

The Tachinid Times

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Jim O'Hara, editor
Invertebrate Biodiversity
Agriculture & Agri-Food Canada
C.E.F., Ottawa, Ontario, Canada, K1A 0C6
Correspondence: oharaj@agr.gc.ca or oharaje@hotmail.com

This year's issue of **The Tachinid Times** is one of the largest yet, with a variety of articles and notes on the Tachinidae by a number of contributors. Following the articles, I have as usual gathered together as much of the tachinid literature published since the last issue as I could find by database searches and other means. The bibliography is followed by the mailing list of this year's issue.

The Tachinid Times is primarily an online newsletter but continues to be offered in hardcopy to provide a permanent record in a few libraries around the world and for persons wishing 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. 2.5 MB in size) on the North American Dipterists Society (NADS) website at:

<http://www.nadsdiptera.org/Tach/TTimes/TThome.htm>.

If you wish to contribute to **The Tachinid Times** next year, then please send me your article, note or announcement before the end of January 2007. 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The Tachinid Times is purposely not peer-reviewed to retain its status as a newsletter and avoid attracting articles that are more properly published in recognized journals.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 sub-

missions, 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 Dave Ladd and Shannon Mahony for their assistance with the preparation of this issue, especially the bibliography. I would also like to thank Bruce Cooper for his 16 years of assistance with this newsletter and wish him well for a long and enjoyable retirement after 40 years of employment with Agriculture and Agri-Food Canada.

***Phytomytera nigrina* (Meigen), a parasite of first generation European grapevine moth larvae in several vineyards in the Roussillon area (by D. Thiéry¹, T. Yoshida^{1*} and M. Guisset²)**

1. UMR 1065 INRA-ENITAB Santé Végétale, INRA Bordeaux, BP 81, 33883 Villenave d'Ornon Cedex, France; thiery@bordeaux.inra.fr
2. Chambre d'Agriculture, 19 avenue de Grande Bretagne, 66000 Perpignan, France.

* Present address: Systematic Entomology, Graduate School of Agriculture, Hokkaido University, Sapporo 060-8589, Japan.

Abstract

We surveyed the occurrence of first generation larvae of *Lobesia botrana* (Lepidoptera: Tortricidae) in four vineyards around Perpignan (France). We report here a few observations concerning the occurrence of *Phytomytera nigrina* as a larval parasite of this species. This parasite is not frequently observed in French vineyards, and to our knowledge this is one of the first observations of its occurrence. This study provides evidence that *P. nigrina* may help control the natural populations of the first generation of *L. botrana*, and possibly the second one too. The most significant percentage of parasitism by *P. nigrina* was observed in Terrats, with 27.7% of *L. botrana*

larvae parasitized.

Introduction

Lobesia botrana (Den. & Schiff.) (Lepidoptera: Tortricidae), the European grapevine moth, is one of the major pest of German, Swiss, French and Mediterranean vineyards. Females almost exclusively oviposit on flower buds before the grape flowering stage and later on all maturation stages of bunches. During the first generation, each larva builds a shelter, called a 'glomerula', to protect itself against parasitoids and predators (Bovey 1966, Thiéry 2005). It completes 2–4 generations per year in France, according to the latitude. The Roussillon vineyards (around Perpignan, France) frequently suffer high densities of *L. botrana* and sometimes 4–6 insecticide applications per year are recommended to control infestations. *Lobesia botrana* larvae complete five instars and the total development time from egg hatching to pupation is about 5–6 weeks under spring conditions.

Larval parasitoids occurring in vineyards

Several larval or pupal parasitoids may naturally control the population of *L. botrana* in European vineyards (Coscola 1980, Lucciano *et al.* 1988, Marchesini and Della Monta 1994, Thiéry *et al.* 2001, Thiéry and Xuéreb 2003, Xuéreb and Thiéry 2005). In France several species, mainly ichneumonids, braconids and pteromalids, are often reported in most of the vineyards, the most frequent and efficient being *Campoplex capitator* (Ichneumonidae), *Dibrachys cavus* and *D. affinis* (Pteromalidae), and to a lesser extent *Dicaelotus inflexus*, *Scambus elegans* and *Itopectis maculator* (Ichneumonidae). *Phytomyptera nigrina* (Meigen) has been documented in Italian, Greek and Turkish vineyards (Lucciano *et al.* 1988, Kara and Tschorsnig 2003, Bagnoli and Lucchi in press, Roditakis, pers. com.) as a parasite of *L. botrana* larvae, but to our knowledge it has not been found in French vineyards. *Phytomyptera nigrina* was also reported as a parasitoid of the spring and autumn larvae of *L. botrana* occurring on an alternative host plant *Daphne gnidium* (Thymeleacea).



Figure 1. Location of the four sampling sites around Perpignan.

Materials and Methods

Sampling methods for *Lobesia botrana* larvae. Four vineyards were surveyed in the Perpignan (France) vineyard

area: Rivesaltes (cv. chardonnay), Banyuls des Aspres (cv. carignan), Terrats (cv. carignan), and Maury (cv. grenache noir) (Fig. 1). Glomerulae occupied by *L. botrana* larvae were hand-collected on 12–13 June 2005 from vine stocks which were randomly selected in different vineyards (Figs. 2–3). The larvae collected resulted from oviposition that started on 26th of April in Terrats (first eggs visually observed), and a bit later in Maury (30th of April). Oviposition was not checked in Rivesaltes.



Figure 2. This picture in Terrats shows the typical appearance of a surveyed vineyard. The vineyards are classically planted with vine stocks trained as goblets (here Carignan variety) and wall vegetation is often present with several species of oaks (*Quercus suber*, *Quercus ilex*) and olive trees. Each larva of *Lobesia botrana* builds a silk shelter within a grape bunch. Nests were randomly collected by hand.



Figure 3. Typical nests (glomerulae) built by *Lobesia botrana* larvae. Arrow points to a larva. Pictures Dr T. Zahavi, Israel.

Weight and Emergence dates of *P. nigrina*. After pupation, *L. botrana* chrysalids were isolated in small glass tubes and each tube was labeled. Each chrysalid was weighed to the nearest .01 mg and tubes were checked daily for parasitoid emergence. Specimens of *P. nigrina* were sexed after death.

Identification of *P. nigrina*. Specimens of *P. nigrina* were identified by T. Yoshida and confirmed by Dr H.P. Tschorsnig (Stuttgart, Germany). The genus *Phytomyptera* can be easily identified using the key of Tschorsnig and Richter (1998). *Phytomyptera s. str.* (i.e. not including *Elfia* Robineau-Desvoidy) in the Palaearctic Region can be

distinguished from other genera of Tachinidae by the combination of the following characters: arista bare and thickened at least on basal two-thirds, second aristomere 3–6X longer than wide, wing with vein M not reaching wing margin and crossvein dm-cu absent, and a single large bristle at base of vein R4+5 (Fig. 4). *Phytomytera nigrina* is very close to *P. vaccinii* Sintenis and they were mixed for a long time, but these two species can be distinguished by genitalic characters. The shapes of the gonopod (pregonite) and cercus are characteristic in the male and the shapes of sternites and subanal plate in the female help in the identification (Andersen 1988 and Fig. 4).

