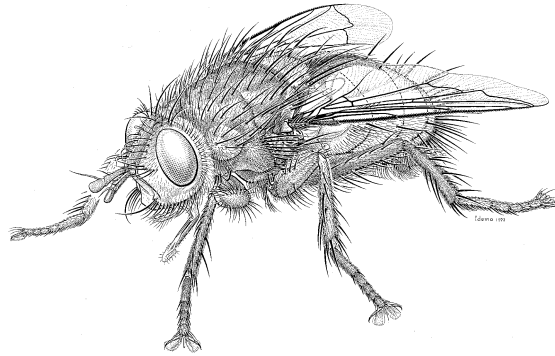


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The Tachinid Times continues to be offered in hardcopy and online, with both versions having identical pagination and appearance except that the figures in the online version are produced in colour and the figures in the printed version are in black and white. The online version is available as a PDF file (ca. 1.5 MB in size) at the North American Dipterists Society (NADS) website at: <http://www.nadsdiptera.org/Tach/TTimes/TThome.htm>.

I would like to dedicate this issue of **The Tachinid Times** to a leader in tachinid systematics who passed away in 2004, Dr. Benno Herting. His high standards of research earned him a respected position among modern tachinid systematists. Through his papers, advice and identifications, he aided many researchers and students in systematics, biological control, faunistics and ecology. The lead article in this issue is an obituary in honour of Benno Herting written by his friend, colleague and former student, Hans-Peter Tschorsnig.

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 2006. 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The Tachinid Times is purposely not peer-reviewed to retain its status as a newsletter and avoid attracting articles that are more properly published in recognized journals.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*.

Benno Herting, 1923–2004 (by H.-P. Tschorsnig)

At the age of 80 years, one of the most outstanding experts on tachinids, Dr. Benno Herting, died in Freiberg am Neckar (south-western Germany) on 19 July 2004.

Benno Wilhelm Herting was born on 30 December 1923 in Bochum (north-western Germany) as a single child of a Catholic schoolteacher. After he finished school, he was forced to join the military. To his great fortune – according to his own words – he was released from the armed forces after three months, so he could survive World War II in the comparatively safe rural country of northern Germany.

After completing three semesters of medical science, Benno began to study biology at the University of Münster in Westfalen in 1949. Five years later he finished his studies with a Ph.D. thesis on the ecology of *Drosophila*, under the supervision of Prof. Bernhard Rensch. Several grants enabled him to work on research programs afterwards. Benno's main projects from the mid 1950s to early 1960s were investigations on the structure of the female postabdomen of Diptera, the biology of West-Palaearctic Tachinidae, and the parasitoids of noxious caterpillars in north-western Germany.

In 1960 Benno applied for a faculty position in science at the University of Erlangen, but was not hired. He later viewed this as a very fortunate outcome, as it would have taken his career in a different direction and away from Tachinidae. Two years later, in 1962, he was successful in gaining employment at the Commonwealth Institute of Biological Control at Delémont in Switzerland. His main task in this institute was to continue Thompson's

parasite and predator catalogue, but he could also study Tachinidae. In July 1969, at last, Herting received a permanent position as curator at the Naturkundemuseum Stuttgart (at that time in the Ludwigsburg branch of the museum), where he could practically work exclusively on Tachinidae. Benno retired from the museum in 1988 but continued his tachinid studies for many years thereafter as an honorary staff member.



Figure 1. Benno Herting at about 30 years old.

Benno Herting had to take some blows during his life. One of his two sons, Martin, died at the age of three in Delémont, and his wife Ilse, who was married to Benno since 1958, died quite unexpectedly in 1980. Benno's mother, however, was very sprightly. She reached the age of one hundred years, and was a regular companion on his field trips, even when she was very old.

Benno was a very good collector of Diptera. He recognized rarities at first glance, and his preparation technique was very fastidious. Usually he did not try to get a large series of a species, preferring to collect single specimens in good condition, which he prepared very carefully. Altogether, Benno's field work produced a very nice collection of 576 species of European Tachinidae, which is now completely integrated into the museum's main collection.

Herting collected his first Tachinidae in 1949, but his special interest in this family did not arise until 1954, when he contacted L.-P. Mesnil, the leading Tachinidae specialist at that time. In his earlier years (1949–1961), the collecting sites of Benno were in Nordrhein-Westfalen and Niedersachsen; destinations of some minor excursions during that time were also the Bavarian Alps (September 1950), Tyrol (August 1952), and near Zürich (May/June 1954). Some major collection trips, funded in part by grants, took place in Austria every year in the summers of 1957–1960.

In 1962, when Benno moved to Delémont, he focused on the near environment of the institute, where he preferred

to collect with his self-constructed tent-window traps. This very active period of collecting lasted until 1969. It was complemented by many field trips of several days duration to the Valais and Ticino in Switzerland, the Vaucluse in southern France, the Aosta-Valley in Italy and the Rhine-area in south-western Germany.

After his move to Ludwigsburg, Benno tried to find similar good collecting places as he had in Delémont, but they were difficult to find in the densely populated metropolitan area of Stuttgart. So he made – between 1969 and 1979 – many short trips to the Kaiserstuhl mountain in south-western Germany, and several trips of one or two weeks duration to the Alps in Italy, Austria, and southern Switzerland, and to southern France. After 1980 his systematic collecting activity ceased, except for some short trips around Ludwigsburg and some minor excursions together with the author.

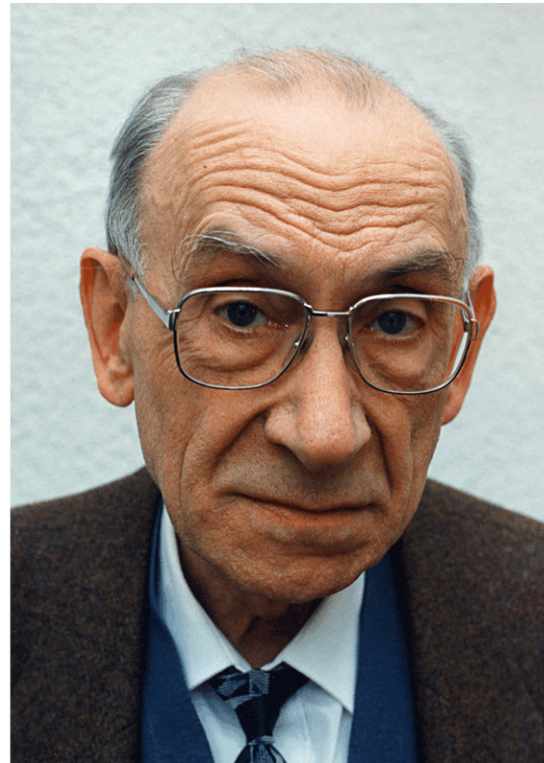


Figure 2. Benno Herting at about 65 years old.

The scientific work of Benno on Tachinidae and Rhinophoridae is known and respected worldwide. Most of his 94 publications deal with Tachinidae. His most important papers are “Das weibliche Postabdomen der calyptraten Fliegen (Diptera) und sein Merkmalswert für die Systematik der Gruppe” (Herting 1957), “Biologie der westpaläarktischen Raupenfliegen” (Herting 1960) and “Catalogue of Palearctic Tachinidae” (Herting 1984). Benno's fundamental idea, to incorporate biological features into tachinid classification instead of merely using

morphological characters, is widely accepted today. His concept of the Goniini, for example, based on a specialized female reproductive system that produces microtype eggs, is now in common usage. In total, Benno described 113 new species of Tachinidae and Rhinophoridae, only nine of which have been treated as synonyms in later revisions. Eight valid names of tachinid genera were proposed by Benno.

Benno was a quiet and serious scientist, who always lived for his work. He did not like parties, congresses or meetings. Nevertheless he was a highly esteemed person, always helpful and friendly, and the few people who were familiar with him, knew that he could also be cordial and humorous. Moreover he was very diligent and accurate – characters of every good scientist – and had an extraordinarily good memory for names. Even difficult nomenclatural questions were no problem for Benno because of his wide knowledge.

Benno Herting was not only a natural scientist, he was also a natural philosopher in his private life. When he was young, he found flies interesting because he believed there might be a higher principle in their wing venation. Benno was very convinced of his abstract ideas on the “beauty of the human shape”, which kept him busy lifelong. His manuscript on the “Geheimnis der Menschengestalt” [secret of the human shape] took more than 30 years to complete and was published as a book in 1986. The basic idea of this book was that the human shape – and among all creatures only that – can be constructed following a few logical steps and mathematical formulas, and that consequently the human shape is beautiful per se. During the last 15 years of his life, Benno made many efforts to make his ideas known, which are, however, not easily understood by everybody.

Benno died after a short but serious disease in the nursing home in which he had lived for the last two years as a consequence of a cerebral hemorrhage. His son Uli took great care of him during that time. A dear friend and colleague has now departed this life and we feel his loss. But Benno will always be remembered and his work will live on.

Benno Herting's publications up to 1979 were published by Jim O'Hara in *Tachinid Times* 1: 6–8. The following list gives a few omissions of earlier papers and additions since 1980, plus the few works cited above. It includes also papers on subjects other than Tachinidae or Diptera.

