments with this species will entail rearing of all leafroller larvae exposed to gravid adult females. Rates of *N. erecta* parasitism success relative to *N. pyste* are expected to be higher, because embryonated eggs are not at risk of being shed by hosts during molts due to their ephemeral nature. One interesting question regarding this species is whether there will be much host instar preference, as the intermolt interval of the host should be less important for a species that does not depend on its egg surviving on a host for the entire period between molts.

Acknowledgements

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<u>References</u>

Autrum, H. 1958. Electrophysiological analysis of the visual systems in insects. Journal of Experimental Cell Research Supplement **5**: 426–439.

Baronio, P. and F. Sehnal, F. 1980. Dependence of the parasitoid *Gonia cinarascens* on the hormones of its lepidopterous hosts. Journal of Insect Physiology **26**: 619–626.

Carey, J.R. 1993. Applied demography for biologists with special emphasis on insects. Oxford University Press Inc., New York. 206 pp.

O'Hara, J.E. 2005. A review of the tachinid parasitoids (Diptera: Tachinidae) of Nearctic *Choristoneura* species (Lepidoptera: Tortricidae), with keys to adults and puparia. Zootaxa **938**: 1–46.

Plantevin, G., Grenier, S., Richard, G. and Nardon, C. 1986. Larval development, developmental arrest, and hormone levels in the couple *Galleria mellonella* (Lepidoptera – Pyralidae) – *Pseudoperichaeta nigrolineata* (Diptera – Tachinidae). Archives of Insect Biochemistry and Physiology **3**: 457–469.

Wood, D.M. 1987. Tachinidae. Pp. 1193–1269. *In*: McAlpine, J.F., Peterson, B.V., Shewell, G.E., Teskey, H.J., Vockeroth, J.R. and Wood, D.M., eds., Manual of Nearctic Diptera. Volume 2. Agriculture Canada Monograph **28**: i–vi, 675–1332.

A new host record for *Bactromyia aurulenta* (Meigen) (Diptera: Tachinidae) (by Jaakko Pohjoismäki)

A collector brought to the author four pinned flies with empty puparia, one puparium with a dead fly, and a host cocoon. The fly larvae had been overwintering inside a single host pupa and exited the host when it was brought to room temperature. The host was collected in Luopioinen, Finland (61°25'N 24°47'E, 100m) in autumn 2005. From the brood of five fly larvae, four managed to develop into adults. The host was identified as *Poecilocampa populi* (L.) (Lepidoptera: Lasiocampidae), the so-called December moth, by Mr. Matti Ahola and Dr. Kimmo Silvonen, Finland, based on dissected pupal remains.

The flies that emerged from the host were identified as *Bactromyia aurulenta* (Meigen) by the author using the key by Tschorsnig and Herting (1994). This identification was confirmed by Mr. Christer Bergström, Sweden. Confusingly, two of the fly specimens lack the median discal bristles on abdominal tergites 3 and 4 that are typically present in *B. aurulenta* (couplet 226, Tschorsnig and Herting 1994: 37). *Bactromyia aurulenta* is fairly polyphagous on Lepidoptera, having been reported from Drepanidae, Geometridae, Lycaenidae, Noctuidae, Notodontidae and Yponomeutidae (Ford and Shaw 1991, Belshaw 1993, Tschorsnig and Herting 1994, Ford *et al.* 2000).

Acknowledgements

I would like to thank Mr. Christer Bergström, Sweden for confirming the identity of the abnormal *B. aurulenta* specimens.

References

Belshaw, R. 1993. Tachinid flies. Diptera: Tachinidae. Handbooks for the identification of British Insects. Royal Entomological Society of London 10, Part 4a(i). 170 pp.

Tschorsnig, H.-P. and Herting, B. 1994. Die Raupenfliegen (Diptera: Tachinidae) Mitteleuropas: Bestimmungstabellen und Angaben zur Verbreitung und Ökologie der einzelnen Arten. Stuttgarter Beiträge zur Naturkunde (A) **506**. 170 pp.

Ford, T.H. and Shaw, M.R. 1991. Host records of some West Palearctic Tachinidae (Diptera). Entomologist's Record and Journal of Variation **103**: 23–38.

Ford, T.H., Shaw, M.R. and Robertson, D.M. 2000. Further host records of some West Palearctic Tachinidae (Diptera). Entomologist's Record and Journal of Variation **112**: 25–36.

2007 Field Meeting of the North American Dipterists Society (by Jim O'Hara)

I do not typically advertize the field meetings of the North American Dipterists Society (NADS) in this newsletter, but I am making an exception this time because I am organizing the 2007 meeting and have selected a venue that is superb for tachinid collecting. The NADS meetings are held every two years at a different location in North America and combine Diptera collecting with paper presentations. There are typically 25–35 participants, comprising professional dipterists, students, and interested amateurs.

Figure 1. *Paradejeania rutilioides* (Jaennicke) on maple in Manzano Mountains, New Mexico. This robust tachiniine is one of the larger tachinids in the American Southwest (ca. 18mm in length) and is common in the mountains north of Silver City.

The 2007 meeting will take place in Silver City, New Mexico, on 13–16 August 2007. This is an area I have visited about a dozen times since 1980 and offers what I consider to be the best tachinid collecting in America north of Mexico. The small city of Silver City is situated on the Continental Divide at 6000 feet. To the north is the Gila National Forest, to the south is pinyon pine–juniper woodland and desert, and to the west the Gila river and its associated riparian habitat. There are hilltops, meadows and canyons where a great diversity of tachinids can be found (Figs. 1–2), including quite a number of new species.

Figure 2. *Trixodes obesus* Coquillett on tree trunk at Cherry Creek campground north of Silver City. This large dexiine (up to 20mm in length) is rare in collections but males can occasionally be found singly on large sunlit tree trunks, generally in Ponderosa pine habitat.

I have already provided many details about the 2007 NADS field meeting in the last issue of *Fly Times* (issue 37, 2006, pp. 5–7), including a few embedded pictures and an associated file of additional images of the Silver City area (click here to access this PDF file). For those readers seeking additional information about tachinid collecting in the Silver City area or more generally in Arizona and New Mexico, see my reports of field trips in these earlier issues of *The Tachinid Times*: issue 7 (1994, pp. 4–6), issue 8 (1995, pp.6–8), issue 9 (1996, pp. 4–5; including a list of hilltopping Tachinidae), issue 13 (2000, pp. 4–7), and issue 15 (2002, pp. 3–4; spring collecting in Sonoran desert).

Additional details about the 2007 NADS field meeting will be provided in the April 2007 issue of *Fly Times* (watch for issue 38 on the *Fly Times* homepage). Interested persons are welcome to contact me for further information about the meeting or collecting opportunities in the area.

Annotated tachinid-host catalogue for the Czech Republic – Preliminary information (by J. Vaňhara[1*], H.-P. Tschorsnig[1], P. Mückstein[2] and V. Michalková[3]

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An annotated host catalogue is currently being prepared for the Tachinidae of the Czech Republic. It comprises about 150 of the 474 known species of Tachinidae from this country (i.e., about 30% of the total fauna of tachinids). After 130 years of research on host-parasitoid relations of Czech Tachinidae, the complete bibliography includes nearly 90 papers by more than 40 researchers.

The tachinid fauna of the Czech Republic has been studied since the first faunistic record of 1791 (Preyssler 1793), but the faunal diversity is still incompletely investigated, as in many other European countries. A new Checklist of the Tachinidae known from the Czech Republic can be accessed online (Vaňhara and Tschorsnig 2006).

There is a long history of the study of hosts from the territory of the present Czech Republic, but as the Tachinidae were not always identified by specialists, there are some published host records that must be regarded as doubtful or even wrong according to our present knowledge. Many of the host records are scattered throughout the literature, often only mentioned in passing or in remarks.

The first host records of Tachinidae from the area of the present-day Czech Republic date from the second half of the 19th century; i.e., the records published by F.A. Wachtl (papers between 1873–1895), which were mostly revised by Tschorsnig and Herting (2005). The next oldest information was provided by Brauer and Bergenstamm (1895). Some findings from the “Collectio Bergenstamm” (housed in the Museum of Natural History in Vienna, see Herting 1960), came from the lepidopterist Ritter von Stein, who lived and collected in west Bohemia. Brauer and Bergenstamm (1895) also mentioned some material from Znojmo that was published by Wachtl (see above). Known Czech entomologist A. Vimmer (papers between 1907–1938) was the one who dealt with butterfly hosts of tachinids at the beginning of the 20th century. Tachinids were intensively studied by forestry researchers for pest control between World Wars I and II (several authors). One result of this period was the first parasitoid catalogue on *Lymantria monacha* (L.) (several authors). The material from this period of Czech forest research was mostly revised by B. Herting, who used the results in part for his publication on the biology of tachinids (1960). At the end of the 1930s, some research was organized by foreigners to study parasitoids of European forest pests that had been introduced into Canada. Two papers on hosts in their pupal stage, which were massively exported from central European countries for purposes of biological control, were published later (Finlayson and Finlayson 1958a, 1958b). Also, the agriculture research branch, especially of the Czech sugar industry, searched for new ways to combat sugar-beet pests using biological control methods (F. Rambousek). Between 1933–1942, D. Jacentkovský recorded several hosts of tachinids in Moravia and Silesia, though his papers were rather focused on faunistics with a special emphasis on practical forestry. From the 1950s on, J. Čepelák systematically studied hosts, particularly in cooperation with M. Čapek and some others. Although their papers were predominantly focused on Slovakia, there were also some records from the Czech Republic. Applied forestry research has also brought new knowledge about the hosts of tachinids during this period (several authors). Some host information from the Czech Republic was also used in the compendious forest monograph of Pschorn-Walcher (1982).

Recently there have been attempts to systematically search for new hosts of tachinids (e.g., Mückstein *et al.* 2004, in press).

Acknowledgements

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References

Brauer, F. and Bergenstamm, J.E. von. 1895. Die Zweiflügler des Kaiserlichen Museums zu Wien. VII. Vorarbeiten zu einer Monographie der Muscaria schizometopa (exclusive Anthomyidae). Pars IV. Denkschriften der Kaiserlichen Akademie der Wissenschaften. Wien. Mathematisch-Naturwissenschaftliche Classe **61** (1894): 537–624.