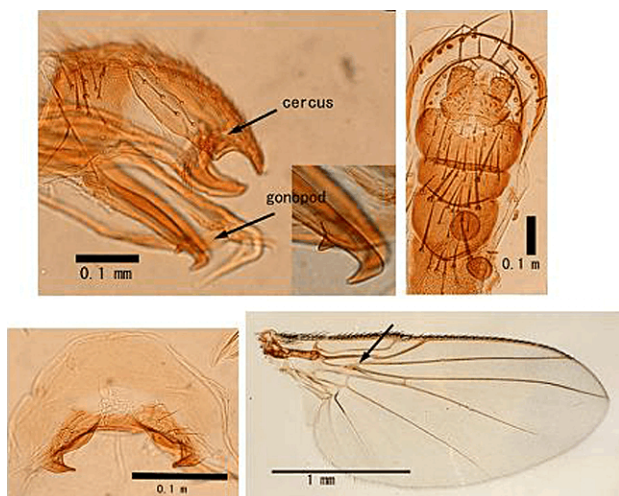


Figure 4. Morphology of *Phytomytera nigrina*: top, male (left) and female (right) terminalia; bottom left, male sternite 5; bottom right, wing showing a single large bristle at the base of R4+5 (arrow), vein M not reaching wing margin, and crossvein dm-cu absent.

Hosts of *P. nigrina*. As far as we know, the reported hosts of *P. nigrina* are *Prays oleae* (Yponomeutidae), *Gypsonoma minutana* (Tortricidae), *Lobesia botrana* (Tortricidae), *Adaina microdactyla* (Pterophoridae) and *Paranthrene tabaniformis* (Sesiidae) (Andersen 1988, Luciano *et al.* 1988, Kara and Tschorsnig 2003, Georgiev 2000).

Results and Discussion

Total parasitism. In the four localities, the parasites emerging from *L. botrana* larvae were only *P. nigrina* and *C. capitator*, except for one specimen of *Bassus tumidulus* (Hymenoptera Braconidae) found in Terrats. *Campoplex capitator* was not found in Maury, and *P. nigrina* was not found in Rivesaltes. The total numbers of parasitized larvae were rather high in Banyuls des Aspres and Terrats (41.2% and 39.4%, respectively) and lower in Rivesaltes (16.7%) and Maury (5.2%). Interestingly, the total percentage of larvae parasitized in Banyuls des Aspres and Terrats were almost similar but the relative proportion of *C. capitator*

and *P. nigrina* was reversed (Fig. 5).

The lowest proportion of parasitized *L. botrana* was observed in Maury. The comparison between the Maury and Terrats results is interesting because the host populations were of similar size and both received an insecticide application against *L. botrana* in spring 2005. Surprisingly, Terrats received constant insecticide application for several years while the vineyard surveyed in Maury used biotechnical options until 2005 (Bt and mating disruption). Maury differs from the other locations in having a less patchy vineyard structure and a lower plant diversity, which may explain the lower populations of parasitoids.

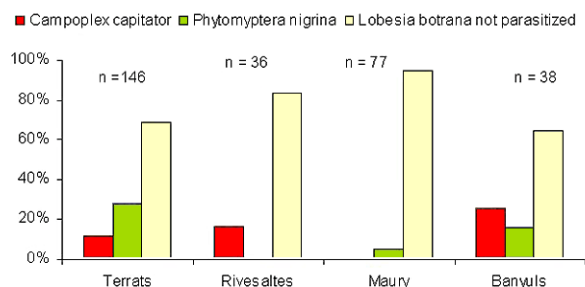


Figure 5. Percentages of *Lobesia botrana* parasitized by *Phytomytera nigrina* and *Campoplex capitator* in the four vineyards surveyed, and of unparasitized *L. botrana*. N = total number of collected larvae of *Lobesia botrana* that reached the chrysalid stage.

Parasitism by *P. nigrina*. Parasitism of *L. botrana* larvae was 27.7% in Terrats, slightly lower in Banyuls des Aspres (15.8%) and even lower in Maury (5.19%). The parasitoid was not found in Rivesaltes, but the first adults of *L. botrana* started to emerge three days after our sampling, which indicates a host phenology earlier than in the other locations. Thus, we cannot exclude the possibility that *P. nigrina* individuals were present in Rivesaltes but emerged earlier.

The parasitism rate observed in Terrats is in agreement with that reported in the spring generation in Sardinia, respectively 25 and 24.1% in 1986 and 1987 (Lucciano *et al.* 1988). Twenty-eight *P. nigrina* (14 males and 14 females) were collected in Terrats. The female and male pupae respectively weighed $3.66 \pm .86$ mg (N = 13) and $2.94 \pm .41$ (N = 8) (mean \pm Sd). The daily emergences of *P. nigrina* could only be monitored from two locations, Banyuls des Aspres and Terrats (Fig. 6). The number of individuals collected from Banyuls des Aspres was too low to permit a comparison between the dynamics of *P. nigrina* at these two localities. However, most of the emergences seemed to occur within one week and this timing suggests that adult *P. nigrina* are present in the vineyard at the beginning of July and could thus naturally

control the *L. botrana* larvae that are present there at that time.

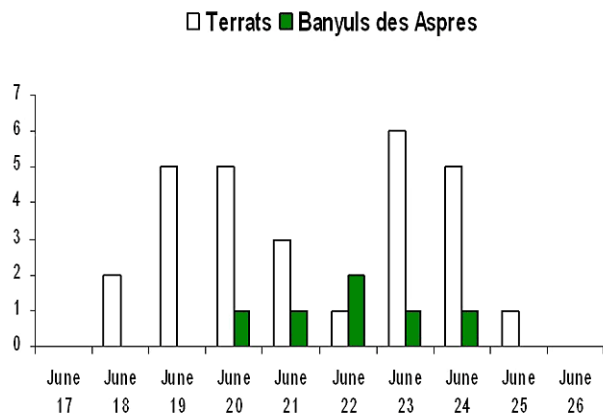


Figure 6. Number of individuals of *Phytomytera nigrina* that emerged daily from parasitized pupae collected in Terrats and Banyuls in June 2005.