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Phylogenetic reconstruction of Exoristinae using molecular data: a Bayesian re-analysis (by J.O. Stireman III)

A few years ago I published the results of a phylogenetic analysis of New World Exoristinae based on molecular data from two genes, 28S rDNA and Elongation Factor 1-alpha (Stireman 2002). In that study I employed parsimony, neighbor joining, and maximum likelihood inference methods to generate phylogenetic reconstructions, and explored a variety of weighting schemes and combinations of the sequence data (i.e. each gene separately and both together). The results of these analyses generally supported recent taxonomic hypotheses (e.g., Herting 1984; Wood 1987; O’Hara and Wood 2004). For example, Tachinidae and Exoristinae were reconstructed as monophyletic in most analyses, as were the Exoristini, Winthemiini, and Blondeliini. However, there were also some ambiguous and unexpected results. First, representative taxa of Tachininae and Phasiinae (used as outgroups) failed to support monophyly for either of these subfamilies. Also, species of the genera *Masiphya* (Masiphysiini), *Ceracia* (Tachininae), and *Phyllophilopsis* (Blondeliini) tended to form a clade that varied widely in position between reconstructions. Perhaps most interesting, all reconstructions indicated a paraphyletic or polyphyletic Goniini. Finally, and most disturbing, was the fact that my representative of *Drino* (*D. incompta*) was often reconstructed near the base of Exoristinae joining taxa from other subfamilies (at least in analyses of EF1 alpha) even though all morphological considerations would place this taxon with other “Eryciini”.

Due to limitations in the software available to me at the time I was engaged in this study, I was limited to parsimony analyses when using the combined data (both genes). This is because I was unable to partition the data and assign different models of evolution to each gene in a single search (which was necessary, given that one gene codes for a protein and the other for a functional RNA product). Recent developments in phylogenetic analysis techniques, particularly the use of Bayesian inference methods, allow partitioning of the data, assigning different models of substitution to these partitions, and faster searching of tree likelihood surfaces. Here I briefly present a Bayesian reanalysis of the data from my 2002 paper

using the program MrBayes 3 (Ronquist and Helsenbeck 2003).

Methods

Please see Stireman (2002) for collecting, sequencing, and alignment methods. A total of 57 taxa were included in the analysis (40 tachinid genera) and 1997 total characters were used (899 Eflalpha and 1098 28S). Difficult to align

“gappy” regions of 28S were subsequently excluded. The Bayesian search was run for 100,000 generations (sampled every 100) with four chains (3 heated) and a burn-in of 50,000 generations. Separate models of nucleotide substitution were estimated for each of four partitions corresponding to the 28S gene, and each codon position of the Eflalpha gene, with initial uniform priors (details of

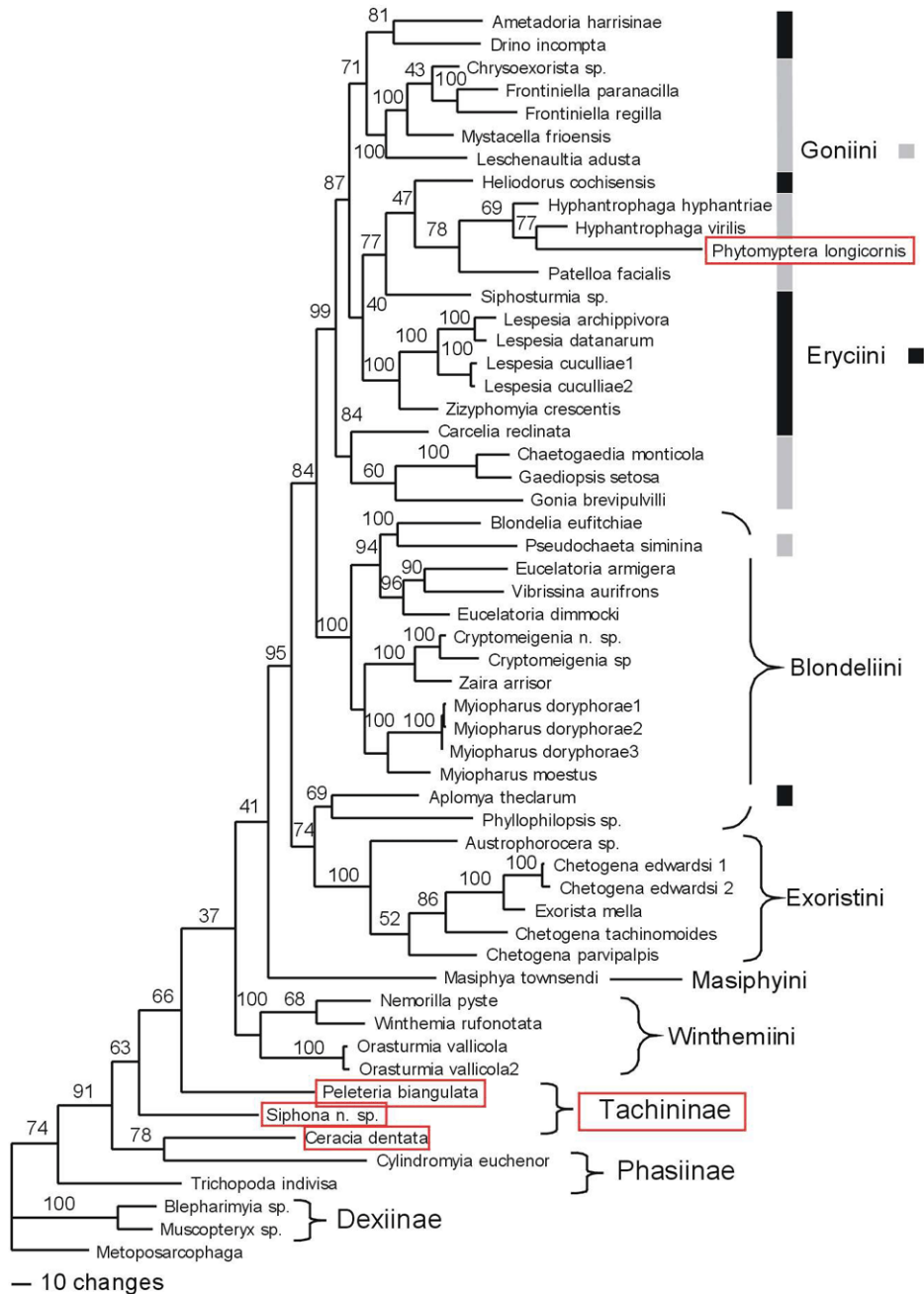


Figure 1. Majority rule consensus of trees from the posterior distribution of the Bayesian analysis of Exoristinae. Numbers above branches indicate the credibility values for each subtended clade (i.e., percentage of all 501 retained trees from the posterior distribution containing the subtended clade). Subfamily and/or tribal associations are indicated by braces, vertical bars, and in the case of Tachininae, red boxes. See text for additional information.

the resulting models and parameter estimates are available upon request).

Results

A summary of the trees from the posterior distribution is given in Figure 1 (mean marginal likelihood: -13425.40). Numbers along branches indicate the clade credibility values of particular nodes (i.e. the percentage of trees from the posterior distribution that contained that node). Goniini are indicated by the vertical gray bar to the right of the cladogram, Eryciini are indicated by the black bars, and Tachininae are indicated by red boxes. Other subfamilies and tribes are indicated by braces to the right of the reconstruction.

Discussion

The consensus tree from the Bayesian analysis generally supports previous conclusions based on alternate tree reconstruction techniques (e.g., parsimony, maximum likelihood), though it also suggests some unique relationships. One valuable aspect of the current Bayesian analysis is that it permits both the assessment of the support for clades in a reasonable amount of time (unlike bootstrapped maximum likelihood searches) and the use of detailed models of substitution partitioned across genes (and/or codon positions, as done here). Thus, nodes with relatively poor support can be easily identified.

The family Tachinidae is weakly supported in the current analysis. Although the two dexiines cluster together strongly (both in the same tribe, Voriini), Tachininae and Phasiinae are reconstructed as paraphyletic and Exoristinae has only weak support (37%). These confusing relationships among subfamilies and the weak support for basal nodes suggest that these genes are probably not appropriate for assessing deep relationships within tachinids, perhaps due to substitutional saturation (homoplasy). The occurrence of the tachinine *Phytomyptera* within the Goniini is inexplicable, perhaps a case of long-branch attraction. This placement is certainly incorrect.

Many relationships indicated in the Bayesian analyses do conform to taxonomic treatments and morphological groupings, often with strong support. Winthemiini, Exoristini, and Blondeliini (with the exception of *Phyllophilopsis*) are all supported in 100% of trees. The clade Goniini + Eryciini is supported by 99% of trees (with the exception of *Aplomya*, which may reflect truly distinct affinities). Again, however, the presence of *Pseudochaeta* in the Blondeliini is unlikely and probably a consequence of long-branch attraction (this taxon was also quite mobile in previous analyses). As in all other analyses of these data, the microtype egg possessing Goniini are not recovered as monophyletic. Interestingly, *Masiphya* occupies an intermediate position between the Winthemiini and the rest of the Exoristinae, which seems appropriate

based the distinctiveness of the Masiphysiini and their possession of unembryonated macrotype eggs. A close affinity of *Aplomya* with Exoristini in the tree is also supported by the possession of unembryonated macrotype eggs.