Finlayson, L.R. and Finlayson, T. 1958a. Notes on parasites of Diprionidae in Europe and Japan and their establishment in Canada on *Diprion hercyniae* (Htg.) (Hymenoptera: Diprionidae). Canadian Entomologist **90**: 557–563.

Finlayson, L.R. and Finlayson, T. 1958b. Notes on parasitism of a spruce sawfly, *Diprion polytomum* (Htg.) (Hymenoptera, Diprionidae), in Czechoslovakia and Scandinavia. Canadian Entomologist **90**: 584–589.

Herting, B. 1960. Biologie der westpaläarktischen Raupenfliegen. Dipt., Tachinidae. Monographien zur angewandte Entomologie **16:** 1–188.

Mückstein, P., Tschorsnig, H.-P. and Vaňhara, J. 2004. Some new host records of west Palaearctic Tachinidae (Diptera). *In*: Bitušík P., ed., Dipterologica bohemoslovaca 12. Acta Facult. Ecol., Zvolen **12**: 111–113.

Mückstein, P., Tschorsnig, H.-P., Vaňhara, J. and Michalková, V. In press. New or interesting host records for some European Tachinidae (Diptera). Entomologica Fennica.

Preyssler, J.D. 1793. Beobachtungen über Gegenstände der Natur auf einer Reise durch den Böhmerwald im Sommer 1791. Sammlung Physikalischer Aufsätäze, Dresden **3**: 135–378.

Pschorn-Walcher, H. 1982. Unterord. Symphyta, Pflanzenwespen. Pamphiliidae, Gespinsblattwespen. Pp. 23–57. *In*: W. Schwenke, ed., Die Forstschädlinge Europas. Vol. 4: Hautflügler und Zweiflügler. P. Parey, Hamburg and Berlin.

Tschorsnig, H.-P. and Herting, B. 2005. Die Raupenfliegen-Sammlung Friedrich A. Wachtl (Diptera: Tachinidae). Veröffentlichungen des Tiroler Landesmuseums Ferdinandeum Innsbruck **84** (2004): 181–236.

Vaňhara, J. and Tschorsnig, H.-P. 2006. Tachinidae Robineau-Desvoidy 1830. *In*: Jedlička L., Stloukalová, V. and Kúdela, M., eds., Checklist of Diptera of the Czech Republic and Slovakia. Electronic version 1. http://zoology.fns.uniba.sk/diptera ISBN 80-969629-0-6.

Abstracts from the Sixth International Congress of Dipterology (from Abstracts Volume edited by M. Suwa)

The Sixth International Congress of Dipterology was held in Fukuoka, Japan, from 23–28 September 2006. Below are reprinted the abstracts of the ten oral and five poster presentations on the Tachinidae that were given at the Congress. Author contact information is given in the Mailing List if not otherwise provided.

Comparative morphology of "*Sturmia*-spots" in male tachinids – first results (Diptera: Tachinidae) (Oral presentation by P. Cerretti, A. Di Giulio[1] and M. Scalici[1])

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Sturmia-spots (also referred to in the literature as "patches of appressed hairs") are hairy areas variable in shape and size, situated in various positions on the abdominal tergites (3–5) of some genera of Exoristinae and in the phasine genus *Besseria*. Though used by taxonomists as diagnostic features, these structures have never received much attention concerning their morphology and biological function. A careful observation of these structures in many specimens of different species and genera showed that the appressed hairs are glued together by viscous substances (often crystallized), hence the hypothesis of a possible glandular function of these areas. This hypothesis represented the starting point of the present comparative morphological and histological study of these structures in 7 genera and 13 species. The fine morphological analysis carried out by SEM highlighted a great variety of different types of spots. In most cases they appear as more or less depressed areas of the cuticle, well distinct and rounded; otherwise they are wide and scarcely defined, occupying part or most of the ventral, lateral and dorsal surface of the tergites, or they arise from non-depressed areas. All types are characterized by modified setation, composed by brushes of elongate and thick setae or by thinner, shorter setae, set more tightly together than normal. All setae are deeply corrugated longitudinally like the setae external to the spots. Close to the base of each seta, and slightly anteriorly, a glandular area composed by a variable number of small pores is evident (this area is present only at the base of setae forming the spot); curls of whitish substance have been observed emerging from these pores. The spots show a microsculpture that can be more or less crowded than normal; a peculiar type of microsculpture, filiform, elongate and strongly packed is also present in some species. The preliminary cytological analysis shows a modified epithelium in correspondence to the spots, characterized by enlarged cells appressed at the base of the hairs, in some cases with evident glandular ducts. The results obtained so far, though preliminary, seem to confirm the initial hypothesis that such appressed hairs could be part of a more complex exocrine glandular tissue, and are possibly functional to the spreading of substances secreted by the glands. Future developments include the analysis of the secreted substances and the cytological analysis by TEM of the cells identified, to evaluate homologies and to argue evolutionary implication of such structures.

Egg placement of the tachinid fly *Sturmia bella* on leaves of the evergreen milkvine *Marsdenia tomentosa* and the feeding habit of its host butterfly *Parantica sita* (Oral presentation by N. Hirai and M. Ishii)

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We investigated the egg placement of the microtype tachinid fly *Sturmia bella* on leaves of the evergreen milkvine *Marsdenia tomentosa*, one of the foodplants of the host butterfly *Parantica sita*, in the southern Kinki district of Japan. Most *S. bella* eggs were found on the undersurface of young *M. tomentosa* leaves around leaf tips or along leaf margins. Choice of oviposition sites was independent of leaf size and existence of leaf damage made by the host larvae. *P. sita* changed its feeding patterns with larval development and left three types of characteristic feeding marks on *M. tomentosa* leaves. Since fourth and fifth instar larval *P. sita* ate the marginal areas, apical areas and sometimes even entire leaves, most *S. bella* eggs are considered to be ingested during these stages. Both female adults and larvae of *P. sita* showed no age preference for the *M. tomentosa* leaves. The relationship between the feeding habit of *P. sita* and the egg placement of *S. bella* on *M. tomentosa* is discussed.

Life history parameters of the parasitoid fly *Zenillia dolosa* (Diptera: Tachinidae) (Poster presentation by G. Ho Thi Thu and S. Nakamura)

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Life history parameters of the tachinid fly, *Zenillia dolosa*, that lays microtype eggs on host plants of some lepidopteran larvae was studied in the laboratory at 25˚C, 60–70% RH and 16L: 8D photoperiod on the host *Mythimna separata*. Newly emerged and mated females started laying eggs on host food plants approximately 6 days after emergence. The duration of mating averaged 90 min. Females of *Z. dolosa* showed a daily oviposition rate of 70 eggs and oviposited 900–2600 eggs in total during their mean longevity of 25 days, which was not significantly different from longevities of unmated females and males. We also discuss about effects of the number of eggs eaten by a host on developing time, body size of the parasitoid and percentage parasitism.

The role of tachinid fly complex in the population dynamics of the mulberry tiger moth (*Lemyra imparilis* (Butler)) in western Japan (Poster presentation by M. Hondô)

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The mulberry tiger moth, *Lemyra* (=*Thanatarctia*, *Spilarctia* or *Spilosoma*) *imparilis* (Butler), is a univoltine arctiid moth, of which is distributed throughout Japan. Population density of the moth increases and decreases in southwestern Japan. The larvae in spring are often a serious insect pest of various crops such as citrus, pears and vegetables, when the density is high. To evaluate the effect of parasitoids and pathogens on *L. imparilis* larvae, sprig larvae of *L. imparilis* were collected every year from three sites in the Kinki region, western Japan during the periods of 1990–1994 and 2003–2005. Mortality of spring larvae caused by parasitoids and pathogens decreased with increasing density and increased at decreasing phase. Mortality by parasitic wasps (two species) decreased with increasing density and increased with decreasing density. Mortality by pathogens (one virus, one fungi and one bacteria) was low value except at the peak density. In contrast, mortality by tachinid flies was constant (15–20%) with the host density. Five species of tachinid flies, *Carcelia rasa*, *Carcelia* sp., *Thelaira nigripes*, *Pales angustifrons* and *Compsilura concinnata* were found. *Carcelia* was the most abundant species (50% of all flies emerged), followed by *T. nigripes* (35%), *P. angustifrons* (8%) and *C. concinnata* (7%). From spring larvae of *L. imparilis*, firstly *C. concinnata* emerged from the 7th instar larvae, followed by *Carcelia* (from the 8th instar larvae), *T. nigripes* (from the 8th and 9th instar larvae) and *P. angustifrons* (from the pre-pupae). It is suggested that tachinid fly complex is a major and constant mortality factor in spring larvae of *L. imparilis* in the Kinki region, Japan.

Larval behaviour of the tachinid fly, *Compsilura concinnata*, within the host midgut (Oral presentation by R. Ichiki[1], Y. Nakahara[2] and S. Nakamura[1])

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How and where they live within the body of their host is very important for endoparasitic insects. Immature parasitoids must defend themselves from host immune systems, obtain nutrition, and respire. The larva of *Compsilura concinnata* (Meigen) (Diptera: Tachinidae) stays in the midgut of the host during the larval stage and achieves respiration by utilizing the tracheae of the host. In this study, heretofore never attempted, we directly observed the behaviour of *C. concinnata* larva from the penetration into the midgut through to the achievement of respiration. The last instar larva of a noctuid, *Mythimna separata* Walker (Lepidoptera: Noctuidae), was dissected alive and exposed the midgut. *C. concinnata* larva was then applied to the exposed midgut of *M. separata*. The larva of this tachinid made an opening on the wall of the midgut using the anterior portion of head skeleton and then entered into the cavity between the peritrophic membrane and the midgut wall of the host. The crawling larva searched for the host trachea and then pulled it by using its anterior portion of head skeleton. On the pulled point, the fly larva turned its body around and attached the posterior abdominal spiracle to the drawn trachea. The midgut lumen appeared to be an ideal place for *C. concinnata* larva to escape from the host immune response and to evade aggressive competitors.