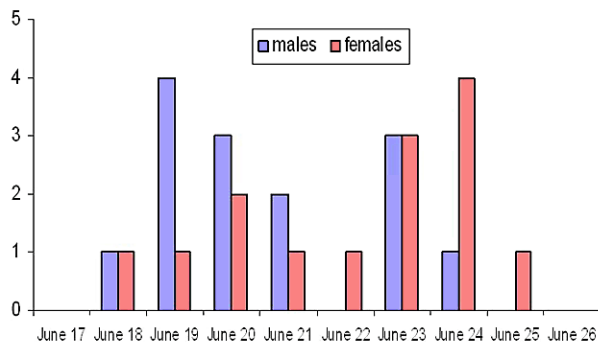


Figure 7. Number of male and female *Phytomytera nigrina* that emerged daily from parasitized pupae whose larvae were collected in Terrats and Banyuls during June 2005.

Males of *P. nigrina* in Terrats emerged earlier than females (Fig. 7): mean date emergences \pm Sd: male = June 20 \pm 1.97, female = June 22 \pm 2.18; $\chi^2 = 14.75$, $df, 7$, $P < .05$. This suggests a protandry in the population sampled.

Conclusion

Because significant parasitism rates by *P. nigrina* were observed, this parasitoid may perform efficient natural control of the European grapevine moth in the Roussillon area, especially by reducing the summer population. Such an efficiency was already observed in Sardinia and Tuscany (Lucciano *et al.* 1998, Bagnoli and Lucchi, in press). The fact that *P. nigrina* can be multivoltine is interesting for the control of later generations of the moth.

Acknowledgements

We thank Dr Hans Peter Tschorsnig (Staatliches Museum für Naturkunde, Stuttgart, Germany) for confirming the identification of *P. nigrina*. We are indebted to Mr Teruhiko Hironaga (Systematic Entomology, Hokkaido

University) for his valuable comments and help with the identification. We are grateful to Mrs. Laure Eschbacher (INRA Bordeaux), Mrs Laure Berard-Delay, Anne de Chancel, Valérie Didier and Audrey Meroz (SPV Perpignan) for their efficient experimental contribution. The second author (TY) was supported by a Japan-France cooperative exchange programme funded by Renault cars. We also warmly thank the estates or vineries that kindly allowed us to harvest grape clusters: Château Mossé (Terrats), Domaine Duffaut (Banyuls des Aspres), Domaine Lloubes (Rivesaltes), and Mas Amiel (Maury).

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***Campylocheta mariae* Bystrowski recorded from Russia, with notes on the Finnish dipterologist Lauri Tiensuu (by C. Bergström and C. Bystrowski)**

Abstract

The tachinid fly *Campylocheta mariae* Bystrowski, 2001, was described from northern Poland from the Słupsk region and Biebrza Valley. The first Russian specimens were however collected much earlier, by the Finnish dipterologist Lauri Tiensuu in spring 1942 and 1943. From his notes it is obvious that he regarded them as representing an undescribed species that he in his notes called *Campylocheta karelica* n. sp. However his important discovery was never published.

Article

During a visit to the Finnish Museum of Natural History in Helsinki in spring 2004, the first author noticed a small box in their tachinid collection labelled *Campylocheta karelica* n. sp. by Lauri Tiensuu. All 26 specimens, 19 males and 7 females, were identified by the first author as *Campylocheta mariae* Bystrowski, 2001. The species was, based on these records, reported from northern Russia in *Fauna Europaea* by the first author but without any details (Tschorsnig *et al.* 2004). The identification was also confirmed by the second author.

Lauri Tiensuu was born in Vesilax near Tampere (Tammerfors) in Finland in 1906. He graduated from upper secondary school in Sordavala (near Ladoga) in 1925, and in 1931 he received a Bachelor of Science degree (B.Sc.) from the University of Helsinki. During 1936-1956 he was employed as an assistant in zoology at the faculty of Agriculture and Forestry at the University of Helsinki and in the summers 1942-1944 during the Second World War, when Finland occupied parts of Russian Karelia, he worked as manager at the Kentjärvi (Konchozero) biological station. He was appointed as a senior teacher in Natural History and Geography at the co-ed (upper) secondary school in Hamina (Fredrikshamn). He died in 1980.

Tiensuu started to collect insects as a schoolboy in Ladoga-Karelia and continued to do so throughout his lifetime. At first his interest was focused on mayflies (Ephemeroptera) but later he gradually became more specialized in Diptera and especially the Muscoidea and Tachinoidea. Most of his scientific papers were published during the 1930s and 1940s. An important contribution to the knowledge of Tachinidae was published in 1939 when he described a new species, *Pales exsulans*, from Madeira. He also contributed to the Finnish Diptera catalogue (Tiensuu 1941) and to the knowledge of the Diptera fauna of the Azores (Tiensuu 1945). As late as 1968 he published an important paper concerning the Muscidae from Spitsbergen (Tiensuu 1968). In 1981, his insect collection and also his notebooks and diaries were donated to the Finnish Museum of Natural History in Helsinki. His notes,

which comprise important and detailed information concerning the faunistics and biology of Diptera, were never published by himself but they are still available and have been used by many recent entomologists.

During his commission in Kentjärvi (Konchozero), Tiensuu participated in many collection trips to adjacent areas. His first specimen of *Campylocheta karelica* (not seen by the authors) was apparently, according to his notes, collected on 15 May 1942 in Pogra, a small village close to Podporozhe and situated at the river Svir in western Russia (Leningrad oblast). Most of his specimens were however collected in April and early May the following year in Kolatselkä (Kolatselg'e), an area that comprises some small villages around the big lake Tulmozero in the Tulemajärvi district of northern Russia (Karelian republic).

Tiensuu's notes for *Campylocheta karelica* contain the following information:

“Campylocheta karelica TIENSU. – Kolatselkä 8.IV. – 9.V.1943; Pogra 15.V.1942, 1 male. This species was very abundant in Kolatselkä in spring 1943. I caught the first specimen already in 8.4. when there was still snow on the ground. A freshly emerged specimen settled itself onto my jacket after a flight above the snow. It emerged at a site close to the source of the river Tulema where bare ground had partly become visible due to sunshine. During the following days I caught several specimens of *C. karelica* from the same locality and subsequently I found it everywhere from the bushy and sparsely forested outskirts of the village. It was a striking species because of its abundance in Kolatselkä and was flying together with two other spring specialists i.e. *Servillia* [= *Tachina*] *ursina* and *Plagia* [= *Cyrtophleba*] *vernalis*.” [Translated from Finnish.]

Material examined by authors: There are still 26 specimens present in the Helsinki museum. They are labelled as follows: Car. or. / Kolatselkä / L. Tiensuu (printed) and with handwritten dates; 3♂♂, 16.IV.1943; 1♂, 1♀, 18.IV.1943; 3♂♂, 1♀, 21.IV.1943; 11♂♂, 3♀♀, 22.IV.1943; 1♀, 27.IV.1943; 1♂, 1♀, 3.V.1943.