It is difficult to assess how much the current Bayesian analysis aids in our understanding of tachinid relationships. Many relationships inferred from morphology were recovered (tribes, subtribes, genera), suggesting that these classificatory schemes may reflect phylogenetic relationships quite well. On the other hand, a few obviously incorrect phylogenetic placements (e.g., *Phytomyptera* and *Pseudochaeta*) raise doubts about which other relationships indicated by the cladogram might be misleading. Only continued analyses with more taxa, more genetic data, and more morphological data (from a variety of life stages and morphological systems) will allow us to gain a better understanding of the evolutionary history and relationships of Tachinidae, and through this an understanding of how their oviposition strategies and host associations have evolved. The current analysis, though flawed, represents a step in that direction.

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***Sturmiopsis* specimens needed for molecular systematics study (by A. Mitchell)**

Sturmiopsis parasitica (Curran) is a widespread species throughout eastern and western Africa. It has been released in South Africa as a biocontrol agent of *Eldana saccharina* Walker, a pyralid stemborer found primarily in sugarcane but also in maize and sorghum. However, *S. parasitica* has also been recorded from Crambidae (*Chilo* spp.) and even Noctuidae (e.g. *Busseola fusca*). A molecular systematics study in progress is revealing the existence of biotypes within *S. parasitica*, with obvious implications for biocontrol. We wish to expand our study

to look at the Oriental species *S. inferens* Townsend and the Israeli endemic *S. emdeni* Mesnil, but first need to obtain more specimens. Both pinned specimens (or only 3 legs from pinned specimens) and 95-100% ethanol preserved specimens would be useful. If you could assist in the collection of specimens for this DNA study then please send an e-mail to Andrew.Mitchell@dpi.nsw.gov.au.

Improvement of the *in vitro* culture of *Exorista larvarum* (L.), a tachinid parasitoid of Lepidoptera (by M.L. Dindo and E. Marchetti)

The tachinid larval parasitoid *Exorista larvarum* (L.) is well known as an antagonist of lepidopterous forest and agricultural pests in several regions of the Palearctic area (Herting 1960). This beneficial insect was successfully reared from egg to adult on artificial media composed of crude components and containing agar as a physical support (Mellini *et al.* 1996).



Figure 1. Early third instar larva of *Exorista larvarum* in a gelled medium.

For *E. larvarum*, the consistency of the food is important to allow gaseous exchange, as its metapneustic larvae breathe atmospheric oxygen and reject CO₂ from the beginning of their development. In the host they form primary integumental respiratory funnels, whereas in the gelled media they penetrate the substrate and keep their spiracles in contact with the air (Fig. 1). Dindo *et al.* (2003) showed that the *in vitro* culture of *E. larvarum* can be made more cheaply by using absorbent cotton (Fig. 2) instead of more expensive agar as a support for the liquid medium, at the rate of 15 ml medium/15 mg cotton. Parasitoid yields did not differ significantly between agar-containing and cotton-absorbed media.

The artificial rearing procedure for *E. larvarum* is usually performed under aseptic conditions to control contamination by fungi. However, no significant increase in mould contamination or decrease in adult yield occurred when rearing was conducted outside of a laminar flow hood in a medium devoid of antifungal agents. The possibility to conduct the *in vitro* culture outside of a laminar flow hood could lead to significant cost savings in the event of large-scale production of *E. larvarum* on

artificial media (Dindo *et al.* 2003).

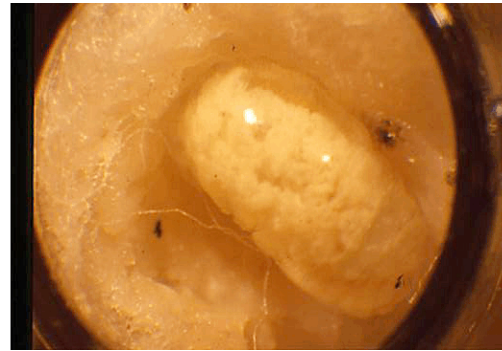


Figure 2. *Exorista larvarum* larva on artificial medium-soaked cotton balls.

Exorista larvarum parasitizes a host by laying macrotype eggs directly on its body. However, in both nature and captivity eggs are deposited also in the environment if host larvae are not sufficient, a behaviour which is common amongst tachinids (Mellini 1990). In the absence of a host, these eggs are obviously wasted. At the moment, for the *in vitro* rearing of *E. larvarum*, eggs are collected from superparasitised *Galleria mellonella* L. larvae and subsequently transferred to the rearing medium. We have found that eggs laid on a plastic sheet placed on the bottom of the cage (Fig. 3) were more easily removed and transferred to medium than those deposited on the host's body. On the artificial substrate, these eggs hatched and the parasitoids developed to the adult stage at rates equivalent to those obtained for host-collected eggs.



Figure 3. Macrotype eggs of *Exorista larvarum* laid on a plastic sheet.

The above technique for rearing *E. larvarum* on medium-soaked cotton outside of a laminar flow hood may thus be recommended to simplify the *in vitro* culture of *E. larvarum*. Studies aimed at stimulating oviposition on a plastic sheet and finding better conditions to store the eggs are now in progress.

Acknowledgements

We wish to thank P. Baronio and F. Santi for taking the pictures shown in Figs. 1–3.

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Tachinidae (Diptera) collected at light in Switzerland (by H.-P. Tschorsnig)

Introduction

To what extent are Tachinidae attracted by light, and how effective are light-traps for collecting this family? As far as known to the author, there is only very scattered and scarce information on Tachinidae collected at light. Single European records are given by Mesnil (1961: 689), Borisova-Zinov'eva (1964: 395, 396), Richter (1970: 900), Herting (1975: 2), Tschorsnig (1992: 50), Andersen (1996: 40, 95), Tschorsnig et al. (1997: 29), and Tschorsnig et al. (2003: 64). It is possible that after an intensive search some more published records might be found. A few additional unpublished records are known to the author.

Hence it was of special interest to evaluate and analyze the large amount of material collected at light by Dr. Ladislaus Rezbanyai-Reser as part of the entomofaunistic research projects of the Natur-Museum Luzern over the past three decades (from 1975 to 2003) in Switzerland. The primary goal of Rezbanyai-Reser's activities were investigations on Lepidoptera, but he also collected and stored specimens of other orders (Coleoptera, Hymenoptera, Diptera). This is perhaps the largest systematic collection of insects ever taken at light in Europe.

Methods and Material

Collections at light were made in central and southern Switzerland at about 60 localities, covering a wide range of habitats, from submediterranean plains in the south to high elevations in the Alps (up to 2000 m). Most were systematic light trap collections which lasted the whole vegetation period over one to several years. The type of light trap (Type Jermy) and its manner of use are described and figured by Rezbanyai (1977). Insects were attracted in most cases by a mixed spectrum lamp (160 watt) or a mercury vapor lamp (125 or 80 watt), and were killed by

chloroform in a container below the trap. Additionally, there was also some personal sampling by Rezbanyai-Reser at the light sheet. For the majority of the localities there is detailed information available on their geography, geology, climate and vegetation; see maps and references in Tóth and Rezbanyai-Reser (1997), Bächli and Rezbanyai-Reser (1998), and Tröger and Rezbanyai-Reser (1998).

The main problem with the samples was that most Diptera and Hymenoptera were stored dry in plastic boxes, mixed together as an amorphous mass, representing nearly one cubic meter of densely packed insects in total. Only a small portion of the flies had been pinned or was preserved in alcohol. So it was first necessary to sift carefully through the delicate material and pick out the Tachinidae, a time-consuming task. The identification of the tachinids was possible, in practically all cases, despite some damage to the flies and an abundance of lepidopteran scales.

Most of the material examined is stored at the Natur-Museum Luzern (Switzerland), with some specimens in the Museo cantonale di storia naturale di Lugano (Switzerland) and in the Naturkundemuseum Stuttgart (Germany).

Results

A total of 1679 specimens representing 179 species of Tachinidae were collected at light (Table 1). The complete list with all details will be published in *Entomologische Berichte Luzern* (Tschorsnig and Rezbanyai-Reser in press).

The species in Table 1 are arranged in the order of a "light-collection ratio" (LR), i.e. species that most commonly occurred at light are placed first. "LR" as here defined means the number of specimens collected at light divided by the number of *all* specimens whose original data are presently known to the author (more than 130,000 European specimens), expressed as a percentage. Only field collected material was used for calculating LR; reared material was excluded. Additionally, data from the literature were considered for some rare species, as well as a small amount of data from collections at light that were known to the author before this study (published and unpublished data, but in total only 26 specimens as far as the species in Table 1 are concerned). Values for the last three species in the table are nil due to rounding.

Females (59 percent) were more frequently collected at light than males (41 percent).

It is obvious that no subfamily dominates in light-collected material. For Tachinidae collected at light, the partition of the species by subfamily (Exoristinae 43%, Tachininae 34%, Dexiinae 13%, Phasiinae 10%) is practically the same as the partition of all species of Palearctic Tachinidae (Exoristinae 40%, Tachininae 34%, Dexiinae 15%, Phasiinae 11%).