Host habitat and host location behavior in the tachinid fly, *Exorista japonica* (Oral presentation byY. Kainoh[1], C. Tanaka[1], R. Ichiki[2], Y. Yamawaki [3] and S. Nakamura[2])

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We demonstrated by a wind tunnel bioassay that the tachinid fly, *Exorista japonica*, is attracted to corn plants damaged by the noctuid larva, *Mythimna separata*. Mated female flies oriented to damaged corn plants, but did not respond to undamaged corn plants. This orientation occurred to the damaged plant itself, but not the host larva or larval frass. In order to test the effect of plant color, blue, green, yellow and red paper models were placed in front of damaged corn plants hidden with a mesh screen. The landing rate of flies was highest on green and lowest on red paper models. In addition, flies did not respond to the green model without a damaged plant or in the presence of a healthy plant. The behavior of flies to chemicals in the host frass were tested by placing a filter-paper patch treated with the frass in a plastic cage. Flies stayed longer in a patch treated with host frass or host frass extracts than in untreated patches and this response was dose-dependent. Responses were strongest to the methanol extract among several solvents. These experiments indicate that *E. japonica* females find the host habitat not only by long-range olfactory cues (damaged plant odor) but also visual cues (plant color), and once in a host habitat they tended to stay longer in a patch with close-range olfactory cues (host frass). Finally, flies use visual cues to attack the host larvae.

<u>Dipterological research by the National Centre for the Study and Conservation of Forest Biodiversity (CNBF), Verona – Bosco della Fontana (Italy)</u> (Poster presentation by F. Mason[1], D. Avesani[1], M. Bardiani[2], D. Birtele[2], P. Cerretti[1], S. Hardersen[2], G. Nardi[2], M. Tisato[1] and D. Whitmore[2])

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During the last ten years, the National Centre for the Study and Conservation of Forest Biodiversity of Verona – Bosco della Fontana (Italy) has been involved in a series of faunistic and ecological studies in Italy, including two LIFE-Nature projects and the CONECOFOR programme (part of the ICP Forests network for long-term monitoring of forest ecosystems). The first LIFE project (1999–2003) was focussed on the study of the ancient oak-hornbeam forest Reserve of Bosco della Fontana (Mantova), and resulted in the finding of over 500 Diptera species, over 50 of which new for Italy, as well as of two Mycetophilidae (*Leia padana* Chandler, *L. fontana* Chandler) and one Phoridae (*Megaselia mantuana* Gori) new to science. A study of the Apennine beach-wood belt in 2000–2001 yielded over 850 Diptera species, including 200 new records for Italy and 5 Hybotidae new to science (*Platypalpus pseudoalter* Raffone, *P. pseudostroblii* Raffone, *P. submaculus* Raffone, *P. subpectoralis* Raffone, *Tachypeza subnubila* Raffone). Many interesting faunistic records and several species new to science (e.g. the Tachinidae *Pales abdita* Cerretti, *P. marae* Cerretti, *Pseudogonia metallaria* Cerretti), some of which still awaiting description, were found during a two-year monitoring scheme (2003–2005) in 12 Italian CONECOFOR permanent plots. In a second LIFE project, currently being carried out in a riparian forest at Vincheto di Celarda (Belluno, NE Italy), tree-crown dipteran communities are being investigated with aerial Malaise traps. With an agreement protocol recently stipulated between the Nature Protection Department of the Italian Ministry for the Environment and the Italian State Forestry Service, the CNBF has been put in charge of monitoring the state of Natura 2000 and CONECOFOR sites in Italy: a network of six entomological labs (CORIN) is being established for this task. Dipterologists wishing to take part in these schemes are kindly invited to contact the CNBF.

<u>Mating behaviour of the parasitoid fly: female choice for large males?</u> (Oral presentation by S. Nakamura and R. Ichiki)

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Although there have been many works on oviposition behaviour and strategies of female parasitoids, studies on behaviour of male parasitoids are very few. In most species of parasitoid wasps, females are usually larger than males, and the advantages of being larger are believed to be relatively less for males than females. Therefore, many studies on behaviour and body size of parasitoids have focused only on those of females. Parasitoid flies are not exceptional in this trend, but in *Exorista japonica* (Diptera: Tachinidae), a gregarious endoparasitoid of lepidopteran larvae, males are on average larger than females. In this species males try to overtake and grasp females without any specific premating behaviour. They usually grapple females on the ground, and females struggle vigorously to get rid of males. When a male seizes a female, males can successfully copulate with females. We conducted an experiment on how male body size affected its mating success. We divided males and females into three different body size groups and observed combinations of mating pairs. While large males could mate with all sizes of females, smaller males had difficulties in mating with females larger than themselves. Large males could thus control female resistance against male mating attempts and males enjoy the advantage for being large. As *E. japonica* takes 5–6 hr for mating which is longer than reported mating durations of other species of tachinid flies, this long duration could be a mating guard behaviour, even females of this species are believed to mate only once in their life time. We also examined a possibility of multi-mating of females and discuss whether females intend to choose a large male for mating to increase their fitness.

Diptera collections in Japan (Oral presentation by H. Shima)

Diptera collections in Japan are rather scatteringly housed in universities or museums. Here are introcuded some large collections of Diptera in Japanese institutes. Hokkaido University, Sapporo, has one of the biggest insect collections in Japan. Matsumura collection contained many types of Diptera in early entomological study of Japan. Others are Shiraki collection (Syrphidae, *et al.*), Takano collection (Tachinidae, Sarcophagidae) and Suwa collection (Anthomyiidae and muscoids, many types); rather big general collection of Diptera are sorted into familes; general collection of Nepales insects also contains many Diptera. National Institute of Agro-environmental Sciences, Tsukuba, houses the type specimens of Syrphidae by Shiraki and other general collection of Diptera which are sorted into to families. National Science Museum, Natural History, Tokyo, recently took over big Diptera collections: Chironomidae of Sasa collection (mainly from Japan), Drosophilidae and some some other acalypterate Diptera of Okada collection (from Japan, Oriental and Oceanian regions), Muscidae, Sarcophagidae and Calliphoridae of Kano, Shinonaga and Kurahashi collections (mainly from Japan, Oriental and Oceania regions, some from Afrotropical); these collections were well studied and contain many type species. Osaka Museum of Natural History, Osaka, has recently received two big collections: Agromyzidae and some other Acalypterae of Sasakawa collection and Brachycera of Nagatomi. Ehime University, Matsuyama, has collections of Brachycera and general acalyptrate and calyptrate Diptera in the Entomological Laboratory. Kyushu University, Fukuoka, has big insect collections in Entomologial Laboratory and Biosystematics Laboratory; the former houses types of Tipulidae (from Japan) by Alexander and Tokunaga, Dixiidae (from Japan) by Takahashi, Chironomidae and some other Nematocera by Tokunaga and Yamamoto; Biosystematics Laboratory has Tachinidae of Shima (mainly from Japan and Oriental region, some from Pacific area), Sciomyzidae and Clusiidae (Japan), and Sepsidae, Spaheroceridae, Fannidae, Muscidae, Sarcophagidae, and Calliphoridae from Nepal; there are also unsorted Diptera collection from Nepal.

Tachinid fauna of Fiji Islands (Oral presentation by H. Shima)

The Fijian Bioinventory Arthropoda Project yielded (and is still yielding) more than 3,500 tachinid specimens collected by Malaise traps in Fiji. I am systematically studying this collection together with Fiji tachinid collections in Bishop Museum, Honolulu, and Kyushu University, Fukuoka. Fijian tachinids have been known from 30 species including 7 introduced species for biocontrol purpose (excluding 4 uncertan misidentified species) (Cantrel & Crosskey, 1983; Shima, 1998). Ten of them, including 4 introduced species, were not found in the present collections, but 45 species were newly added, now totally 75 species of Tachinidae being known from Fiji: more than 20 species are undescribed and 2 (or 3) are unassignable to any known genera. Some of these species apparently have their relationships with Australia or New Guinea, such as *Paropsivora* sp. (Exoristinae, Blondeliini), *Anagonia* sp. (Blondeliini), *Voriella* sp. (Tachininae, Neaerini), *Donovanius transfuga* (Dexiinae, Rutilliini), *Rasiliverpa vicinella* (Dexiinae, Dexiini) and *Leverella* sp. (Phasiinae, Parerigonini), but many others appear to belong to genera of mainly known from the Oriental Region. Among this rather small number of Fiji tachinids, Leskiini appear to be diverse and include about ten endemic species of two or three genera, *Cavillatrix* and unknown ones. Siphonini comprise 3 genera of 7 species, 3 of them appearing endemic. *Pales* (Goniini) is characteristic, comprising 7 endemic species, *bezziana*, *poecilochaeta* and 5 undescribed ones. *Pales* is known from some ten species in New Zealand and the phylogenetic relationships of these species are very interesting. It is also interesting that eryciine *Palexorista*, most species of which are widely distributed over the tropical and subtropical Asia and Oceania, comprises 3 species including 2 endemic and undescribed.

DNA barcodes reveal cryptic species in Costa Rican *Belvosia* (Diptera: Tachinidae) (Poster presentation by M.A. Smith[1], N.E. Woodley[2], D.H. Janzen[3], W. Hallwachs[3] and P.D.N. Hebert[1])

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Insect parasitoids, including tachinid flies (Diptera: Tachinidae), are a major component of global biodiversity and affect population dynamics of their hosts. We used the cytochrome *c* oxidase DNA barcode to test the taxonomic integrity of 20 species of *Belvosia* reared from Lepidoptera hosts in the Area de Conservación Guanacaste in Guanacaste Province, Costa Rica. DNA barcodes corroborated all 20 morphospecies that were recognized, but within 3 of the morphospecies additional cryptic species were discriminated by the DNA sequence data. The 3 morphospecies that turned out to be species complexes were somewhat polyphagous as initially recognized, but the cryptic species that were revealed are highly host-specific. These results, if found to be general for other parasitoid groups, will increase estimates of global species richness and imply that tropical host-parasite interactions are more complex than expected.