The description of *Campylocheta mariae* was based on eight specimens collected at the Biebrza Valley and Słupsk in northern Poland (one specimen collected by Otto Karl in 1941) (Bystrowski 2001). The new records for *C. mariae* from Russia have significantly expanded the known distribution of the species northwards. It seems plausible that the distribution of this species includes a wider area in northern Russia and perhaps also the eastern districts of Fennoscandia. The reason why it has not been found yet is apparently correlated to its early flight period and also to a usually very low population density. Such abundance as noted by Lauri Tiensuu from Kolatselkä in 1943 must be regarded as rather exceptional.

It is well known that the populations of tachinid flies are characterized by considerable periodic fluctuations due to host-parasitoid interactions. This situation is well documented for parasitoids attacking many forest defoliators (Berryman 1996, 1998). Every year since spring 1999, when *C. mariae* was discovered in the Biebrza Marshes (Fig. 1) for the first time, attempts have been made to collect additional specimens, in suitable localities and at different times. The results of these investigations were however rather poor. Two specimens were collected in 1999, seven specimens were collected in 2000, and finally one male was collected at the end of March 2002. The species was fairly abundant only in spring 2000. In the beginning of the 1940s when Tiensuu found his specimens of *C. mariae* in Russian Karelia another European dipterologist, Otto Karl, collected this species near Słupsk (Stolp) in Poland (Karl 1944: 84). This record was initially published as *Campylocheta fuscinervis* (Stein) but was later revised by the second author (Bystrowski 2001). The specimens collected by Tiensuu and Karl somewhat coincide in time, indicating that the factor(s) affecting the abundance of this parasitoid also affect a wide geographical area.



Figure 1. Sparse birch forest in the Biebrza Marshes of Poland, a typical habitat of *Campylocheta mariae*.

The habitat preferred by *C. mariae* could, considering the notes of Tiensuu and the observations made by the second author, be characterized as a mixed bushy vegetation in early succession stage or as a sparsely birch forest. The sites visited by *C. mariae* in the Biebrza Marshes were located on “mineral elevation” covered by sparsely growing birch forest situated among marshy areas. One female in 1999 was however collected on a peat-bog with *Betula humilis* Schrk. (Bystrowski 2001). Tiensuu noted that numerous specimens were observed at a site close to the beginning of the river Tulema and at the bushy areas outskirts of Kolatselkä.

Campylocheta mariae is a species that appears very early in the spring. Tiensuu collected his first specimens when the ground was partly covered by snow. In Poland

(Biebrza Valley) in 2000, the period of flight began when the snow had already melted away but during night the temperature reached minus 5 or 6°C. Specimens that had spent the cold night in the low vegetation were found early in the morning before the temperature had risen above the freezing point (Fig. 2). During daytime specimens of *C. mariae* were frequently observed while resting on dry grass and on leaves from last year but also quickly running on plants near the ground. Specimens that were covered by an entomological net did not fly up into the net but actively leaped down into the low vegetation to hide. Such behaviour is rather unusual among tachinid flies.



Figure 2. *Campylocheta mariae* on frosted vegetation.

The host of this species is still unknown. Some members of the genus *Campylocheta* are recorded as parasitoids of caterpillars, mostly geometrids. Considering that *C. mariae* appears in early spring, it seems reasonable to assume that the host is a caterpillar that is overwintering near the ground.

The females of both *C. mariae* and a recently described species *C. ziegleri* Tschorsnig show a unique feature of the female postabdomen. Sternite 7 is elongated and sternite 6 is developed into the form of a long spatula. The function or biological significance of this adaptation of the ovipositor is unknown (Tschorsnig 2002). A key separating these two species and both from the other members of the genus was provided by Tschorsnig (2002).

Acknowledgements

It is a pleasure for us to express our sincere thanks to Mr. Kaj Winqvist (Turku) for his valuable help translating relevant parts of Tiensuu’s notebook [concerning *Campylocheta karelica*] and also to Mr. Hans Silfverberg, Helsinki who has kindly contributed some information to our short biography on Tiensuu.

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A new species of tachinid is a potential biological control agent of the Mexican bromeliad weevil in Florida (by R.D. Cave)

The Mexican bromeliad weevil, *Metamasius callizona* (Chevrolat), was first found in Florida in a Broward County nursery in 1989, apparently having entered the state in a shipment of bromeliads imported from Veracruz, Mexico. It became established in several natural areas and could not be eradicated. The weevil's spread to the western coast of Florida was most likely aided by human movement of infested bromeliads. From these initial infestations it has steadily spread in south Florida (presently in 18 counties), where it attacks and devastates native bromeliads. Two native bromeliads are now on Florida's endangered species list specifically as a result of weevil attack (Florida Administrative Code 2000). Ten other state-listed threatened and endangered native bromeliads and one endemic species face immediate risk as the weevil continues to spread.

In 1993 I found a species of Tachinidae in Honduras that attacks the larva of *Metamasius quadrilineatus* Champion, another bromeliad-eating weevil. It was first

determined as an undescribed species of *Admontia*, then *Lixophaga*. Finally, Monty Wood decided that it does not properly belong to either of these genera, so we have submitted a manuscript which proposes a new genus for the fly.

This fly has been the subject of intensive recent research in order to determine its biology and specificity. Dr. Alonso Suazo, a postdoctoral scientist working at the Panamerican School of Agriculture in Honduras, conducted a number of studies to increase our knowledge of this fly. As far as has been determined, it will attack only *Metamasius* larvae in bromeliads, it deposits neonate larvae rather than eggs, and these neonate larvae search for the host weevil larva in the bromeliad stem and parasitize 3rd or 4th instar hosts. The host is killed before it pupates. The optimal temperature for rearing the fly is 21°C because the fly lives in tropical montane cloud forests in Honduras and Guatemala.

Two students at the Panamerican School of Agriculture, Diego Pú Pacheco and Margarita García Gavilán, participated in the weevil project in Honduras and submitted theses for graduation (see below). Their participation in the project was key to increasing the level of research conducted.

The next step in this program is to establish a fly colony at the University of Florida's Biological Control Research & Containment Laboratory in Ft. Pierce. Four shipments of 40 parasitic fly puparia each were received into the BCRCCL on the following dates in 2005: November 4, November 16, December 2, and December 15. There was good (80%) to excellent (98%) emergence of adult flies from the puparia. Adult flies were placed in a large cage and exposed to 7–15 *M. callizona* larvae every 3–4 days. Feeding on hummingbird food and mating were observed on occasions. Twenty days after exposure of the first weevil larvae, we observed fly maggots exiting weevil larvae, which demonstrates that successful parasitization can occur in the laboratory conditions presented to the flies. Since then, we have obtained over 20 parasitized weevil larvae. Twenty days after pupation of the first maggots in our laboratory colony, adult flies (both sexes) began emerging from puparia. The adults were placed in a cage and provided food. Adult flies (at least females) will survive up to 2–3 weeks as long as conditions in the laboratory do not exceed 30°C and the cage is kept humid by lightly spraying it with water daily.