The "Malaise trap ratio" (MR, column 5 of Table 1)

indicates the relative frequency of species collected in Malaise traps (A = less than 10% of all specimens collected in Malaise traps, B = 10–50%, C = more than 50%), based on the same data of the author as mentioned above. No Malaise trap ratio is given for a few species because the number of specimens was too low. “Malaise trap” as here understood includes also related trap constructions, such as the tent window trap used by Herting (1969). Consequently “A” denotes species which are not or only rarely collected in Malaise traps, and “C” the typical Malaise trap species. Twenty-nine percent of the light-collected specimens can be assigned to type “A” and 26% to type “C”. Since there is practically no difference between these percentages, there is probably no correlation between “Malaise trap species” and “light collected species”.

Column 4 (Size) gives a simple classification of the body length: s (small) = usually smaller than 5 mm, m (medium) = about 5–10 mm, l (large) = usually larger than 10 mm. The data clearly show that small species (36% of the specimens) and medium-sized species (56% of the specimens) prevail over large species (8% of the specimens) at light. This imbalance towards small species is even more distinct for specimens collected in Malaise traps (small: 66%, medium: 31%, large: 3%).

Discussion

This study was limited by the amount of data available to the author. So, even though a large number of specimens in total were included, certain rarer species were represented by very few specimens. The LRs reported here provide only a preliminary tool for the interpretation of the data, and cannot be taken as universally valid.

A high number of specimens taken at light (e.g. *Estheria bohemani*, *Siphona geniculata*, *Lydina aenea*) do not necessarily indicate a special attraction to light (see the values of LR in Table 1), nor prove that a species is normally active at night. Quite the contrary, it must be supposed that nearly all specimens were based on accidental occurrence, as all except two species show unquestionable diurnal behavior. It is likely that most tachinid specimens were only active because of the artificial illumination near their vicinity, hence simulating “day”. Accidental records from light traps are also known for other diurnal insects, e.g. diurnal butterflies (see Malicky 1988, Rezbanyai-Reser 1989b). The long species list of Table 1 is probably due mainly to the extensive time period over which the light traps were in operation, though a special behavior on the part of some species may also have played a role.

Only two of the listed species are likely to be truly nocturnal: *Istocheta sublutescens* and *Therobia leonidei*. Fifteen of the 17 known specimens of *Istocheta sublutescens* have been collected at light, and for the other two

specimens this type of information is lacking (but they could also have been taken at light). Because of this, and because activity at night (or at least at dawn) is known also for other species of *Istocheta* (Golovianko 1916:17, Couturier 1952: 61, Couturier & Robert 1954: 46, Mesnil 1961: 689, Borisova-Zinov'eva 1964: 395, 396), a nocturnal behavior may be strongly suspected for this species. For *Therobia leonidei*, a locust parasitoid, there are many more reared specimens known than specimens collected in the field, but at least two records clearly concern collections at light (Richter 1970: 900, Tschorsnig et al. 1997: 29). A nocturnal behavior is obvious for this species because the females find their hosts at night, using their ultrasound sensitive ear (Lakes-Harlan and Heller 1992, Lehmann 1998).

We do not know much about the other species that are present at the top of Table 1. It cannot completely be ruled out that some of them might be partially active during night or dawn, but without more information on their development and behavior this must remain pure speculation. *Hemimacquartia paradoxa* is a rare species of unknown biology, but Stein (1924: 85) wrote explicitly that he collected his material from leaves. *Lydella thompsoni* is a commonly reared parasitoid of *Ostrinia nubilalis*, rarely collected in the field, but not very likely to be nocturnal. *Estheria bohemani* was collected at a single locality only; perhaps it was very common over several years there, and therefore also common in the light traps. Concerning *Zaira cinerea*, there might be an indirect conclusion that the females must be at least partially active at night. The hosts of this species are adult Carabidae, consisting of daily active genera (e.g. *Zabrus*, *Harpalus* and *Amara*), and genera which have a nocturnal behaviour (e.g. most *Carabus*). Direct oviposition on *Carabus* would, most probably, only be possible at night.

It is also of interest that certain species were not found during nearly thirty years of light-trapping in Switzerland. For *Ceromya silacea* there is a note by Andersen (1996: 40), based on a single specimen: “Specimen from Norway taken at light; night activity also indicated by the extremely yellow color.” However, true night activity for *Ceromya silacea* is not very likely because the present author has seen almost 500 specimens, mostly collected in Malaise traps. A hasty conclusion can easily be wrong, even if many specimens (see Table 1) are collected at light. The bright yellow color does not necessarily indicate night activity.

How effective are light traps for collecting Tachinidae? An exact value for their efficiency cannot be given because the material from the light traps was stored in various amounts, but the average number is about eight tachinid specimens per year and per trap (none or nearly none at high elevations and cold climates, up to 30–50 in

the warmer and more southern areas of Switzerland). For comparison, a Malaise trap placed at a suitable locality in Central Europe yields more than 1000 specimens during the vegetation period. Nevertheless, light trapping is not without interest because it is evident that the upper fifth of Table 1 consists of about 50% rare species, whereas the lower fifth comprises almost entirely common species. The reason why there were only two really night-active species among the material is perhaps due to their general rareness in Switzerland.

On an average, there were more females than males collected at light, but it is unknown whether this is a stable or significant feature. Malaise trap collections are inconsistent in this respect, where males or females may prevail, depending on locality and species composition.

The author thought for a long time that tachinids might have flown into the light traps during the daytime because predominantly diurnal species were present in the samples. But L. Rezbanyai-Reser has indicated that the collecting bottles were removed in the early morning hours and mounted again in the evening. It is therefore quite unlikely that Tachinidae were caught in the light traps during the day.

To what extent there might be an olfactory attraction on the part of certain Tachinidae to hosts present (dead or alive) in the collecting bottle of a light trap is unknown. The common occurrence of two rarer Phasiinae (*Redtenbacheria insignis* and *Lophosia fasciata*) in the light traps was surprising, and one cannot rule out the possibility that this was due to the presence of bugs in the traps.

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Table 1. Tachinidae collected at light in Switzerland. Number of collected males and females, size of body, Malaise-trap ratio (MR), and light-collection ratio (LR) are given for each species. See text for explanation. *Meigenia* females are omitted because of problems with their identification to species.

Species	♂♂	♀♀	Size	MR	LR
<i>Istochea sublutescens</i> Herting	2	11	m	A	88.2
<i>Therobia leonidei</i> (Mesnil)	1	1	m	-	66.6
<i>Redtenbacheria insignis</i> Egger	13	26	m	A	59.1
<i>Lydella thompsoni</i> Herting	8	5	m	A	56.5
<i>Phytomyptera bohémica</i> (Kramer)	18	7	s	B	49.0
<i>Hemimacqartia paradoxa</i> B. & B.	2	15	m	A	47.2
<i>Hyalurgus tomostethi</i> Cepelák	1	2	m	-	42.9
<i>Rondania dimidiata</i> (Meigen)	4	42	s	B	22.4
<i>Neophryxe vallina</i> (Rondani)	0	2	m	-	22.2
<i>Phebellia pauciseta</i> (Vill.)	3	5	m	B	21.6
<i>Ceromya flaviceps</i> (Ratzeburg)	0	1	s	-	18.2
<i>Estheria bohémica</i> (Rondani)	52	76	m	A	18.0
<i>Phytomyptera nigroaenea</i> (Herting)	0	2	s	-	16.7
<i>Graphogaster brunnescens</i> Vill.	1	0	s	-	16.7
<i>Admontia seria</i> (Meigen)	2	2	m	C	15.4
<i>Paratryphera bisetosa</i> (B. & B.)	2	1	m	B	14.3
<i>Trichactia pictiventris</i> (Zett.)	8	10	s	B	13.7
<i>Admontia blanda</i> (Fallén)	9	9	s	B	13.6
<i>Loewia brevifrons</i> (Rondani)	7	1	m	A	13.6
<i>Lophosia fasciata</i> Meigen	6	28	l	A	13.4
<i>Macqartia pubiceps</i> (Zett.)	6	8	m	B	12.8
<i>Macqartia grisea</i> (Fallén)	9	38	m	B	12.7
<i>Admontia grandicornis</i> (Zett.)	4	9	m	B	11.2
<i>Macqartia macularis</i> Vill.	0	2	m	-	11.1
<i>Ceranthia lichtwardtiana</i> (Vill.)	3	4	s	B	11.1
<i>Eurysthaea scutellaris</i> (R.-D.)	11	10	s	B	10.9
<i>Phasia aurulans</i> Meigen	3	3	m	A	10.7
<i>Lydina aenea</i> (Meigen)	25	39	s	B	10.3
<i>Bessa parallela</i> (Meigen)	6	9	s	A	9.3
<i>Ceromya flaviseta</i> (Vill.)	1	2	s	C	9.1
<i>Aphantorhaphopsis siphonoides</i> (Strobl)	2	0	s	B	8.3
<i>Subclytia rotundiventris</i> (Fallén)	4	2	s	B	7.8
<i>Leiophora innoxia</i> (Meigen)	9	2	m	B	7.1
<i>Winthemia cruentata</i> (Rondani)	1	0	m	A	7.1
<i>Ramonda latifrons</i> (Zett.)	1	4	m	B	7.1
<i>Senometopia separata</i> (Rondani)	1	1	m	B	6.9
<i>Dexia rustica</i> (Fabricius)	1	18	l	A	6.6
<i>Zaira cinerea</i> (Fallén)	5	13	m	B	6.3
<i>Anthomyiopsis nigrisquamata</i> (Zett.)	1	0	s	A	5.6
<i>Chetoptilia puella</i> (Rondani)	2	1	s	B	5.6
<i>Ramonda spathulata</i> (Fallén)	15	12	m	B	5.3
<i>Dexia vacua</i> (Fallén)	2	3	m	B	5.2
<i>Allophorocera ferruginea</i> (Meigen)	46	9	m	B	5.1
<i>Phryxe nemea</i> (Meigen)	21	33	m	B	4.9
<i>Ligeria angusticornis</i> (Loew)	10	11	s	B	4.5
<i>Actia maksymovi</i> Mesnil	0	3	s	C	4.5
<i>Compsilura concinnata</i> (Meigen)	16	39	m	C	4.0
<i>Dexiosoma caninum</i> (Fabricius)	6	8	l	A	4.0
<i>Admontia maculisquama</i> (Zett.)	3	2	m	C	3.7
<i>Loewia nudigena</i> Mesnil	4	5	s	B	3.6