Phylogeny of the tribe Exoristini based on morphological and molecular data (Diptera, Tachinidae) (Oral presentation by T. Tachi and H. Shima)

The tribe Exoristini has approximately 250 species belonging to 21 genera in the world. This is one of oviparous tribes in the family Tachinidae, where females lay the unincubated eggs directly on their hosts. This reproductive strategy is considered to be primitive within this family (Herting, 1960). In morphological analysis the monophyly of the Exoristini has been so far suggested by many researchers (e.g. Herting, 1957; Wood, 1972; Tachi & Shima, 2006). Stireman (2002, 2005) showed that the tribe was monophyletic using the nuclear genes (28S rRNA and elongation factor 1-alpha). However, only five species of three genera were used in his analyses. To elucidate the monophyly of the Exoristini and the phylogenetic relationships within the tribe, we conducted phylogenetic analyses with the mitochondrial DNA (16S rRNA and ND 5), nuclear DNA (18S and 28S rRNA) and morphology. Based on the mitochondrial data analysis, the monophyly of the Exoristini is weakly supported and a few generic relationships within Exoristini are shown, though detailed affinities are still unclear. On the other hand, the nuclear data suggests that the Exoristini is not monophyletic, forming that *Phorinia* and *Ctenophorinia* being clustered with members of the Blondeliini. In this presentation, we show phylogenetic relationships within Exoristini based on the morphological and molecular data, and discuss the differences in the generated trees.

Artificial neural networks for insect identification (Oral presentation by J. Vaňhara[1], N. Muráriková[2], P. Fedor[3], I. Malenovský[4] and J. Havel[5])

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ANN have already been very rarely applied for identifying of insects. We developed, tested and applied the ANN methodology at three different insect orders:

I. DIPTERA – TACHINIDAE: The objects were primarily photographed, then digitalized; consequently the picture was scaled. The variables used were length of wing veins and widths of antennal segments. There were 17 characters studied, particularly in males and females (*Tachina*), or in right or left wings (*Ectophasia*). Right and left wings data are interchangeable and data from one wing are sufficient. Additionally, the sex of the studied specimens was included. It was shown that classification using ANN was possible assuming sufficiently high number of specimens of each species in the “training set”.

II. THYSANOPTERA – THRIPIDAE: The three species of *Dendrothrips* were characterized by 20 quantitative and three binary characters, and by sex. The optimum ANN architecture was found from the data set containing 74, 75, and 14 specimens. It enabled a 100% correct classification. The prediction of unknown species was 99–99.8%. Thus, reliable characters were found and the model provided a fast identification tool.

III. HEMIPTERA – PSYLLOIDEA – PHACOPTERONIDAE: Adults of up to ten species of the genus *Pseudophacopteron* were measured (17 characters on forewings, antenna, head and hind legs), and sex as the18th variable were used. In spite of a limited number (7–14) of specimens of each species, the ANN model performed well on the data set and unambiguously classified unknown samples. ANN classification of three different insect orders is possible and quite general. It can be applicable for objects where appropriate database can be created. After ANN “learning” (training) the species identification is fast and reliable. In contradiction to “manual” identification, all characters are simultaneously taken into account over the complete database. This approach is non-destructive unlike e.g. molecular analyses. Where the identification appears difficult or it is e.g. sp.n., ANN can indicate the situation. Study is supported by MSM 0021622416 and GACR 524/05/H536 projects.

Study on the tribe Blondeliini (Diptera, Tachinidae) from China (Poster presentation by C.-t. Zhang[1], J.-y. Liu[1] and C.-m. Chao[2])

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The tribe Blondeliini (Tachinidae, Exoristinae) from China are studied, and 69 known species (two newly recorded) and 3 undetermined species of 23 genera (one newly recorded) are recognized, viz, *Admontia* sp. from Sichuan, *blanda* (Fallén), *cepelaki* (Mesnil), *continuans* Strobl, *gracilipes* (Mesnil), *grandicornis* (Zetterstedt); *Biomeigenia auripollinosa* Chao *et* Liu, *flava* Chao, *gynandromima* Mesnil; *Blondelia siamensis* (Baranov), *inclusa* (Hartig), *nigripes* (Fallén); *Compsilura concinnata* (Meigen); *Compsiluroides communis* Mesnil, *flavipalpis* Mesnil; *Dolichocoxys* Townsend, newly recorded for China and *Dolichocoxys* sp. from Mêdog, Tibet; *Drinomyia hokkaidensis* (Baranov); *Eophyllophila elegans* Townsend, *includens* (Walker); *Istocheta altaica* (Borisova), *bicolor*

(Villeneuve), *brevichirta* Chao *et* Liang, *brevinychia* Chao *et* Zhou, *graciliseta* Chao *et* Zhou, *grossa* (Chao), *leishanica* Chao *et* Sun, *longicauda* Liang *et* Chao, *ludingensis* Chao *et* Zhou, *nigripedalis* Yang *et* Chao, *nyalamensis* Chao *et* Liang, *nyctia* (Borisova), *rufipes* (Villeneuve), *subrufipes* (Borisova), *shanxiensis* Chao *et* Liu, *tricaudata* Yang *et* Chao, *zimini* (Borisova); *Leiophora innoxia* (Meigen); *Ligeriella aristata* (Villeneuve); *Lixophaga fallax* Mesnil, *latigena* Shima, *parva* Townsend; *Medina collaris* (Fallén), *fuscisquama* Mesnil, *malayana* (Townsend), *melania* (Meigen); *Meigenia* sp. from Jilin, *dorsalis* (Meigen), *majuscula* (Rondani), *nigra* Chao *et* Sun, *tridentata* Mesnil, *velutina* Mesnil; *Opsomeigenia orientalis* Yang; *Oswaldia eggeri* (Brauer *et* Bergenstamm), *illiberis* Chao *et* Zhou, *issikii* (Baranov), *muscaria* (Fallén); two new records for China, *glauca* Shima from Shanxi and *hirsuta* Mesnil from Heilongjiang; *Prodegeeria chaetopygialis* (Townsend), *japonica* (Mesnil), *javana* Brauer *et* Bergenstamm, *villeneuvei* (Baranov); *Steleoneura minuta* Yang *et* Chao; *Trigonospila ludio* (Zetterstedt), *transvittata* (Pandell..); *Urodexia penicillum* Osten-Sacken; *Uromedina atrata* (Townsend), *caudata* Townsend; *Vibrissina debilitata* (Pandell..), *turrita* (Meigen); *Zaira cinerea* (Fallén). And keys to the species and genera of Chinese Blondeliini are presented.

The search for a sister group: first results on the phylogeny, taxonomy and biogeography of the genus *Germaria* (Diptera, Tachinidae) (Oral presentation by J. Ziegler)

The author is in the process of revising the phylogeny, taxonomy and biogeography of the poorly-known Holarctic tachinid genus *Germaria* Robineau-Desvoidy, 1830. This genus currently contains 11 rarely collected species of which 8 have been described in the last 50 years. A further 3–4 undescribed species have been found by the author in the course of his current investigations. The only species of the genus to have a relatively wide distribution are the Holarctic *G. angustata* and the possibly transpalaearctic *G. ruficeps*. The other species are found only in the southern Palaearctic eremial belt. This region – the former Thetys – has a climate that is becoming progressively more dry and has been separate from the rest of the Palaearctic region since the Tertiary. This region is thought to be the centre of origin of the genus *Germaria*. At least 6 species occur in the Mediterranean subregion, and three of these are also found in parts of the adjacent Irano-Turanian subregion to the east, where, together with at least eight further species that occur there, they form a centre of diversity. By adapting to hosts that are difficult to access, the species of *Germaria* have come to occupy a very special niche. Their hosts are Lepidoptera larvae that live in the soil or which are borers in plants, the families Phycitidae and Sesiidae. As the female flies do not have a specialised ovipositor, the first-instar larvae have to act independently to seek out their concealed hosts, and they have adaptations for this. On the other hand, the characters of the third larval instar are predominantly plesiomorphous. Adults are characterised by their elbowed and thickened arista and by their broad frons, for which reason the species were placed in the genus *Gonia* in the time of Meigen and Zetterstedt. However, these similarities to not indicate a common descent but are rather the result of convergence – as is so often the case in Tachinidae. The systematic position of *Germaria* is not clear at present. It has been thought to be related to the most diverse genera, but recent authors are in agreement that it belongs to the subfamily Tachininae. This presentation will discuss different hypotheses concerning the sister-group of the genus *Germaria* in the light of the characters of the immature stages, biology and historical biogeography.

ANNOUNCEMENTS

Request for comments

Re: Revision of Belshaw's (1993) work on tachinids.

Matt Smith and Chris Raper have been asked to revise the content of this important work on British tachinids. Work has already started to include new species discovered as British since 1993. Comments would be appreciated from anyone who uses this book regularly; e.g., what do they like and dislike about it? Are there any improvements that they would like to see in the book?

Many thanks, Chris Raper and Matt Smith.

Reference

Belshaw, R. 1993. Tachinid flies. Diptera: Tachinidae. Handbooks for the identification of British Insects. Royal Entomological Society of London 10, Part 4a(i). 170 pp.

Checklist of Diptera of the Czech Republic and Slovakia

A new version of this Checklist (Jedlička *et al.* 2006) is now available online at http://zoology.fns.uniba.sk/diptera/. It follows in the tradition of two earlier checklists, the first compiled by Ježek (1987) with the help of 52 authors and the second compiled by Chvála (1997) with the help of 43 authors. In the first checklist, the Tachinidae of the former Czechoslovakia were listed with 461 species (Čepelák 1987). The second checklist recorded 430 species for the Czech Republic (CZ) and 435 for Slovakia (SK) (Čepelák and Vaňhara 1997). A revised checklist of Tachinidae (Vaňhara *et al.* 2004) listed 462 species from CZ and 436 from SK. The present online checklist has brought the total number of Tachinidae known from CZ to 474 and from SK to 438 (Vaňhara and Tschorsnig 2006).

References

Čepelák, J. 1987. Tachinidae. Pp. 305–320. *In*: Jezek, J., ed., Enumeratio insectorum bohemoslovakie. Check list of Czechoslovak insects II (Diptera). Acta faunistica entomologica Musei Nationalis Pragae **18**. 341 pp.

Čepelák, J. and Vaňhara, J. 1997. Tachinidae. Pp. 100–106. *In*:

Chvála, M., ed., Check list of Diptera (Insecta) of the Czech and Slovak Republics. Karolinum – Charles University Press, Prague. 130 pp.

Chvála, M., ed. 1997. Check list of Diptera (Insecta) of the Czech and Slovak Republics. Karolinum – Charles University Press, Prague. 130 pp.