In early December, one weevil larva was left in a pineapple stem and this was placed in the oviposition cage. The larva was parasitized. Therefore, female flies will deposit maggots on pineapple stems containing a larva of *M. callizona*. This is important information for future mass rearing because we are currently using *Tillandsia utriculata* (L.) stems as host material for weevils exposed

to flies. If the availability of this host plant becomes problematic, then pineapple stems may be used instead.

Future objectives

1. Continue to receive shipments of 40–50 puparia from Honduras every 2 weeks.
2. Increase the size of the colony.
3. Submit publications of research results.
4. Compile all information and prepare a release permit application to USDA APHIS PPQ.

Submitted theses

- García Gavilánez, M.S. 2005. Fecundidad de cf. *Lixophaga* (Diptera: Tachinidae) y parasitismo artificial de *Metamasius quadrilineatus* (Coleoptera: Dryophthoridae) como forma alterna para su producción masiva. Ing. Agr. thesis, Escuela Agrícola Panamericana, El Zamorano, Honduras.
- Pú Pacheco, D.E.A. Biología reproductiva de *Metamasius quadrilineatus* (Coleoptera: Dryophthoridae) y parasitismo por su agente de control biológico cf. *Lixophaga* (Diptera: Tachinidae) en condiciones de laboratorio. Ing. Agr. thesis, Escuela Agrícola Panamericana, El Zamorano, Honduras.

The life cycle of *Therobia leonidei* Mesnil (Ormiini), a European parasitoid of bushcrickets (by G.U.C. Lehmann)

Tachinid flies of the tribe Ormiini rely on acoustic host cues to locate hosts. Adult Ormiini possess a conspicuously inflated prosternal region, enabling them to detect the mating songs of their hosts (Cade 1975). Unfortunately, a lot of work is still to be done in the majority of Ormiini fly species. Our current knowledge on biogeography and host usage is summarized in Lehmann (2003). In the only European Ormiini representative, *Therobia leonidei* (Mesnil), the auditory sensitivity of the hearing organ is tuned to the dominant frequency of its host's song (Lakes-Harlan and Heller 1992). The species is sexually dimorphic in the size of the prosternal organ, which is much more inflated in females. Furthermore, in males both eyes are in broad contact on top of the head, whereas there are well separated in females (Fig. 1).



Figure 1: A female of *Therobia leonidei*. The white inflated hearing organ (modified prosternum) is visible on the underside between the head and thorax.

This species has been found to attack the singing sex of three different families of bushcrickets (Leonide 1969, review in Lehmann 2003). In populations of the Greek phaneropterine bushcricket *Poecilimon mariannae* Willemse and Heller, males, which produce long calls, were found to be parasitized in large proportions, up to 65% at the end of their season. The mute females were never found to be infected (Lakes-Harlan and Heller 1992, Lehmann and Heller 1998). In contrast, the morphologically similar species *Poecilimon veluchianus* Ramme (Fig. 2) produces short calls and is therefore less parasitized (Lehmann and Heller 1998).



Figure 2: A male of *Poecilimon veluchianus*. Six of the eight species of the *Poecilimon propinquus*-group have been found to be parasitized (Lehmann 1998, 2003).



Figure 3: A parasitized male of *Poecilimon mariannae*. Eight breathing funnels of fly maggots are visible. The different pigmentation corresponds with the age of the funnels, indicating superparasitism in this male. Fifty percent of host males are singly infected, the mean number of fly maggots is 2.1 per host, with no increase over the season (Lehmann 1998, unpubl. data).

After locating a singing male bushcricket, the female fly deposits planidia larvae on its abdomen, which burrow inside the host. A few days later, the larvae produce a connection with the air outside through a funnel in the host's abdomen (Leonide 1969). Subsequently, the infection by the fly is indicated by a brown dot on the

ventral side of the male's abdomen (Fig. 3), normally after four days (Lehmann and Heller 1998).

Infected host males inevitably die following parasitoid emergence (Fig. 4).

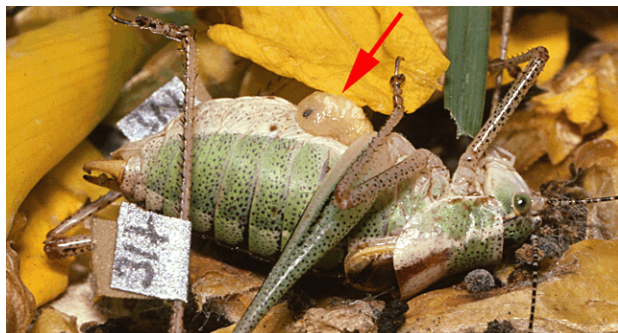


Figure 4: A dying *Poecilimon mariannae* host. The fly maggot hatches through the intersegmental skin of the abdomen (see arrow).

The mean survival from appearance of the breathing funnel is seven days. The longest that parasitized males survive is 14 days after fly attack (Lehmann and Lehmann, in press).

Fly maggots weight around 10% of male hosts at emergence (Lehmann 1998, unpubl. ms) and search actively for shelter to pupate (Fig. 5).



Figure 5: Maggot of *Therobia leonidei* shortly after hatching.

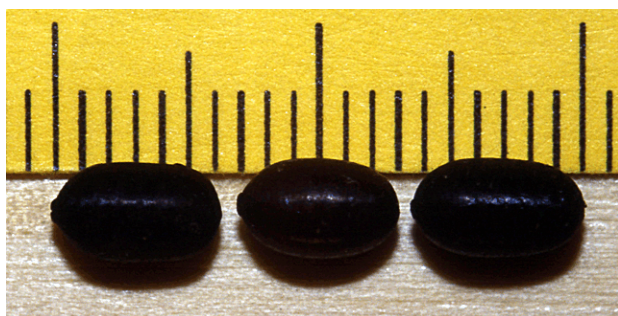


Figure 6: Three pupae of *Therobia leonidei* on a centimetre scale.

The maggots crawl under any decaying matter or burrow themselves into the ground, where they pupate immediately. The puparia are dark brown and about 6 mm long (Fig. 6). Interestingly all flies hatched within 20 days after pupating (Lehmann 1998, unpubl. ms), whereas the host populations declined to zero. Until now, we do not know whether this is an artificial response to our haltering conditions or flies use alternative hosts over the season.