<i>Carcelia falenaria</i> (Rondani)	0	3	m	A	3.5
<i>Bactromyia aurulenta</i> (Meigen)	1	5	m	B	3.2
<i>Carcelia lucorum</i> (Meigen)	7	4	m	A	3.2
<i>Ceromya dorsigera</i> Herting	1	2	s	C	3.2
<i>Vibrissina turrata</i> (Meigen)	1	3	m	B	3.0
<i>Rhacodinella apicata</i> (Pandellé)	1	0	m	A	3.0
<i>Vibrissina debilitata</i> (Pandellé)	0	2	m	B	2.9
<i>Drino lota</i> (Meigen)	0	2	m	B	2.9
<i>Sturmia bella</i> (Meigen)	1	4	l	B	2.9
<i>Gastrolepta anthracina</i> (Meigen)	9	21	s	C	2.8
<i>Medina luctuosa</i> (Meigen)	2	2	s	B	2.7
<i>Loewia foeda</i> (Meigen)	3	0	m	C	2.7
<i>Eumea mitis</i> (Meigen)	0	4	m	A	2.6
<i>Pales pavida</i> (Meigen)	13	15	m	B	2.4
<i>Hebia flavipes</i> R.-D.	1	6	s	C	2.3
<i>Pseudopachystylum gonioides</i> (Zett.)	0	2	l	A	2.3
<i>Phytomyptera nigrina</i> (Meigen)	1	1	s	B	2.3
<i>Campylochea inepta</i> (Meigen)	4	6	m	B	2.3
<i>Periscepsia carbonaria</i> (Panzer)	3	3	s	A	2.3
<i>Bessa selecta</i> (Meigen)	0	5	s	B	2.2
<i>Pseudoperichaeta nigrolineata</i> (Walk.)	3	3	m	B	2.2
<i>Siphona cristata</i> (Fabricius)	0	1	s	B	2.2
<i>Peribaea setinervis</i> (Thomson)	7	2	s	C	2.1
<i>Siphona geniculata</i> (De Geer)	26	63	s	C	2.1
<i>Senometopia excisa</i> -group	0	1	m	B	2.0
<i>Eumea linearicornis</i> (Zett.)	5	6	m	B	2.0
<i>Siphona grandistylum</i> Pandellé	0	1	s	C	2.0
<i>Thelyconychia solivaga</i> (Rondani)	1	0	s	B	1.9
<i>Myxexoristops stolidus</i> (Stein)	1	0	m	A	1.9
<i>Meigenia grandigena</i> (Pandellé)	0	7	m	A	1.8
<i>Oswaldia eggeri</i> (B. & B.)	0	1	m	B	1.8
<i>Oswaldia muscaria</i> (Fallén)	9	17	m	C	1.7
<i>Paracraspedothrix montivaga</i> Vill.	3	2	s	C	1.7
<i>Acemya acuticornis</i> (Meigen)	5	0	s	A	1.7
<i>Admontia podomyia</i> B. & B.	0	1	m	A	1.6
<i>Ramonda prunaria</i> (Rondani)	12	3	s	C	1.6
<i>Actia pilipennis</i> (Fallén)	3	5	s	C	1.5
<i>Phylomya procera</i> (Meigen)	0	1	m	B	1.5
<i>Ocytata pallipes</i> (Fallén)	16	27	m	C	1.4
<i>Siphona variata</i> Andersen	0	2	s	B	1.4
<i>Blondelia nigripes</i> (Fallén)	12	37	m	B	1.3
<i>Cyzenis albicans</i> (Fallén)	7	12	s	C	1.3
<i>Mintho rufiventris</i> (Fallén)	4	3	m	A	1.3
<i>Zenillia libatrix</i> (Panzer)	0	1	m	B	1.2
<i>Phytomyptera cingulata</i> (R.-D.)	0	2	s	C	1.2
<i>Aphantorhaphopsis brunnescens</i> (Vill.)	0	1	s	C	1.2
<i>Phasia hemiptera</i> (Fabricius)	4	11	l	A	1.2
<i>Leucostoma anthracinum</i> (Meigen)	2	2	s	C	1.2
<i>Medina separata</i> (Meigen)	1	4	s	B	1.1
<i>Phytomyptera minutissima</i> (Zett.)	3	0	s	C	1.1
<i>Billaea adelpha</i> (Loew)	1	0	l	A	1.1
<i>Meigenia dorsalis</i> (Meigen)	8	0	m	A	1.0
<i>Myxexoristops blondeli</i> (R.-D.)	1	0	m	B	1.0
<i>Prosenia siberita</i> (Fabricius)	6	4	m	A	1.0
<i>Acemya rufitibia</i> (von Roser)	0	1	s	B	0.9
<i>Carcelia gnava</i> (Meigen)	1	0	m	A	0.9
<i>Linnaemya comta</i> (Fallén)	2	2	l	A	0.9
<i>Linnaemya lithosiphaga</i> (Rondani)	1	0	m	A	0.9

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<i>Cinochira atra</i> Zett.	1	0	s	C	0.9	<i>Phryxe heraclei</i> (Meigen)	0	1	m	B	0.1
<i>Parasetigena silvestris</i> (R.-D.)	5	1	l	A	0.8	<i>Tachina fera</i> (Linnaeus)	7	2	l	A	0.1
<i>Chrysosomopsis aurata</i> (Fallén)	1	0	m	A	0.8	<i>Nemoraea pellucida</i> (Meigen)	1	1	l	A	0.1
<i>Siphona ingerae</i> Andersen	1	0	s	-	0.8	<i>Linnaemya tessellans</i> (R.-D.)	1	0	l	B	0.1
<i>Siphona pauciseta</i> Rondani	2	16	s	C	0.8	<i>Eurithia anthophila</i> (R.-D.)	1	0	l	A	0.1
<i>Trixa conspersa</i> (Harris)	0	2	l	B	0.8	<i>Peribaea apicalis</i> R.-D.	0	1	s	C	0.1
<i>Phasia barbifrons</i> (Girschner)	5	1	l	B	0.8	<i>Peribaea tibialis</i> (R.-D.)	1	3	s	C	0.1
<i>Medina collaris</i> (Fallén)	0	1	s	B	0.7	<i>Dinera carinifrons</i> (Fallén)	3	0	m	A	0.1
<i>Drino inconspicua</i> (Meigen)	1	0	m	A	0.7	<i>Dinera ferina</i> (Fallén)	1	0	l	A	0.1
<i>Siphona paludosa</i> Mesnil	0	2	s	C	0.7	<i>Eriothrix rufomaculatus</i> (De Geer)	3	3	m	B	0.1
<i>Voria ruralis</i> (Fallén)	5	11	m	B	0.7	<i>Actia lamia</i> (Meigen)	0	1	s	C	0.0
<i>Phasia pandellei</i> (Dupuis)	1	1	s	A	0.7	<i>Phasia pusilla</i> Meigen	0	1	s	A	0.0
<i>Leucostoma crassum</i> Kugler	1	0	s	A	0.7	<i>Phania funesta</i> (Meigen)	0	1	s	C	0.0
<i>Meigenia mutabilis</i> (Fallén)	11	0	m	B	0.6						
<i>Smidtia conspersa</i> (Meigen)	0	2	m	B	0.6						
<i>Drino vicina</i> (Zett.)	0	1	m	B	0.6						
<i>Eloceria delecta</i> (Meigen)	5	3	s	C	0.6						
<i>Macquartia tenebricosa</i> (Meigen)	3	3	m	B	0.6						
<i>Actia crassicornis</i> (Meigen)	0	2	s	B	0.6						
<i>Siphona flavifrons</i> Staeger	2	3	s	C	0.6						
<i>Leskia aurea</i> (Fallén)	0	1	m	B	0.6						
<i>Phasia aurigera</i> (Egger)	1	1	l	A	0.6						
<i>Hemyda vittata</i> (Meigen)	0	1	m	A	0.6						
<i>Prosopea nigricans</i> (Egger)	0	1	m	A	0.5						
<i>Macquartia dispar</i> (Fallén)	5	13	m	A	0.5						
<i>Triarthria setipennis</i> (Fallén)	9	8	s	C	0.5						
<i>Billaea triangulifera</i> (Zett.)	1	1	l	A	0.5						
<i>Paratrypha barbatula</i> (Rondani)	1	0	m	B	0.4						
<i>Nemorilla floralis</i> (Fallén)	1	0	m	B	0.4						
<i>Lydella grisescens</i> R.-D.	4	1	m	C	0.4						
<i>Carcelia bombylans</i> R.-D.	1	0	m	B	0.4						
<i>Erycia fatua</i> (Meigen)	0	1	m	A	0.4						
<i>Phytomyza zonella</i> (Zett.)	0	1	s	C	0.4						
<i>Demoticus plebejus</i> (Fallén)	1	0	m	A	0.4						
<i>Cyrtophleba ruricola</i> (Meigen)	1	1	m	A	0.4						
<i>Ectophasia crassipennis</i> (Fabricius)	3	5	l	A	0.4						
<i>Gymnosoma rotundatum</i> (Linnaeus)	6	3	m	B	0.4						
<i>Phorocera obscura</i> (Fallén)	0	2	m	B	0.3						
<i>Winthemia quadripustulata</i> (Fabricius)	0	2	m	B	0.3						
<i>Pseudoperichaeta paleoidea</i> (R.-D.)	0	1	m	A	0.3						
<i>Tachina magnicornis</i> (Zett.)	3	6	l	A	0.3						
<i>Pelatachina tibialis</i> (Fallén)	0	1	m	A	0.3						
<i>Dinera grisescens</i> (Fallén)	1	0	m	B	0.3						
<i>Blepharomyia pagana</i> (Meigen)	0	1	m	C	0.3						
<i>Microsoma exiguum</i> (Meigen)	9	4	s	C	0.3						
<i>Phasia obesa</i> (Fabricius)	4	0	m	B	0.3						
<i>Phebellia nigripalpis</i> (R.-D.)	0	1	m	B	0.2						
<i>Phryxe vulgaris</i> (Fallén)	2	5	m	B	0.2						
<i>Huebneria affinis</i> (Fallén)	0	1	m	A	0.2						
<i>Pales processionae</i> (Ratzeburg)	0	1	m	B	0.2						
<i>Lypha dubia</i> (Fallén)	4	1	s	B	0.2						
<i>Entomophaga nigrohalterata</i> (Vill.)	1	0	s	C	0.2						
<i>Bithia spreta</i> (Meigen)	0	1	m	A	0.2						
<i>Estheria microcera</i> (R.-D.)	0	1	l	A	0.2						
<i>Leucostoma simplex</i> (Fallén)	1	1	s	C	0.2						
<i>Exorista rustica</i> (Fallén)	1	2	m	B	0.1						
<i>Nemorilla maculosa</i> (Meigen)	1	0	m	A	0.1						
<i>Aplomya confinis</i> (Fallén)	0	1	m	B	0.1						