Jedlička, L., Stloukalová, V. and Kúdela, M., eds. 2006. Checklist of Diptera of the Czech Republic and Slovakia. Electronic version 1. http://zoology.fns.uniba.sk/diptera + CD-ROM: ISBN 80-969629-0-6.

Ježek, J., ed. 1987. Enumeratio insectorum Bohemoslovakiae. Check list of Czechoslovak insects II (Diptera). Acta faunistica entomologica Musei Nationalis Pragae **18**. 341 pp.

Vaňhara, J. and Tschorsnig, H.-P. 2006. Tachinidae Robineau-Desvoidy 1830. *In*: Jedlička, L., Stloukalová, V. and Kúdela, M., eds., Checklist of Diptera of the Czech Republic and Slovakia. Electronic version 1. http://zoology.fns.uniba.sk/diptera + CD-ROM: ISBN 80-969629-0-6.

Vaňhara, J., Tschorsnig, H.-P. and Barták, M. 2004. New records of Tachinidae (Diptera) from the Czech Republic and Slovakia, with revised check-list. Studia dipterologica **10** (2003): 679–701.

TACHINID BIBLIOGRAPHY

Each year I include here tachinid references I have found during the past year for the period 1980 to the present that have not appeared in previous issues of this newsletter. The complete bibliography 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.

Aalbu, R.L. 2005. The pimeliine tribe Cryptoglossini: classification, biology and inferred phylogeny (Coleoptera: Tenebrionidae). Annales Zoologici (Warsaw) **55**: 677–756.

Abraham, R., Krogmann, L. and Peters, R. 2005. Oekologische und systernatische Untersuchungen an Pteromalidae (Hymenoptera: Chalcidoidea). Faunistisch-Ökologische Mitteilungen **8**: 353–361.

Aldrich, J.R., Khrimian, A., Zhang, A. and Shearer, P.W. 2006. Bug pheromones (Hemiptera: Heteroptera) and tachinid fly host-finding. Denisia **19**: 1015–1031.

Allen, A.A. 2005. The recent occurrence of *Sturmia bella* (Meigen) (Diptera: Tachinidae) in south-west England, including rearings from two host species of Nymphalidae. British Journal of Entomology and Natural History **18**: 269–271.

Ambrosino, M.D., Luna, J.M., Jepson, P.C. and Wratten, S.D. 2006. Relative frequencies of visits to selected insectary plants by predatory hoverflies (Diptera: Syrphidae), other beneficial insects, and herbivores. Environmental Entomology **35**: 394–400.

Arodokoun, D.Y., Tamò, M., Cloutier, C. and Brodeur, J. 2006. Larval parasitoids occurring on *Maruca vitrata* Fabricius (Lepidoptera: Pyralidae) in Benin, West Africa. Agriculture, Ecosystems & Environment **113**: 320–325.

Baugnée, J.-Y. 2005. Quelques Diptères remarquables du camp militaire de Lagland (Arlon, province de Luxembourg, Belgique). Notes Fauniques de Gembloux **58**: 3–6.

Bergström, C. and Bartsch, H. 2005. *Phasia barbifrons* (Girschner, 1887) – a small tachinid fly (Dipt., Tachinidae) new to the Nordic countries. [In Swedish.] Entomologisk Tidskrift **126**: 187–190.

Bloxham, M. 2005. *Medina separata* (Meigen) (Diptera, Tachinidae) reared from *Adalia decempunctata* (Linnaeus) (Coleoptera, Coccinellidae). Dipterists Digest (2nd series) **12**: 96.

Bolu, H. and Kara, K. 2006. A new host (*Nordmannia acaciae* (Fabricius) (Lep.: Lycaenidae)) record for *Aplomya confinis* (Fallén) (Dip.: Tachinidae) from Turkey. Belgian Journal of Zoology **136**: 113–114.

Brooks, S.E., Cumming, J.M., O'Hara, J.E., Skevington, J.H. and Cooper, B.E. 2007. Diptera types in the Canadian National Collection of Insects. Supplement. Third edition. PDF document, Internet publication. 51 pp.

Bystrowski, C. 2005. Materials to the knowledge of tachinid flies (Diptera: Tachinidae) of the Biebrza Valley. [In Polish.] Dipteron (Wroclaw) **21**: 3–4.

Bystrowski, C. and Szpila, K. 2002. *Melisoneura leucoptera* (Meigen, 1824) (Diptera: Tachinidae) – a tachinid fly new to the Polish fauna. [In Polish.] Wiadomosci Entomologiczne **21**: 173–177.

Calvo, R. 2004. Parasitoidismo por dipteros en larvas de *Caligo atreus* (Lepidoptera: Nymphalidae) en Cartago, Costa Rica. Revista de Biologia Tropical **52**: 915–917.

Caravas, J., Walker, M., Balasubramanian, S., Hanrahan, R., Neral, M., Beckenbach, A., Chaudhary, V. and Friedrich, M. 2006. Mitochondrial genome phylogeny of the Schizophora. Pp. 34–35. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Cerboneschi, A. 2004. Risulalti di cinque anni di osservazioni sul parassitismo determinato da *Blepharipa pratensis* (Meig.) e *Brachymeria intermedia* (Nees) su due popolazioni di *Lymantria dispar* L. in Sardegna. Atti del Congresso Nazionale Italiano di Entomologia **19**: 849–854.

Cerretti, P., Di Giulio, A. and Scalici, M. 2006. Comparative morphology of "*Sturmia*-spots" in male tachinids – first results (Diptera: Tachinidae). Pp. 38–39. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Cerretti, P. and Wyatt, N. 2006. A new species of *Eomedina* Mesnil (Diptera: Tachinidae) from Namibia. Zootaxa **1147**: 61–68.

Chao, C.-m. and Zhou, S.-x. 2003. Tachinidae. Pp. 443–498. *In*: Huang, B., ed., Fauna of insects in Fujian Province of China. Vol. 8. [In Chinese.] Fujian Science and Technology Press, Fuzhou. 706 pp.

Chatterjee, S.N., Taraphdar, T. and Mohandas, T.P. 2005. Molecular analysis of divergence in tachinid Uzi (*Exorista sorbillans*) populations in India. Genetica (Dordrecht) **125**: 1–15.

Chaudhari, S.V. 2001. Effect of temperature on development and longevity of life stages of *Carcelia illota* Curran (Diptera:

Tachinidae); a larval pupal parasitoid of *Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae). Pp. 223–224. *In*: Symposium on Biocontrol Based Pest Management for Quality Crop Protection in the Current Millennium, July 18–19, 2001. PAU, Ludhiana, Punjab, India.

Chaudhari, S.V. 2001. Reproductive biology and ovary structure of *Senometopia illota* Curran (Diptera: Tachinidae), a larval-pupal parasitoid of *Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae). Rayat Research Journal **9**: 67–74.

Chaudhari, S.V. 2003. Parasitism in relation to host age selection by *Senometopia illota* Curran (Diptera: Tachinidae) on *Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae). Rayat Research Journal **11**: 63–65.

Chaudhari, S.V. and Nikam, P.K. 2002. Parasitism in relation to host age selection by *Carcelia illota* Curran (Tachinidae) on *Helicoverpa armigera* (Hubner). Journal of Insect Science **15**: 61–62.

Cho, Y., Kwon, O. and Nam, S.-h. 2006. Ecological and morphological characteristics of the endoparasitoids of larval *Acronicta rumicis* (Lepidoptera: Noctuidae). Entomological Research **36**: 208–215.

Diaz, S., Vieira, V. and Báez, M. 2005. Diptera. Pp. 210–218. *In*: Borges, P.A.V., Cunha, R., Gabriel, R., Martins, A.F., Silva, L. and Vieira, V., eds., A list of the terrestrial fauna (Mollusca and Arthropoda) and flora (Bryophyta, Pteridophyta and Spermatophya) from the Azores. Direcção Regional do Ambiente and Universidade dos Açores, Horta, Angra do Heroísmo and Ponta Delgada. 317 pp.

Dindo, M.L., Grenier, S., Sighinolfi, L. and Baronio, P. 2006. Biological and biochemical differences between in vitro- and in vivo-reared *Exorista larvarum*. Entomologia Experimentalis et Applicata **120**: 167–174.

Elkinton, J.S., Parry, D. and Boettner, G.H. 2006. Implicating an introduced generalist parasitoid in the invasive browntail moth's enigmatic demise. Ecology **87**: 2664–2672.

Fagan, W.F. and Bishop, J.G. 2000. Trophic interactions during primary succession: herbivores slow a plant reinvasion at Mount St. Helens. The American Naturalist **155**: 238–251.

Frank, J.H. and Walker, T.J. 2006. Permanent control of pest mole crickets (Orthoptera: Gryllotalpidae: Scapteriscus) in Florida. American Entomologist **52**: 138–144.

Gallardo-Covas, F. 2005. Parasitoids of *Pseudoplusia includens* Walker (Lepidoptera: Noctuidae) larvae on the south coast of Puerto Rico. Journal of Agriculture of the University of Puerto Rico **89**: 119–122.

Grissell, E.E. 2005. A review of North American species of *Microdontomerus* Crawford (Torymidae: Hymenoptera). Journal of Hymenoptera Research **14**: 22–65.

Hardwick, S. 2006. Parasitoids and hyperparasitoids of *Mythimna convecta* (Walker) (Lepidoptera: Noctuidae) larvae infesting late-maturing maize in southern New South Wales. Australian Journal of Entomology **45**: 96–100.

Harrison, S., Hastings, A. and Strong, D.R. 2005. Spatial and temporal dynamics of insect outbreaks in a complex multitrophic system: tussock moths, ghost moths, and their natural enemies on bush lupines. Annales Zoologici Fennici **42**: 409–419.

Havel, J. and Vaňhara, J. 2006. Evaluation of the use of artificial neural networks in taxonomy: towards automating insect identification. P. OP 01. *In*: 10th International Conference on Chemometrics in Analytical Chemistry: Chemometrics in the tropics: Nature, Medicine and Industry CAC-2006, Águas de Lindóia, 10–15 Sept. 2006, SP-Brasil, Book of Abstracts.

Heitland, W. and Pschorn-Walcher, H. 2005. Biology and parasitoids of the peculiar alder sawfly, *Platycampus luridiventris* (Fallen) (Insecta, Hymenoptera, Tenthredinidae). Senckenbergiana Biologica **85**: 215–231.