Developing fly larvae reduce male bushcricket survival and reproductive effort. Parasitism will reduce a male host's investment capability into spermatophore production (Lehmann and Lehmann 2000a). The reduced amount of spermatophylax material transferred at mating make them even more inferior with regard to female refractory period and the number of eggs laid during this period (Lehmann and Lehmann 2000b). Infected males call less and are discriminated against by their phonotactic searching females (Lehmann and Lehmann, in press). The multiple costs of parasitoid infection on reproduction and survival is assumed to be a major force in shaping host life history (Zuk and Kolluru 1998). However, predation by non-acoustic hunting enemies has a much greater influence on survival and potential reproduction than parasitism (Lehmann and Lehmann, in press).

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Notes on *Elodia morio* (Fallén) and other tachinids reared from field-collected Lepidoptera in Emilia Romagna, northern Italy (by A. Reggiani, M.L. Dindo and S. Maini)

The codling moth, *Cydia pomonella* (L.) (Tortricidae), is recognised worldwide as the key insect pest in apple, pear and walnut orchards (Barnes, 1991). In the last two decades in Emilia Romagna (northern Italy), Integrated Pest Management has been applied to control this species and, in recent years, both biotechnical (mating disruption) and microbial (CpGV) methods have been increasingly used (Galassi *et al.* 2001). In this framework, the role of natural antagonists, which has until now been considered of minor interest for codling moth control, can be reevaluated.

A study was conducted from 2003 to 2005 in 17 locations throughout the provinces of Modena, Bologna and Ferrara (Emilia Romagna, northeast Italy), with the aim of verifying the occurrence of codling moth parasitoids on the major plant hosts (*Pyrus communis* L., *Malus* spp. and *Juglans regia* L.) and in agroecosystems characterized by different ecological complexities and pest management strategies. For this area, no recent record of *C. pomonella* parasitoids was found in the literature. Some specimens of Hymenoptera (Ichneumonidae, Braconidae and Chalcididae) were, however, obtained from *C. pomonella* in the province of Bologna between 1930 and 1936, and in the province of Ravenna (Romagna, northeast Italy) between 1954 and 1957. These specimens are kept in the entomological collections of the Departments of Agroenvironmental Sciences and Technology of the University of Bologna, and of Animal Biology of the University of Modena and Reggio Emilia.

In the present study, *C. pomonella* larvae were collected using cardboard strips that were placed around the

trunks of plant hosts in August and removed in full winter. In the laboratory, the live larvae were placed in corrugated cardboard cylinders inside PVC jars with a hole in the lid. Glass jars were put over the holes to collect the newly-emerged moths and parasitoids. More than 12,000 larvae were collected and reared from 2003 to 2005 to monitor parasitoid emergence.

Collections were also made of other Lepidoptera, mainly Tortricidae, which shared plant hosts with *C. pomonella* or were particularly abundant in the investigated agroecosystems. On pear, apple and walnut trees, the same cardboard stripes used for *C. pomonella* larvae were used to collect larvae of the quince moth *Euzophera bigella* (Zeller) (Pyrilidae), while buds infested by *Tortrix viridana* (L.) larvae (Tortricidae) were collected from oaks, in particular *Quercus pubescens* Willd.



Figure 1. *Elodia morio* adult on a cotton ball soaked in a honey and water solution (picture by F. Santi).

A number of parasitoids emerged in the laboratory from the field-collected larvae, including tachinids that were kindly determined by Hans-Peter Tschorsnig of the Staatliches Museum für Naturkunde, Stuttgart, Germany. All of the tachinids that emerged from *C. pomonella* belonged to the species *Elodia morio* (Fallén) [= *tragica* (Meigen)] (Fig. 1), which was also obtained from *T. viridana*. Both moths were reported as natural hosts of *E. morio* by Kara and Tschorsnig (2003). *Clausicella suturata* Rondani emerged from *E. bigella*.

Elodia morio is reported as one of the most important parasitoids of the codling moth in continental Europe (Rosenberg 1934, Coutin 1974, Attanassow *et al.* 1997). However, it was not found in recent studies in northwest Italy (Re *et al.* 1998, Alma 2006 pers. comm.). In the present study conducted in northeast Italy, *E. morio* was only obtained from larvae collected in complex agroecosystems of the hill land. In these environments, the percentages of successfully parasitized *C. pomonella* larvae ranged from 2.5% to 7.4%. In his field study carried out in Romagna (northeast Italy) using an entomological net, Campadelli (1989) also collected *E. morio* adults in a hill site with a rich vegetation.



Figure 2. A puparium inside a larva of *Cydia pomonella* (picture by F. Santi).

Elodia morio is known as a solitary, larval-pupal parasitoid (Coutin 1974, Kahrer 1987), but Rosenberg (1934) reported that it may complete larval development also in the host larvae. In the present study well-formed puparia were found inside *C. pomonella* larval remains (Fig. 2). However, no adults emerged from these puparia and we have no clear evidence that they actually belonged to *E. morio* (though no other tachinid was obtained from the codling moth in this three-year study). According to Herting (1974), *E. morio* females oviposit microtype eggs (0.22 mm long) on foliage, which are then ingested by larvae. These microtype eggs have a thin chorion and are thus less resistant to dehydration than those of some other tachinids.

In this three year-study, the life cycle of *E. morio* was not found to be synchronised with that of the host *C. pomonella* at least in the winter generation, as the adult parasitoids emerged 1–4 weeks before the adult moths. These observations are consistent with the findings of Coutin (1974) and Kahrer (1987), who respectively reported that *E. morio* adults emerged 25–30 days and 1–5 weeks before the host. According to Kahrer (1987), this asynchronism may indicate that *C. pomonella* is not fully suitable as a host for *E. morio*, although due to adult fly longevity females are not precluded from parasitizing *C. pomonella* larvae of the first generation. We found that *E. morio* adults that were fed on a honey and water solution survived in captivity for 18–39 days.

Oligophagy may represent a parasitoid strategy to synchronize the life cycle of a tachinid on different hosts. This allows, for example, *E. morio* to parasitize the faster developing *T. viridana* before the larvae of *C. pomonella* are available. Complex ecosystems, which are potentially richer in host species, may support the survival of *E. morio* by providing hosts with somewhat different life cycles. If this is true, then the parasitism of *C. pomonella* by *E. morio* is likely higher in areas with complex ecosystems.