Electronic products on the Tachinidae (by J.E. O'Hara)

Listed here are several recent additions to the growing number of online products on the Tachinidae.

Fauna Europaea

Fauna Europaea has developed a database of the names and distributions of the animal species of Europe. This includes current data on the Tachinidae, as prepared by H.-P. Tschorsnig, V.A. Richter, P. Cerretti, T. Zeegers, C. Bergström, J. Vanhara, G. Van de Weyer, C. Bystrowsky, C. Raper, J. Ziegler and Z. Hubenov. The website address is <http://www.faunaeur.org>.

Tachinid Genera of the World

Jim O'Hara has recently added a new PDF document entitled, *World Genera of the Tachinidae (Diptera) and their Regional Occurrence* to his Tachinidae website. This product consists primarily of a table listing all the currently recognized tachinid genera of the world along with their regional distributions. The list will be updated periodically to incorporate new genera, nomenclatural changes, and new distribution records. The PDF file can be viewed or downloaded at <http://www.nadsdiptera.org/Tach/Genera/generahom.htm>.

Tachinidae of the Deutschen Entomologischen Instituts

The tachinid collection of the Deutschen Entomologischen Instituts (DEI) in Eberswalde, Germany, has been databased by H. Ewald and J. Ziegler and is available online at http://www.zalf.de/home_zalf/institute/dei/dei/sammlungen/diptera/tachinid.htm.

Czech and Slovak Dipterological Literature

Literature by J. Vanhara, R. Rozkošný, P. Bitušík and J. Rozehnal on Czech and Slovak Diptera, including the Tachinidae, is available online at <http://www.sci.muni.cz/zoolecol/inverteb/research.htm>.

Abstracts from the XXII International Congress of Entomology (by J.E. O'Hara)

The XXII International Congress of Entomology was held in Brisbane, Australia, 15–21 August 2004. Below are given, in alphabetical order by author, the abstracts of the oral and poster presentations on the Tachinidae that were given at the Congress. These abstracts were included on a CD that accompanied the official congress program.

Managing leaf beetles in eucalypt plantations: non-target impacts, biocontrol and natural enemy recolonisation (Poster presentation by G.R. Allen*, J.A. Elek and M. Matsuki; *School of Agricultural Science, Private Bag 54, University of Tasmania, Hobart 7001, Tasmania, Australia)

A field trial examined the impact of chemical spraying on leaf beetle (*Chrysophtharta agricola*: Chrysomelidae) control by natural enemies in *Eucalyptus nitens* plantations. We compared the impact of the Naturalyte insecticide Success® with the broad-spectrum pyrethroid Dominex®. In addition to reducing natural enemy loss to insecticides we hypothesised that we would enhance natural enemy effectiveness and residency in the plantation. Non-target impacts were monitored using op sheets during aerial spraying, sticky traps, malaise traps and visual searches of branches before and at intervals after spraying. The efficacy of natural enemies was assessed by protecting sentinel cohorts of beetle larvae during spraying and monitoring their disappearance due to predation or levels of parasitism. As anticipated, Dominex® reduced levels of non-target species, including natural enemies, more than Success®. However, predation rates were higher following Dominex® spraying with the few recolonising and remaining resident predators targeting the sentinel larvae. By contrast, predation rates following Success® spraying mirrored that of unsprayed plantations. Parasitism rates of sentinel larvae by tachinid flies were severely impacted by either spray, though less so under Success®. The return to pre-spray levels of natural enemies varied according to species but was often at least two months following broad-spectrum spraying.

Seasonal occurrence of parasitoids attacking *Helicoverpa armigera* (Lepidoptera: Noctuidae) in Kenya (Poster presentation by R. Brzezowski*, S. Nakamura and T. Yoshida; *Jircas, 1-1 Owashi, Tsukuba, 305-8686, Japan)

Helicoverpa armigera Hubner, a serious pest of important crops in Kenya, is attacked by various natural enemies, including several species of tachinid flies. Weekly collections of *H. armigera* larvae were initiated in order to obtain information on the pest and its parasitoids occurrence throughout the year. Larvae were collected from a pigeon-pea (*Cajanus cajan*) field, maintained for

the purpose, located in the Nairobi University Kabete Campus. Collected larvae were kept individually, provided with artificial diet, and their development was observed. Data on seasonal occurrence, percentage parasitism and host stage attacked were compiled for months, for the period from June 2002 to the present, and compared to data of monthly precipitation and temperature in the area. The most important mortality factor of collected *H. armigera* larvae was parasitization of tachinids, *Pallexorista zonata* Curran, and *Linnaemya longirostris* Macquart. Parasitization of the both species peaked in different time of the year and total parasitism sometimes exceeded 50%. The results encouraged us for further investigations of these parasitoids as biological control agents of the pest.

Life history parameters of *Pallexorista zonata* (Diptera: Tachinidae): host acceptance & suitability of three lepidopteran species (Poster presentation by R. Brzezowski*, S. Nakamura and T. Yoshida; *Jircas, 1-1 Owashi, Tsukuba, 305-8686, Japan)

Biology of *Pallexorista zonata*, one of important natural enemies of *Helicoverpa armigera* in Kenya was studied. Larvae of *H. armigera* collected from Nairobi University Kabete campus were reared in the laboratory. Emerging *P. zonata* flies were used to initiate a laboratory colony. Flies mated easily in captivity and oviposited on introduced caterpillars. Host larvae were then kept individually in containers provided with artificial diet. Their development and parasitization were observed daily. Larvae of three lepidopteran species were used as hosts: *H. armigera* along with two species of stemborers, *Sesamia calamistis* and *Chilo partellus*. The two latter species were introduced in order to assess their suitability for easy-maintenance of *P. zonata* colony. Records obtained during colony rearing as well as separate experimental sets explain some aspects of *P. zonata* biology, such as average clutch size, egg hatching time, duration of larval development, and the effect of superparasitism. Stemborer species could be used in *P. zonata* rearing, however their efficiency in terms of fly's body size and the number of puparia supported by one host were lower than that of *H. armigera*.