Henne, D.C. 2004. Parasitoid survey of *Anisota virginiensis* (Lepidoptera: Saturniidae) at Belair, Manitoba from 1989–1999. Proceedings of the Entomological Society of Manitoba **60**: 5–10.

Hirai, N. and Ishii, M. 2006. Egg placement of the tachinid fly *Sturmia bella* on leaves of the evergreen milkvine *Marsdenia tomentosa* and the feeding habit of its host butterfly *Parantica sita*. P. 106. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Ho Thi Thu, G. and Nakamura, S. 2006. Life history parameters of the parasitoid fly *Zenillia dolosa* (Diptera: Tachinidae). P. 109. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Hoch, G., Kalbacher, G. and Schopf, A. 2006. Gypsy moth revisited: studies on the natural enemy complex of *Lymantria dispar* L. (Lep., Lymantriidae) during an outbreak in a well known gypsy moth area. Mitteilungen der Deutschen Gesellschaft fuer Allgemeine und Angewandte Entomologie **15**: 201–204.

Hoddle, M.S. 2006. Historical review of control programs for *Levuana iridescens* (Lepidoptera: Zygaenidae) in Fiji and examination of possible extinction of this moth by *Bessa remota* (Diptera: Tachinidae). Pacific Science **60**: 439–453.

Hondô, M. 2006. The role of tachinid fly complex in the population dynamics of the mulberry tiger moth (*Lemyra imparilis* (Butler)) in western Japan. P. 113. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Ichiki, R., Nakahara, Y. and Nakamura, S. 2006. Larval behaviour of the tachinid fly, *Compsilura concinnata*, within the host midgut. P. 121. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

International Commission on Zoological Nomenclature. 2006. Opinion 2142 (Case 3251). *Thereva* Latreille, 1797 and *Phasia* Latreille, 1804 (Insecta, Diptera): usage conserved by the designation of *Musca plebeja* Linnaeus, 1758 as the type species of *Thereva*. Bulletin of Zoological Nomenclature **63**: 72–73.

Islamoglu, M. and Kornosor, S. 2003. Investigations on the adult parasitoids (Diptera, Tachinidae) of the Sunn pest in overwintering site and wheat fields in Gaziantep and Kilis. [In Turkish.] Bitki Koruma Bulteni **43**: 99–110.

Jüngling, H and Tschorsnig, H.-P. 2006. Weitere Wirtsbefunde von Raupenfliegen (Diptera: Tachinidae) aus dem Wallis (Schweiz). Mitteilungen Entomologischer Verein Stuttgart **41**: 165–166.

Kainoh, Y., Tanaka, C., Ichiki, R., Yamawaki, Y. and Nakamura, S. 2006. Host habitat and host location behavior in the tachinid fly, *Exorista japonica*. P. 127. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Kalyebi, A. and Nakamura, S. 2006. The biology of the parasitoid fly *Drino inconspicuoides* (Diptera: Tachinidae) in the host *Mythimna separata* (Lepidoptera: Noctuidae). Applied Entomology and Zoology **41**: 365–370.

Karimpour, Y., Fathipour, Y., Talebi, A.A., Moharramiopur [sic], S. and Tschorsing [sic], H.-P. 2005. Report of parasitoid fly, *Pales pavida* (Meigen, 1824) (Dip.: Tachinidae) from Iran. [In Farsi.] Applied Entomology and Phytopathology **72**: 137.

Karimpour, Y., Fathipour, Y., Talebi, A.A. and Moharramipour, S. 2005. Biology of leafy spurge defoliator moth *Simyra dentinosa* (Lep., Noctuidae) and determination of its parasitoids in Orumieh, Iran. Iranian Journal of Agricultural Sciences **36**: 475–484.

Karimpour, Y., Fathipour, Y., Talebi, A.A., Moharramipour, S. and Tschorsnig, H.-P. 2005. Report of *Nilea anatolica* (Dip.: Tachinidae) from Iran. [In Farsi.] Journal of Entomological Society of Iran **25**: 71–72.

Kuhlmann, U., Schaffner, U. and Mason, P.G. 2006. Selection of non-target species for host specificity testing. Pp. 15–37. *In*: Bigler, F., Babendreier, D. and Kuhlmann, U., eds., Environmental impact of invertebrates for biological control of arthropods: methods and risk assessment. CABI Publishing, Wallingford. 288 pp.

Kulikova, N.A. 2005. Comparative morphology and evolution of the labella of calypterate flies (Diptera, Calyptrata). [In Russian.] Chteniya Pamyati Nikolaya Aleksandrovicha Kholodkovskogo **58**: 1–94.

Kulikova, N.A., Ratyni, A.I. and Stakovetskaya, O.K. 2000. Characteristic of functional activity of filtration zone of the oral disk of Muscomorpha proboscis (Diptera: Muscidae, Calliphoridae, Tachinidae). [In Russian.] Izvestiya Kharkovskogo Entomologicheskogo Obshchestva **8**: 39–42.

Lahiri, A.R. 2003. Insecta: Diptera: Tachinidae. Pp. 387–399. *In*: Fauna of Sikkim. Part 3. [State Fauna Series 9.] Zoological Survey of India, Kolkata. 411 pp.

Lahiri, A.R. 2004. Diptera: Tachinidae. Pp. 509–514. *In*: Fauna of Manipur. Part 2. Insects. [State Fauna Series 10.] Zoological Survey of India, Kolkata. 625 pp.

Lahiri, A.R. 2006. Insecta: Diptera: Tachinidae. Pp. 199–211. *In*: Fauna of Nagaland. [State Fauna Series 12.] Zoological Survey of India, Kolkata. 620 pp.

Lahiri, A.R. and Mitra, B. 2004. Insecta: Diptera. Pp. 127–159. *In*: Fauna of Gujarat. Part 2. Zoological Survey of India, Kolkata. 427 pp.

Lastra, B. and Gómez, L. 2006. La cría de *Diatraea saccharalis* (F.) para la producción masiva de sus enemigos naturales. Serie Tecnica CENICANA, Centro de Investigacion de la Cana de Azucar de Colombia. Serie Técnica No. 36. Cenicaña, Cali. 30 pp.

Lehmann, G.U.C. and Lehmann, A.W. 2006. Potential lifetime reproductive success of male bushcrickets parasitized by a phonotactic fly. Animal Behaviour **71**: 1103–1110.

Liu, J.-y, Zhang, C.-t, Ge, Z.-p and Wang, Y. 2006. Taxonomic study on the tribe Blondeliini from China (Diptera, Tachinidae). Journal of Shenyang Normal University (Natural Science) **24**: 334–339.

Loch, A.D. 2006. Phenology of Eucalyptus weevil, *Gonipterus scutellatus* Gyllenhal (Coleoptera: Curculionidae), and chrysomelid beetles in *Eucalyptus globulus* plantations in south-western Australia. Agricultural and Forest Entomology **8**: 155–165.

Londt, J.G.H. 2006. Predation by Afrotropical Asilidae (Diptera): an analysis of 2000 prey records. African Entomology **14**: 317–328.

Lozada, P.W., Valencia, L., Díaz-B, W. and Burckhardt, D. 2005. Material tipo de insectos en el Laboratorio de Sanidad Vegetal, SENASA, Lima, Perú. Revista Peruana de Biologia **12**: 457–461.

Marchal, M., Robert, P. and Goujet, R. 2004. Sensibilité des larves de *Melolontha melolontha* L. (Coleoptera: Scarabaeidae) à la mycose causée par *Beauveria brongniartii* (Sacc.) Petch en présence de l'endoparasite *Dexia rustica* F. (Diptera: Tachinidae). Laimburg Journal **1**: 248–253.

Marino, P.C., Landis, D.A. and Hawkins, B.A. 2006. Conserving parasitoid assemblages of North American pest Lepidoptera: does biological control by native parasitoids depend on landscape complexity? Biological Control **37**: 173–185.

Martínez-Sánchez, A., Marcos-García, M.Á. and Rojo, S. 2005. Biodiversidad de la comunidad de dípteros sarcosaprófagos en ambientes insulares del sudeste Ibérico (Diptera: Calliphoridae, Muscidae, Sarcophagidae). Nouvelle Revue d'Entomologie **22**: 251–265.

Mason, A.C., Lee, N. and Oshinsky, M.L. 2005. The start of phonotactic walking in the fly *Ormia ochracea*: a kinematic study. Journal of Experimental Biology **208**: 4699–4708.

Mason, F., Avesani, D., Bardiani, M., Birtele, D., Cerretti, P., Hardersen, S., Nardi, G., Tisato, M. and Whitmore, D. 2006. Dipterological research by the National Centre for the Study and Conservation of Forest Biodiversity (CNBF), Verona – Bosco della Fontana (Italy). Pp. 333–334. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Mason, F., Cerretti, P., Nardi, G., Whitmore, D., Birtele, D., Hardersen, S. and Gatti, E. 2006. Aspects of biological diversity in the CONECOFOR plots. IV. The InvertebrateBiodiv pilot project. Pp. 51–70. *In*: Ferretti, M., Petriccione, B., Fabbio, G. and Bussotti, F., eds., Aspects of biodiversity in selected forest ecosystems in Italy. Status and changes over the period 1996–2003. Report 3 of the Task Force on Integrated and Combined (I&C) Evaluation of the CONECOFOR programme. Annali Istituto Sperimentale per la Selvicoltura, Special Issue, Volume 30, Supplemento 2. 112 pp.

Mellini, E. 1997. Dalla predazione al parassitoidismo nell'ordine dei Ditteri. Bollettino dell'Instituto di Entomologia "Guido Grandi" della Universita degli Studi di Bologna **51**: 91–159.

Mishra, C.S.K. 2003. Tachinid parasitization of perbrinised tasar silkmoth larvae. Journal of Insect Science (Ludhiana) **16**: 61–62.

Mishra, C.S.K. 2004. Changes in protein and lipid content of tasar silk moth, *Antheraea mylitta* (Drury) parasitized by tachinid endoparasitoid *Blepharipa zebina* (Walker). Journal of Insect Science (Ludhiana) **17**: 46–48.