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***Apamea illyria* Freyer, 1846 [= *Hadena illyria*] (Lep. Noctuidae), the first host record for *Linnaemya haemorrhoidalis* (Fallén, 1810) (by C. Bergström)**

Linnaemya haemorrhoidalis is a rather common tachinid in Europe. In the Nordic countries this species has frequently been mixed with *Linnaemya rossica* Zimin and *L. olsufjevi* Zimin by previous authors. I have as a part of my work for The Swedish Taxonomy Initiative examined numerous tachinid specimens from the collection of the Zoological Museum in Helsinki. A specimen of *L. haemorrhoidalis* is labelled as follows: handwritten label /Ex *Hadena illyria* /Hyvinge /em. 1944 /J. Waselius/ and /*Micropalpus*/ *haemorrhoidalis* Fall./ Tiensu det. This is the first host record for this species. Also mentioned under *Micropalpus haemorrhoidalis* in the notebook (unpub-

lished) of the Finnish entomologist Lauri Tiensuu; in Finnish "Hyvinkää (J. WASELIUS) 1944, e *Parastichtis illyria* FRR.

***Cosmorhoe ocellata* (Linnaeus, 1758) [= *Cidaria ocellata* (L.)] (Lep. Geometridae), a host of *Trafoia monticola* Brauer & Bergenstamm, 1893 (by C. Bergström)**

Trafoia monticola is a rare species in Europe and there are very few records from the Nordic countries. *Cosmorhoe ocellata* was initially recorded as a host for *Trafoia* (?) *monticola* B.B. by Herting already in 1962. This record was based on a single Swedish specimen available in the collection of the Zoological Museum in Lund. The specimen was reared from a larva of *Cidaria ocellata* collected at Ekerö in the district Södermanland by F. Nordström. Unfortunately the head is dorso-ventrally compressed and is also covering the anterior part of the thorax. Apparently the bad condition of the specimen caused Herting in 1966 to change his mind regarding its identity and to associate it with *Trafoia gemina* n. sp. Since then *C. ocellata* has incorrectly been regarded as a host for *T. gemina*. I have re-examined the specimen reared by Nordström. There are three dorsocentral bristles before the suture, the ocelli form an elongated isosceles triangle, abdominal tergite 2 possesses yellow hairs below, and therefore this specimen clearly must represent *T. monticola*.

Cosmorhoe ocellata is in fact, as was recorded by Herting in 1962, a host for *T. monticola* and no host is currently known for *T. gemina*. The latter species should also be removed from the Swedish checklist.

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Taxonomy and biogeography of West Palaearctic Tachinidae (by P. Cerretti)

Abstract of Ph.D. thesis

Aim. The aim of this work was to prepare an easy instrument for the identification of the West Palaearctic tachinid flies, to provide a biogeographical analysis to genus level, as well as to provide a complete picture of the Italian tachinid fauna.

Materials and methods. INTERACTIVE MULTI-ENTRY KEY. The key to the West Palaearctic genera consists of an interactive multi-entry system run by a PC software (Mosch 1.1b 2005) especially created for the purpose. The system is based on a matrix containing the codified morphological characters of each of the 310 terminal taxa; the programme

simultaneously compares all morphological characters selected by the user with the database matrix and outputs the genus name (or genera names) corresponding to these characters. A detailed card is provided for each genus, with an iconographic database of over 700 digital pictures for a correct recognition of characters and information on phenology and Italian distribution of each species.

DICHOTOMOUS KEYS. The keys to species are presented on paper under the classic dichotomous form; they allow the identification of a total of 744 species, including all those known to Italy and most of the Euro-Mediterranean ones.

DATABASE. A faunistic database containing phenological, ethological and bionomic information for over 16,000 records, which can be processed and used for statistical and biogeographical analyses.

BIOGEOGRAPHICAL ANALYSIS. A biogeographical analysis was carried out by analysing the distributional information on West Palaearctic genera contained in the database.

Results. INTERACTIVE MULTI-ENTRY KEY. The interactive multi-entry key system allows a completely different approach to the taxonomic diagnosis compared to the dichotomous key. It does not show the limits of the latter and is an easy tool which can be used also by the beginner in the field of tachinidology. The main advantage is that the diagnosis does not follow a pre-established route, but is determined by the user, who can choose the characters (which appear simultaneously, not in a sequence like in the dichotomous key) himself and is free to leave out the more ambiguous ones or those which are difficult to detect or missing in the examined specimen, which may be incomplete. This is allowed by the high redundancy of the data contained in the character matrix.

BIOGEOGRAPHICAL ANALYSIS. The chorological spectrum of the West Palaearctic Tachinidae consists mainly of three groups: genera the distributional range of which is comprised in the West Palaearctic, genera with a Holarctic distribution and genera with a Palaeotropical distribution that occur in the Mediterranean area. These last two groups can be explained by the alternation of Quaternary glaciations. The widespread arid climate which characterized the whole Palaearctic and most of Africa during the last glaciation (confirmed also by recent studies on fossil pollens) appears to have determined a consistent decrease of forest cover during that period, parallel to an expansion of the steppic biomes. The westerly expansion of the cold Asiatic steppe would have permitted the arrival in Europe of genera of Asian origin, whereas the palaeotropical elements would have reached the Mediterranean area during the periods of maximum contraction of the Sahara desert, during phases of both glacial expansion and retraction.

PERSONAL NOTES

Hye-Woo Byun writes: I am currently conducting a taxonomic revision of the tribe Blondeliini from Korea for my Ph.D. dissertation under the supervision of Dr. Ho-Yeon Han at Yonsei University, Wonju, Korea. So far we have recognized 45 species and 20 genera of Blondeliini from Korea, but the numbers are increasing every year. This winter Dr. Han and I visited Drs. Wood and O'Hara in Ottawa to help get our tachinid specimens identified by comparing them with types and identified specimens in the CNC (Canadian National Collection of Insects). Earlier, in 2002, we identified many of our Korean specimens using the collection of Dr. H. Shima at Kyushu University, Fukuoka. In addition to the recognition and description of Korean taxa, I am planning to conduct a phylogenetic analysis using all Korean blondeliines plus some additional species representing various Palaearctic genera based on morphological characters. I am also analyzing Korean taxa using mitochondrial 12S and 16S rRNA gene sequences. We believe that these studies, even though geographically limited, will be useful to test the generic placement of some species, will help with the association of males and females of some species with sexual dimorphism, and will help confirm the membership of some taxa in the Blondeliini. As you might expect, Korea has a rich tachinid fauna with many unknown taxa. Dr. Han and I have so far identified 215 species from the roughly 500 species we have sorted from our collections, but we believe that the actual number of Korean species might be well over 800 species. We are planning to keep working on this fascinating group of flies to shed light on the tachinid fauna of this part of the world.