Biological control of pest mole crickets in Florida, USA (Oral presentation by J.H. Frank; Entomology and Nematology Department, University of Florida, Gainesville, FL 32611-0630, USA)

Three South American pest mole crickets occur in Florida. They arrived in Georgia or Florida in 1899-1904 in ship ballasts. For >100 years, chemicals were the control method, at great annual cost, in vegetables, turf, and pastures. In the 1980s, three specialist biological control

agents were introduced into northern Florida against them, all from southern South America. These were a wasp, *Larra bicolor* (Hymenoptera: Sphecidae), a nematode, *Steinernema scapterisci* (Rhabditida: Steinernematidae), and a fly, *Ormia depleta* (Diptera: Tachinidae). The nematode was applied as a biopesticide in many counties but spreads slowly. The wasp has spread to >15 counties after release in northern Florida. The fly spread fastest, now occupies southern and central Florida, but is limited by inability to overwinter north of »29°N. Trapping stations in northern Florida established in 1979 showed no trend in total annual catches of mole crickets for nine pre-release years. After the biological control agents reached the vicinity of the trapping stations, numbers began to decline. They have declined for 12+ years. In 2003, the total annual catch of the worst of the three pests (*Scapteriscus vicinus*) achieved less than 0.5% of the annual average catch for the pre-release years. Statewide control is within reach.

The potential for a classical biological control programme against painted apple moth (*Teia anartoides* Walker) in New Zealand (Oral presentation by P.J. Gerard*, J.G. Charles, M.B. Malipatil, F. Page, A. Chagan, M.R. McNeill and L. Semeraro; *AgResearch, Ruakura Research Centre, Private Bag 3123, Hamilton, New Zealand)

The painted apple moth *Teia anartoides* Walker, a minor native Australian pest, is the target of an eradication programme in Auckland, New Zealand, where it poses a serious threat to indigenous and modified environments. As a precursor to a possible classical biocontrol programme in the event of eradication failure, searches for natural enemies of *T. anartoides* were carried out in autumn and in late spring to early summer 2003 in south-east Australia. At least 18 species of egg, larval and larval-pupal parasitoids were reared, the majority being Hymenoptera from the families Braconidae, Ichneumonidae and Eulophidae, and Diptera (at least two species of Tachinidae). The most common species from Victoria and Tasmania was *Cotesia* sp. (Hymenoptera: Braconidae), a solitary parasitoid of young larvae. The parasitoid guild showed greater diversity in spring-early summer than in autumn, and had some structural similarity with guilds of other Lymantriidae around the world. The guild was compared with existing natural enemies of *T. anartoides* in New Zealand and with those attacking other Lymantriidae occupying the same Australian habitats and host plants. Several Hymenoptera attacking *T. anartoides* larvae appear to be host specific and could act as effective biological control agents for this pest in New Zealand.

Suitability of five danaid butterflies for parasitization by the tachinid, *Sturmia bella* (Poster presentation by N.

Hirai* and M. Ishii; *Entomological Laboratory, Graduate School of Agriculture and Biological Sciences, Osaka Prefecture University, Sakai, Osaka 599-8531, Japan)

The tachinid fly, *Sturmia bella*, is a principal parasitoid of the migrant danaid, *Parantica sita* in Japan. Female adults deposit microtype eggs on foliage of host's food plants, and parasitization starts by host ingestion of eggs with leaf tissue. Eggs of *S. bella* were found on leaves of *Hoya carnosa*, *Tylophora tanakae*, *Parsonia laevigata*, *Cynanchum liukiense* and *Ficus microcarpa*, host plants of 5 danaids, *P. sita*, *Ideopsis similis*, *Idea leuconoe*, *Salatura genutia* and *Euploea mulciber*, respectively, in Ryukyu Islands. However, there have been few records of parasitization of these danaids except *P. sita*. In this study, we gave a piece of artificial diet with *S. bella* eggs to 4th or 5th instar larvae of the 5 danaids to compare parasitism rates. Most of *P. sita* and *E. mulciber* larvae died from parasitization, while most individuals of *I. similis*, *I. leuconoe* and *S. genutia* emerged as healthy-looking adults. We found melanized larvae of *S. bella* within the abdomen of most *I. similis* adults emerging, while no sign of parasitization was observed inside the body of *I. leuconoe* and *S. genutia*. The results show that larvae of *I. similis*, *I. leuconoe* and *S. genutia* have the ability to overcome the parasitization by *S. bella* and develop into adults. We will discuss the relationship between migratory activities and food plant preference of these danaids from a view of defence ability against parasitoids.

The importance of considering the impact of providing nectar sources on pests as well as natural enemies (Oral presentation by L.E. Jamieson*, P.S. Stevens, G. Burnip and D.M. Suckling; *HortResearch, PO Box 92, 169 Mt. Albert, Auckland, New Zealand)

The provision of nectar sources in the form of flowering plants has the potential to increase the level of biological control in orchards. Laboratory experiments concluded that the provision of flowers of buttercup, dandelion or honey solution increased the net reproductive rate of the leafroller egg parasitoid *Trichogrammatoidea bactrae fumata* when compared to provision of clover or water. In addition, the provision of honey solution increased the longevity and fecundity of a larval parasitoid, *Trigonospila brevifacies*, attacking leafrollers. Although field trials in an apple orchard revealed that the provision of *Alyssum* resulted in an increase in sticky trap catches of the leafroller larval parasitoid *Dolichogenidea tasmanica*, no corresponding increase in leafroller parasitism on the crop could be detected. The benefits of nectar sources increasing the reproductive rate of a parasitoid would be negated if the reproductive rate of the pest also increased. Subsequent trials showed that although the provision of honey solution increased longevity of the adult leafroller

Ctenopseustis obliquana, it did not increase the pest's fecundity. We highlight the importance of the provision of plants that provide benefits to natural enemies but do not confer any benefits to the pest. We also emphasize the need to make the link to the desired end result - a reduction in pest damage.

Leafroller (Lepidoptera: Tortricidae) species & their parasitoids on fruit crops & shelter in Hawke's Bay, New Zealand (Poster presentation by P.L. Lo* and J.T.S. Walker; *HortResearch, Hawke's Bay Research Centre, Private Bag 1401, Havelock North, New Zealand)

Leafrollers and their parasitoids were collected from apple, grape and boysenberry crops, and shelter plants in Hawke's Bay, New Zealand. Sixteen properties were visited monthly from November or December until April or May, between 1996-99. Leafroller larvae and pupae were reared to determine their species, or if they were parasitised. The introduced *Epiphyas postvittana* comprised over 80% of leafrollers at nine sites, whereas two native species (*Ctenopseustis obliquana* and *Planotortrix octo*) dominated on six properties. The leafroller species composition changed at one site during the study, and at another property compared with samples collected 12 years earlier. In both cases, *E. postvittana* replaced native leafrollers. Leafrollers were generally most abundant in March, but numbers varied considerably amongst sites and between years at the same site. Parasitoids from seven genera in four families (Hymenoptera: Bethyridae, Braconidae, Ichneumonidae; Diptera: Tachinidae) were reared. The relative abundance of the most common parasitoid, *Dolichogenidea* spp., was positively correlated with that of *E. postvittana*. Sites where native leafrollers were more common had more of the tachinid fly *Trigonospila brevifacies*. The percentage of leafrollers emerging as adults declined from over 60% in December to about 30% in April, as parasitism increased from approximately 10% to 50% respectively. Overall, 48% of leafrollers collected from crops were parasitised compared with 14% for larvae from shelter.

Oviposition preference of the tachinid fly, *Exorista japonica* (Diptera: Tachinidae): can female flies recognize suitable host instars? (Poster presentation by S. Nakamura; Jircas, 1-1 Owashii, Tsukuba, 305-8686, Japan)

The oviposition preference of the tachinid fly, *Exorista japonica* for 5th and last instar larvae of *Mythimna separata* (Lepidoptera: Noctuidae) was investigated at different host encounter rates in the laboratory. Egg retention of host-deprived females under the conditions of low host encounter rates was also examined. *E. japonica* laying unincubated macrotype eggs directly onto host cuticles, cannot usually parasitize on

soon-to moult hosts as day-1 5th instar larvae of *M. separata*. Females conditioned with either host instar larva until 24h before the experiment, were provided with a pair of those host instar larvae simultaneously. The same female was examined with a pair of the hosts for 5 times at the time interval of 1 min (shortly after the previous oviposition). The females oviposited on the conditioned instar larva at first, but tended to prefer last instar to 5th instar larva. The eggs that were retained in the uterus hatched earlier than the other eggs on hosts, and successfully parasitized on day-1 5th instar larvae. The results show that the females have oviposition preference and retained eggs increase probability for parasitization at low host encounter rates.

Parasitoids on *Acronicta rumicis* in South Korea (Oral presentation by S.H. Nam; Department of Biology, Daejeon University, 96-3 Yongun-dong, Dong-gu, Daejeon 300-716, Korea)

The endoparasitoids of *Acronicta rumicis* were studied from May 2000 to October 2002 at Yong-Un dong area of Daejeon city in S. Korea. The number of species and parasitic rates were recorded. The number of endoparasitoids was 8 species in 2 orders and 3 families: *Glyptapanteles liparidis* and *Microplitis* sp. belonging to Order Hymenoptera, Family Braconidae. *Diadegma* sp. and *Mesochorus semirufus* belonging to Order Hymenoptera, Family Ichneumonidae. *Compsilura concinnata*, *Euexorista* sp., and *Exorista* sp. belonging to Order Diptera, Family Tachinidae. Among them, *G. liparidis* and *C. concinnata* are well known endoparasitoids of *Lymantria dispar*. Of the 322 field-collected larvae of *A. rumicis*, 74 showed parasitoids (22.98% parasitism). The collected field record showed relatively high parasitism in May (39.50±34.04%) and in October (50.05±2.70%). In addition, parasitism by Hymenopteran and Dipteran parasitoids was about 85.61±7.30% and 12.22±4.42% respectively.