Mitra, B., Parui, P., Banerjee, D., Mukherjee, M. and Bhattacharjee, K. 2005. A report on flies (Diptera: Insecta) as flower visitors and pollinators of Kolkata and it's [sic] adjoining areas. Records of the Zoological Survey of India **105**: 1–20.

Morris, R.K.A. 2005. Exceptionally early emergence of *Cheilosia illustrata* (Harris) and *Phasia hemiptera* (Fabricius) (Diptera, Syrphidae and Tachinidae). Dipterists Digest (2nd series) **12**: 140.

Moura, J.I.L., Toma, R., Sgrillo, R.B. and Delabie, J.H.C. 2006. Natural efficiency of parasitism by *Billaea rhynchophorae* (Blanchard) (Diptera: Tachinidae) for the control of *Rhynchophorus palmarum* (L.) (Coleoptera: Curculionidae). Neotropical Entomology **35**: 273–274.

Muráriková, N., Ondrouchová, H., Tóthová, A., Bryja, J. and Vaňhara, J. 2006. Phylogenetic relationships within the genus *Tachina* (Diptera, Tachinidae): preliminary results on the basis of 16S rDNA sequences. Dipteron (Wroclaw) **22**: 34–35.

Murúa, G., Molina-Ochoa, J. and Coviella, C. 2006. Population dynamics of the fall armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae) and its parasitoids in northwestern Argentina. Florida Entomologist **89**: 175–182.

Murza, G.L., Heaver, J.R. and Davis, A.R. 2006. Minor pollinator-prey conflict in the carnivorous plant, *Drosera anglica*. Plant Ecology **184**: 43–52.

Nakamura, S. and Ichiki, R. 2006. Mating behaviour of the parasitoid fly: female choice for large males? P. 173. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Nash, D.R. 2005. *Sturmia bella* (Meigen) (Diptera: Tachinidae) an interesting addition to the Suffolk list. Suffolk Natural History **41**: 63–67.

Nash, D.R. 2005. *Trichopria nigra* (Nees) (Hym.: Diapriidae) reared from *Sturmia bella* (Meigen) (Dipt.: Tachinidae) – a new host record. Entomologist's Record and Journal of Variation **117**: 167–168.

Nihei, S.S. 2006. Revision and systematic placement of *Prospalaea* Aldrich (Diptera, Tachinidae). Papéis Avulsos de Zoologia **46**: 197–201.

Nihei, S.S. and Pansonato, M.P. 2006. Revision of *Prophorostoma* Townsend, 1927 (Diptera, Tachinidae, Dexiinae), with the description of a new species. Papéis Avulsos de Zoologia **46**: 239–244.

Nikdel, M., Dordaei, A.A. and Sadaghian, B. 2005. Report of two tachinid flies from Iran. Iranian Journal of Forest and Range Protection Research **3**: 85.

O'Hara, J.E. 2004. Tachinidae Resources Website. Diptera Data Dissemination Disk **2**: Electronic publication.

O'Hara, J.E. 2006. World genera of the Tachinidae (Diptera) and their regional occurrence. Version **2**. PDF document, Internet publication. 70 pp.

Omid, R., Azizkhani, E., Askary, H. and Moniri, V.R. 2005. Biological investigation of *Ocneria terebinthina* in Khojir protected area. Iranian Journal of Forest and Range Protection Research **2**: 209–211.

Özdikmen, H. 2006. New substitute names for two preoccupied tachinid genera *Paragonia* Mesnil, 1950 and *Menetus* Aldrich, 1926 (Diptera). Munis Entomology & Zoology **1**: 270–272.

Özdikmen, H. 2007. A nomenclatural act: replacement names for homonymous tachinid genera with lepidopteran genera (Diptera: Tachinidae). Munis Entomology & Zoology **2**: 163–168.

Özdikmen, H. and Abang, F. 2006. *Sarawaka* nom. nov, a replacement name for preoccupied genus *Cleonice* Thomson, 1864 (Coleoptera: Cerambycidae). Munis Entomology & Zoology **1**: 55–56.

Padmaja, P.G. and Prabhakar, M. 2004. Natural parasitisation of spotted stem borer, *Chilo partellus* (Swinhoe) on sweet sorghum in Andhra Pradesh. Indian Journal of Entomology **66**: 285–286.

Papp, L., Merz, B. and Földvári, M. 2006. Diptera of Thailand. Acta Zoologica Academiae Scientiarum Hungaricae **52**: 97–269.

Piekarska-Boniecka, H., Wilkaniec, B. and Trzciński, P. 2005. Natural control of abundance of rose tortrix moth *Archips rosanus* (L.) in a fruit-growing environment in the environs of Śrem. [In Polish.] Progress in Plant Protection **45**: 986–988.

Prakash, B.M. and Puttaraju, H.P. 2006. *Wolbachia* endosymbiont in some insect pests of sericulture. Current Science **90**: 1671–1674.

Pratt, G. 2000. Terrestrial Arthropods of Edwards Air Force Base, 1996–1998. ERDC/EL TR-00-20. U.S. Army Engineer Research and Development Center, Vicksburg, MS. i–iv + 1–32 + A1–A62 + 2 unnumbered pages.

Pratt, G. 2000. Terrestrial Invertebrates, Edwards Air Force Base, 1997. ERDC/EL TR-00-3. U.S. Army Engineer Research and Development Center, Vicksburg, MS. i–iv + 1–15 + A1–A22 + 2 unnumbered pages.

Puttaraju, H.P. and Prakash, B.M. 2005. Effects of *Wolbachia* in the uzifly, *Exorista sorbillans*, a parasitoid of the silkworm, *Bombyx mori*. Journal of Insect Science (Tucson) **5**(30): 7 pp.

Puttaraju, H.P. and Prakash, B.M. 2005. Effects of *Wolbachia*-targeted tetracycline on a host-parasitoid-symbiont interaction. European Journal of Entomology **102**: 669–674.

Puttaraju, H.P. and Prakash, B.M. 2005. *Wolbachia* and reproductive conflict in *Exorista sorbillans*. Archives of Insect Biochemistry and Physiology **60**: 230–235.

Ramírez-Salinas, C., Pacheco-Flores, C. and Castro-Ramírez, A.E. 2006. *Cryptomeigenia* sp. (Diptera: Tachinidae) como parasitoide de adultos de *Phyllophaga* (*Phytalus*) *rufotestacea* (Moser, 1918) (Coleoptera: Melolonthidae) en Chiapas, México. Acta Zoológica Mexicana Nueva Serie **22**: 1–8.

Raper, C.M., Smith, M.N. and Gibbs, D.J. 2006. *Carcelia laxifrons* Villeneuve (Diptera, Tachinidae) new to Britain and a revised key to the British *Carcelia* species. Dipterists Digest (2nd series) **13**: 49–55.

Revels, R. 2006. More on the rise and fall of the holly blue. British Wildlife **17**: 419–424.

Richter, V.A. 2006. 124. Fam. Tachinidae – tachinids. Addition. Pp. 889–891. Corrections. P. 935. *In*: Sidorenko, V.S., ed., Opredelitel nasekomykh Dalnego Vostoka Rossii. Volume VI. Dvukrylye i blokhi. Part 4. [In Russian.] Dal'nauka, Vladivostok. 935 pp.

Richter, V.A. 2006. On the fauna of the tachinid flies (Diptera, Tachinidae) of Turkmenia. II. Entomologicheskoe Obozrenie **85**: 686–690.

Richter, V.A. and Wood, D.M. 2006. The tachinid *Macquartia plumbea* Richter & Wood new for the European part of Russia (Diptera: Tachinidae). Zoosystematica Rossica **15**: 86.

Rogers, D.J., Walker, J.T.S., Moen, I.C., Weibel, F., Lo, P.L. and Cole, L.M. 2003. Understorey influence on leafroller populations in Hawke's Bay organic apple orchards. New Zealand Plant Protection **56**: 168–173.

Rognes, K. 2005. Faunistics of Norwegian Phasiinae (Diptera, Tachinidae). Norwegian Journal of Entomology **52**: 127–136.

Roland, J. 2005. Are the "seeds" of spatial variation in cyclic dynamics apparent in spatially-replicated short time-series? An example from the forest tent caterpillar. Annales Zoologici Fennici **42**: 397–407.

Roth, D., Roland, J. and Roslin, T. 2006. Parasitoids on the loose – experimental lack of support of the parasitoid movement hypothesis. Oikos **115**: 277–285.

Rwomushana, I., Kyamanywa, S., Ngi-Song, A.J. and Omwega, C.O. 2005. Incidence of larval and pupal parasitoids of Lepidoptera in Uganda with special reference to new associations. International Journal of Tropical Insect Science **25**: 274–280.

Santos, R.S.S., Redaelli, L.R., Diefenbach, L.M.G., Romanowski, H.P., Prando, H.F. and Antochevis, R.C. 2006. Seasonal abundance and mortality of *Oebalus poecilus* (Dallas) (Hemiptera: Pentatomidae) in a hibernation refuge. Brazilian Journal of Biology **66**: 447–453.

Saraiva, O.F. 2004. Documentos245: resultados de pesquisa da Embrapa Soja – 2003 entomologia. Documentos Embrapa Soja: 92 pp.

Scriber, J.M. 2004. Non-target impacts of forest defoliator management options: decision for no spraying may have worse impacts on non-target Lepidoptera than *Bacillus thuringiensis* insecticides. Journal of Insect Conservation **8**: 241–261.

Sehnal, P. 2005. Erstnachweis von *Atylomyia loewi* Brauer, 1898 in Wien und ein weiterer Beleg für Niederösterreich (Diptera: Tachinidae). Beiträge zur Entomofaunistik **6**: 171–172.

Shima, H. 2006. Diptera collections in Japan. Pp. 228–229. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Shima, H. 2006. A host-parasite catalog of Tachinidae (Diptera) of Japan. Makunagi/ Acta Dipterologica. Supplement **2**: 1–171.

Shima, H. 2006. Tachinid fauna of Fiji Islands. P. 230. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Smith, M.A., Woodley, N.E., Janzen, D.H., Hallwachs, W. and Hebert, P.D.N. 2006. DNA barcodes reveal cryptic species in Costa Rican *Belvosia* (Diptera: Tachinidae). P. 239. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Solervicens, J., Estrada, P. and Béeche, M. 2004. Entomofauna asociada a tallos florales e infrutescencias de especies de *Puya* (Bromeliaceae) de Chile Central. Revista Chilena de Entomologia **30**: 31–44.