Life history of *Euselasia bettina* and *E. chrysippe* (Lepidoptera: Lycaenidae: Riodininae) on *Miconia calvescens* (Melastomataceae) from Costa Rica (Poster presentation by K. Nishida; Sistema de Estudios de Posgrado en Biología, Escuela de Biología, Universidad de Costa Rica, 2060 San José, Costa Rica)

The life history and early stages of *Euselasia bettina* (Hewitson, 1869) and *E. chrysippe* (Bates, 1866) on *Miconia calvescens* Schrank & Mart. ex DC., are described and illustrated. The species possess six larval instars and the larvae are processionary throughout their development. The eggs are laid in clusters on the underside of leaves — the mean number of eggs in each cluster: *E. bettina* 89 (SD=9; range=82-99; n=3) and *E. chrysippe* 70

(SD=20; range=44-113; n=29). The larvae are gregarious foliage consumers that feed, rest, and molt synchronously. A species of Aphelinidae was reared from eggs of these two species, and a species of *Calolydella* sp. tachinid fly was reared from late instar larvae of *E. chrysippe*. *M. calvescens* is currently registered as one of the threatening invasive weeds in Tahiti and in Hawaii, and these two *Euselasia* species are currently considered as one of the potential biological control agents (Miconia Project Hawaii-University of Costa Rica 2004). This information will be useful for the biological control workers and personnel responsible identifying insects in quarantine in Hawaii.

Identification of tachinid parasitoids (Diptera: Tachinidae) of Nearctic *Choristoneura* species using puparia (Lepidoptera: Tortricidae) (Poster presentation by J.E. O'Hara; Invertebrate Biodiversity, Agriculture and Agri-Food Canada, 960 Carling Avenue, Ottawa, Ontario, Canada K1A 0C6)

Leafrollers of the genus *Choristoneura* (Lepidoptera: Tortricidae) comprise 17 species in the Nearctic region and include such serious agricultural and forestry pests as the spruce budworm (*C. fumiferana*), western spruce budworm (*C. occidentalis*), jack pine budworm (*C. pinus*), oblique-banded leafroller (*C. rosaceana*) and large aspen tortrix (*C. conflictana*). Twenty-seven species of Tachinidae have been recorded as parasitoids of Nearctic *Choristoneura* species, of which 15 are commonly or occasionally reared and 12 represent rare or accidental parasitism or erroneous records. A paper is under preparation to provide identification keys to the adults and puparia of the 15 tachinid species in the former group, and will include a review of the biology of each species. These tachinids belong to six tribes in the Exoristinae and Tachininae and display a wide range of parasitic attack strategies, though all parasitize late instar *Choristoneura* larvae. Tachinid puparia obtained from parasitized *Choristoneura* have distinctive differences in the posterior spiracular discs that permit the species to be identified, thereby obviating the need to rear the tachinids to the adult stage. A key to, and illustrations of, the puparia of the 15 common or occasional tachinid parasitoids of Nearctic *Choristoneura* species are presented.

Key arthropods for the control of *Epiphyas postvittana* (Walker) (Lepidoptera: Tortricidae) in Coonawarra vineyards, South Australia (Oral presentation by C. Paull*, A.D. Austin and N. Schellhorn; *Centre for Evolutionary Biology and Biodiversity, University Of Adelaide, SA 5005, Australia)

Epiphyas postvittana (Walker) light brown apple moth (LBAM) is indigenous to Australia and a major pest of

horticultural crops including grapevines. We conducted studies to identify predatory and parasitic arthropods of LBAM, from Coonawarra vineyards in South Australia and investigate the density-dependant response of key parasitoids to varying host densities of LBAM in the field. Arthropods in Coonawarra vineyards were surveyed for 12 consecutive months using pit-, pan-, sticky-traps and beating techniques. More than 60 species of beneficial arthropods were identified. However few occur in the canopy. The species that attack LBAM include a predatory mite *Anystis baccarum* and four parasitoids. The most dominant parasitoid is a braconid *Dolichogenidea tasmanica* (Cameron) followed by two species of Ichneumonidae and a tachinid *Voriella uniseta*. To evaluate the response of hymenopteran parasitoids to varying host densities we experimentally manipulated the number of larvae in vineyards on three occasions. Our results show that parasitism at the scale of a panel (four grape vines) was inversely density-dependent. Percentage parasitism was 29% and 38% for high and low host densities respectively. Evaluating predation and parasitism will contribute to moving one step closer to integrated pest management of LBAM in Coonawarra vineyards.

Is reproduction of the silkworm parasitoid *Exorista sorbillans* (Diptera: Tachinidae) totally dependent on the endosymbiont *Wolbachia*? (Oral presentation by H.P. Puttaraju* and B.M. Prakash; *Department of Sericulture, Bangalore University, Bangalore-560 056, India)

Several species of arthropods harbour endosymbiotic bacteria of the genus *Wolbachia*. These endosymbionts are transmitted vertically from one generation to the next and are facultative / obligatory in several Dipterans that have been studied to date. The tachinid uzifly, *Exorista sorbillans* known to cause extensive damage to silk industry by adopting obligate parasitic mode of life on its host silkworm, *Bombyx mori* L (Lepidoptera: Bombycidae). Further this pest is known that it harbour *Wolbachia* endosymbiont. Administration of 0.05 mg/ml oxytetracycline to the adult uzifly, removed *Wolbachia* endosymbiont and results in causing different invasive effects such as i) reduction in fecundity of aposymbiotic females ii). Cytoplasmic Incompatibility in the crosses between symbiotic male and aposymbiotic female. iii) Partial Genomic incompatibility in crosses between both sexes untreated and in crosses between aposymbiotic males and symbiotic females, as well as in the crosses between both males and females administered with antibiotics. It is hypothesised that there is a driving force which causes partial genomic incompatibility in crosses between both sexes untreated (uncured) and in crosses between cured male and uncured female, is pronounced might be due to the lack of *Wolbachia*. However, the tetracycline has no

much effect on longevity and survivability of uzifly. These results suggest that, *Wolbachia* present in the uzifly display obligate mutualism as it controls the overall development of reproductive physiology of its hosts.

Host defense and parasitoid reproductive strategies limit niche breadth in a host-parasitoid system (Oral presentation by A.D. Rice* and G.R. Allen; *CRC for Sustainable Production Forestry, Private Bag 12, Hobart, Tasmania 7001, Australia)

Defensive behaviour of larval *Chrysophtharta agricola* and host-stage preferences of two tachinid flies that parasitise it (*Paropsivora australis* and Tachinidae sp.) were examined. Data collected was used in conjunction with the results from other studies we conducted to establish the extent that host defence, host developmental biology and parasitoid reproductive strategies are impacting on the niche breadth of the two tachinids. Our data shows that Tachinidae sp. takes a relatively long time to oviposit and prefers early instar hosts which have less vigorous defensive behaviour than the final fourth instar, which thrashes its abdomen with sufficient vigour to dislodge the fly and interrupt oviposition. *P. australis* however, prefers to oviposit on fourth instars but as it can deposit an egg very quickly it effectively avoids being dislodged during oviposition. We discuss these results in relation to developmental interactions between host and parasitoids, and suggest that intraspecific host choice of these two tachinid flies is a result of interactions between both the biology and defensive behaviour of the host, and the reproductive strategies of the parasitoids.

Are opportunities for biological control of leafrollers in apples afforded by newer, selective insecticides? (Poster presentation by M. Sarvary*, H. Reissig and J. Nyrop; *Department of Entomology, NYSAES, Cornell University, Barton Hall, Geneva, NY 14456, USA)

Insect species which, in natural systems are regulated at low densities by natural enemies are often at high densities in commercial apple orchards because insecticides decimate natural enemies and/or commercial orchards provide a rich and abundant resource for herbivores. It was also thought that the orchard habitat, due to its relatively low diversity, was less than optimal for many natural enemies. Recent experiments indicated that orchards are quite adequate habitats for the natural enemies. To determine the potential for the obliquebanded leafroller (OBLR) biological control in commercial apple orchards, studies were conducted in 2003-2004 to assess parasitism and predation in orchards treated with conventional insecticides and with novel, more selective compounds. To eliminate the potentially lethal effects of insecticides trees were artificially infested with sentinel

larvae using newly developed methods. Larvae were exposed for 48 hours and natural enemy inflicted mortality was recorded. Appropriate statistical methods were used to compare natural enemy levels and species diversity in the two insecticide regimes. Both the treatment and the geographical location of the orchard influenced mortality levels. *Actia interrupta* (Tachinidae), *Onchophanes americanus* (Braconidae) and *Exochus albifrons* (Ichneumonidae) were identified as dominant parasitoid species. Predacious insect species were also identified using different collecting methods.

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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.

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