Stireman, J.O., Dyer, L.A., Janzen, D.H., Singer, M.S., Lill, J.T., Marquis, R.J., Ricklefs, R E., Gentry, G.L., Hallwachs, W., Coley, P.D., Barone, J.A., Greeney, H.F., Connahs, H., Barbosa, P., Morais, H.C. and Diniz, I.R. 2005. Climatic unpredictability and parasitism of caterpillars: implications of global warming. Proceedings of the National Academy of Sciences of the United States of America **102**: 17384–17387.

Strazanac, J.S. 2004. Electronic database and revision of Paul H. Arnaud, Jr.'s A host-parasite catalog of North American Tachinidae (Diptera). Diptera Data Dissemination Disk **2**: Electronic publication.

Suazo, A., Arismendi, N., Frank, J.H. and Cave, R.D. 2006. Method for continuously rearing *Lixadmontia franki* (Diptera: Tachinidae), a potential biological control agent of *Metamasius callizona* (Coleoptera: Dryophthoridae). Florida Entomologist **89**: 348–353.

Suazo, A., Pacheco, D.P., Cave, R.D. and Frank, J.H. 2006. Longevity and fecundity of *Metamasius quadrilineatus* Champion (Coleoptera: Dryophthoridae) on a natural bromeliad host in the laboratory. The Coleopterists Bulletin **60**: 264–270.

Sugiura, S. 2005. Population establishment of the leafroller *Eudemis gyrotis* (Lepidoptera: Tortricidae) at a new plantation of bayberry *Myrica rubra* (Myricaceae). Applied Entomology and Zoology **40**: 399–404.

Szpila, K. 1999. Calyptrata (Diptera) of the Górzno-Lidzbark Landscape Park. II. Tachinidae. [In Polish.] Wiadomosci Entomologiczne **18**: 111–120.

Szpila, K. and Konefał, T. 2004. New record of *Besseria dimidiata* (Zetterstedt, 1844) (Diptera: Tachinidae) and its host *Menaccarus arenicola* (Scholtz, 1864) (Heteroptera: Pentatomidae) from Poland. [In Polish.] Wiadomosci Entomologiczne **23**: 239–242.

Tachi, A. and Shima, H. 2006. Insect type specimens in the collection of the Biosystematics Laboratory, Graduate School of Social and Cultural Studies, Kyushu University, Fukuoka. [In Japanese.] Bulletin of the Kyushu University Museum **4**: 1–38.

Tachi, T. and Shima, H. 2006. Phylogeny of the tribe Exoristini based on morphological and molecular data (Diptera, Tachinidae). P. 256. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Tachi, T. and Shima, H. 2006. Systematic study of the genus *Phorinia* Robineau-Desvoidy of the Palearctic, Oriental and Oceanian regions (Diptera: Tachinidae). Invertebrate Systematics **20**: 255–287.

Tavares, M.T., Navarro-Tavares, A.B. and De Souza Soares de Almeida, G. 2006. The species of Chalcididae (Hymenoptera) parasitoids of *Parides ascanius* (Cramer), an endangered Papilionidae (Lepidoptera) from restingas of southeastern Brazil. Zootaxa **1197**: 55–63.

Tillman, P.G. 2006. Effect of selected insecticides on the leaf-footed bug (Hemiptera: Coreidae). Journal of Entomological Science **41**: 184–186.

Tillman, P.G. 2006. Feeding responses of *Trichopoda pennipes* (F.) (Diptera: Tachinidae) to selected insecticides. Journal of

Entomological Science **41**: 242–247.

Tillman, P.G. 2006. Mortality of the corn earworm (Lepidoptera: Noctuidae) on sorghum panicles in Georgia. Journal of Entomological Science **41**: 292–304.

Tillman, P.G. 2006. Sorghum as a trap crop for *Nezara viridula* L. (Heteroptera: Pentatomidae) in cotton in the southern United States. Environmental Entomology **35**: 771–783.

Tillman, P.G. 2006. Susceptibility of pest *Nezara viridula* (Heteroptera: Pentatomidae) and parasitoid *Trichopoda pennipes* (Diptera: Tachinidae) to selected insecticides. Journal of Economic Entomology **99**: 648–657.

Toma, R. and Nihei, S.S. 2006. Catálogo do material-tipo de Tachinidae (Diptera) depositado no Museu de Zoologia da Universidade de São Paulo. Revista Brasileira de Entomologia **50**: 240–256.

Tooker, J.F., Hauser, M. and Hanks, L.M. 2006. Floral host plants of Syrphidae and Tachinidae (Diptera) of Central Illinois. Annals of the Entomological Society of America **99**: 96–112.

Tóthová, A., Bryja, J., Bejdák, P. and Vaňhara, J. 2006. Molecular markers used in phylogenetic studies of Diptera with a methodological overview. Dipterologica Bohemoslovaca **13**: 125–133.

Tschorsnig, H.-P. and Boness, M. 2006. *Neoplectops pomonellae* (Schnabl & Mokrzecki) (Diptera: Tachinidae) neu für Deutschland. Mitteilungen Entomologischer Verein Stuttgart **41**: 167.

Tschorsnig, H.-P., Richter, V.A., Cerretti, P., Zeegers, T., Bergström, C., Vaňhara, J., Van de Weyer, G., Bystrowski, C., Raper, C., Ziegler, J. and Hubenov, Z. 2005. Fauna Europaea: Tachinidae. *In*: Pape, T., ed., Fauna Europaea: Diptera, Brachycera. Fauna Europaea version **1.2**. Electronic publication available from: http://www.faunaeur.org.

Tschorsnig, H.-P., Vaňhara, J., Barták, M. and Kubík, Š. 2006. Tachinidae. Pp. 398–414. *In*: Barták, M. and Kubík, Š., eds., Diptera from the Podoyjí National Park and its Environs. Česká zemědělská univerzita v Praze, Prague.

Urban, J. 2005. Contribution to the knowledge of development and harmfulness of imported willow leaf beetle (*Plagiodera versicolora*) (Coleoptera, Chrysomelidae). Journal of Forest Science **51**: 481–507.

Urban, J. 2006. Occurrence, bionomics and harmfulness of *Chrysomela populi* L. (Coleoptera, Chrysomelidae). Journal of Forest Science (Prague) **52**: 255–284.

Vaňhara, J. 2005. Diptera: Tachinidae. Pp. 367–369. *In*: Farkač, J., Král, D. and Škorpík, M, eds., Red List of Threatened Species in the Czech Republic. Invertebrates. Agentura ochrany přírody a krajiny ČR, Praha.

Vaňhara, J., Muráriková, N., Fedor, P., Malenovský, I. and Havel, J. 2006. Artificial neural networks for insect identification. Pp. 289–290. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Vaňhara, J. and Tschorsnig, H.-P. 2006. Tachinidae Robineau-Desvoidy 1830. *In*: Jedlička, L., Stloukalová, V. and Kúdela, M., eds., Checklist of Diptera of the Czech Republic and Slovakia. Electronic version **1**. [Also published on CD ROM, Comenius University, Bratislava.] Electronic publication available from: http://zoology.fns.uniba.sk/diptera.

Vázquez Moreno, L.L., Medina Muñoz, H. and Castellanos Sarmientos, J.A. 2005. Notas sobre la introducción de insectos entomófagos en Cuba. Fitosanidad **9**(4): 63–65.

Vélez, M.J. and Brockmann, H.J. 2006. Seasonal variation in female response to male calling song in the field cricket, *Gryllus rubens*. Ethology **112**: 1041–1049.

Venkatachalapathy, K.N. and Puttaraju, H.P. 2006. An analysis of chromosomes in the uzi fly, *Blepharipa zebina* Walker (Diptera: Tachinidae) using C- and Q-banding. Cytologia (Tokyo) **71**: 189–196.

Vijaykumar, [initial?] and Patil, B.V. 2004. *Mythimna* sp. nr. *albavena* (Lepidoptera: Noctuidae) – a new pest of paddy in Tungabhadra Project Area of Karnataka. Karnataka Journal of Agricultural Sciences **17**: 827.

Vrieling, K. 2006. Chemical ecology of the cinnabar moth (*Tyria jacobaeae*) on a newly recorded host *Senecio adonidifolius*. Acta Oecologica **30**: 168–172.

Wen, L.-z. 2004. Prospect on the parasitical enemies and its natural control effect of *Agrius convolvuli*. [In Chinese.] Chinese Journal of Biological Control **20**: 273–275.

Wood, D.M. and Cave, R.D. 2006. Description of a new genus and species of weevil parasitoid from Honduras (Diptera: Tachinidae). Florida Entomologist **89**: 239–244.

Xu, Y.-x., Sun, X.-g., He, Z., Liu, X.-h. and Ge, F. 2006. Electroantennogram responses of *Carcelia matsukarehae* to the volatiles of *Pinus massoniana* damaged by *Dendrolimus punctatus*. [In Chinese.] Kunchong Zhishi **43**: 319–322.

Yang, Z.-q, Wei, J.-r. and Wang, X.-y. 2006. Mass rearing and augmentative releases of the native parasitoid *Chouioia cunea* for biological control of the introduced fall webworm *Hyphantria cunea* in China. BioControl **51**: 401–418.

Zhang, C.-t., Liu, J.-y. and Chao, C.-m. 2006. Study on the tribe Blondeliini (Diptera, Tachinidae) from China. Pp. 327–328. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

Zhang, C.-t. and Shima, H. 2006. A systematic study of the genus *Dinera* Robineau-Desvoidy from the Palaearctic and Oriental regions (Diptera: Tachinidae). Zootaxa **1243**: 1–60.

Zhang, C.-t., Wang, M.-f. and Liu, J.-y. 2006. A new species and a new record of the genus *Leptothelaira* from China (Diptera, Tachinidae). Acta Zootaxonomica Sinica **31**: 430–433.

Ziegler, J. 2006. The search for a sister group: first results on the phylogeny, taxonomy and biogeography of the genus *Germaria* (Diptera, Tachinidae). Pp. 329–330. *In*: Suwa, M., ed., Abstracts Volume, 6th International Congress of Dipterology, Fukuoka.

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