Silvio Nihei writes: I completed my Doctoral thesis on the systematics and biogeography of world Muscini (Muscidae) at the Universidade Federal do Paraná (Curitiba, Brasil) in 2004. Since March 2005 I have been developing a taxonomic and cladistic study of the Exoristini as a post-doc project at the Museu de Zoologia, Universidade de São Paulo (São Paulo, Brasil). I plan to produce identification keys to Latin American genera and species, diagnoses and redescriptions of poorly known taxa, and also to hypothesize on the phylogenetic relationships among the world genera of Exoristini based on morphological characters. For this year (2006), I am planning to visit some South American (Argentinean and Chilean) and American museums, and also the Canadian National Collection (Ottawa). I would be grateful to receive and examine material of Exoristini from any Latin American country. If you have any collected material and/or any suggestions or comments about my study, please do not hesitate to contact me.

Recently, Dr. Ronaldo Toma (now at the Universidad de Carabobo, Valencia, Venezuela) and I finished the

cataloguing of the Tachinidae type-material housed at the Museu de Zoologia. The catalogue has been submitted to *Revista Brasileira de Entomologia* for publication in Portuguese. I have also been involved in a databasing of the Tachinidae collection, with the assistance of Dr. Carlos Lamas (curator of the Diptera).

Marcelo Pansonato writes: Since April 2005 I have been working on two different projects as an undergraduate researcher at the Museu de Zoologia, Universidade de São Paulo (São Paulo, Brasil), under the supervision of Silvio Nihei. Both projects concern the taxonomy of the Dexiini. The first is a taxonomic revision of the genus *Prophorostoma* Townsend that will include a morphological redescription and terminalia illustration of both sexes of the type species. The second is an identification key to the Brazilian genera of Dexiini based on morphological characters. I have yet to examine the following genera, and would be grateful for the loan of specimens belonging to them: *Itamintho* Townsend, *Pachymyia* Macquart, *Sarcocalirrhoe* Townsend, *Tropidodexia* Townsend, and *Tropidosiomorpha* Townsend.

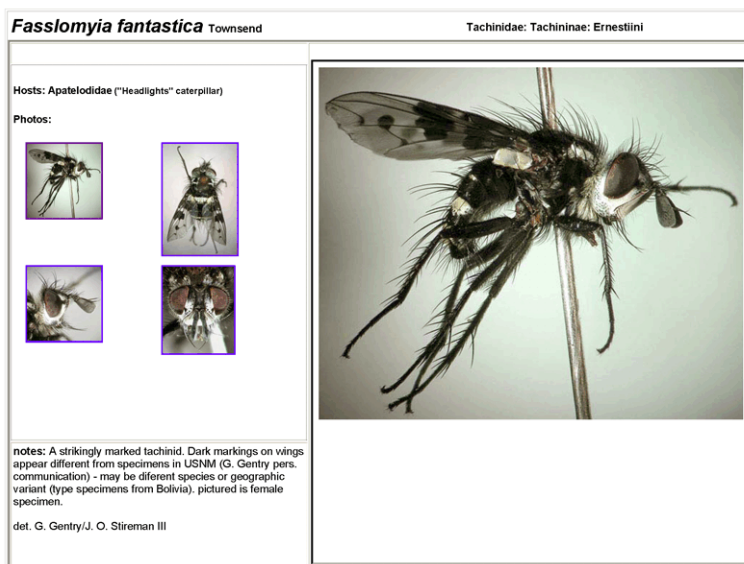
John Stireman writes: Since completing my PhD thesis work at the University of Arizona (2001) that was focused on the evolution and ecology of tachinid-host associations, I have been involved in a number of research projects as a postdoctoral researcher dealing with a variety of non-tachinid insect taxa. I have, however, attempted to reserve some portion of my research interests and time focused on tachinids. I recently accepted a faculty position at Wright State University (Dayton, Ohio, USA) as an invertebrate zoologist, which may allow somewhat more freedom in research directions, but much more responsibility in teaching.

I hope that readers of this newsletter are aware of the recent review article of tachinid biology that I collaborated on with Jim O'Hara and Monty Wood, which was recently published in *Annual Review of Entomology* (2006, vol. 51, pp. 525–555). Although far from comprehensive, the review summarizes several areas of tachinid biology in which there has been recent work and/or that we thought could benefit from review (e.g., Jim O'Hara provides a very nice summary of biogeographic diversity patterns and endemism in tachinids). We also point out some of the more promising areas for future research on tachinid flies. If anyone would like a pdf file of the review article please let me know and I will be happy to e-mail one.

One ongoing project dealing with tachinids that I am involved with is a biological survey of Lepidoptera and their parasitoids in Andean Ecuador. The project is based at a small biological station (Yanayacu) at approximately 2000m on the eastern slope of the Andes Mountains. The

area is characterized by a particularly diverse and visible tachinid fauna, with various tribes of the Tachininae especially well represented (e.g., Tachinini, Polideini). Preliminary sampling suggests that the region may be an epicenter of tachinid diversity. We are building a collection of both hand-netted and reared specimens that will be identified (to the extent possible given the certainty of new species and high probability of new genera) and used to analyze patterns of species diversity and the diversity of species interactions (e.g., host-plant-caterpillar-parasitoid). These collections will also serve as a foundation for taxonomic and systematic research. I am currently working to develop web pages that document and illustrate the

reared tachinids, including information on their host associations and notes on life histories (Fig. 1). Various impediments including an early lack of 24-hour electricity and miscommunication between researchers and local Ecuadorians employed as “parataxonomists” has resulted in slow initial progress, but we have now started to accumulate many diverse specimens that I am beginning to sort and identify. We hope that we can secure sufficient funding to support this project for several more years (if not indefinitely). If anyone is interested in including taxa from this region in revisions or other taxonomic work, please contact me.



LIFE HISTORY DATA	
Development time	emerge from host 20 days after collection; pupation duration ~ 40 days
Rearing Results	1
Host plant (of host)	Nectandra sp. (Lauraceae)
Caterpillar host	"headlights caterpillar" Apatelodidae
Natural History Observations	gregarious (7 reared from one host), emerged from host larval stage, pupated outside host.
Voucher location	Wright State University

Figure 1. Sample web page of tachinid reared in Ecuador.

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.

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- MAILING LIST**
- Telephone numbers, FAX numbers and E-mail addresses are included where known.
- Acquisitions Section, Department of Library Services, Natural History Museum, Cromwell Road, London, SW7 5BD, UK
Entomology Library, Peabody Museum, Yale University, New Haven, Connecticut 06511, USA
- Dr. Peter Adler, Department of Entomology, Clemson University, Long Hall, Box 340365, Clemson, South Carolina 29634-0365, USA [Tel: 864-656-5044, ext. 5070; Fax: 864-656-5069; E-mail: padler@clemson.edu]
- Dr. Paul H. Arnaud, Jr., Curator Emeritus, Department of Entomology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118, USA [Tel: 415-750-7233; Fax: 415-750-7106; E-mail: parnaud@calacademy.org]
- Prof. Piero Baronio, Dipartimento Scienze e Tecnologie Agro-ambientali (ex Entomologia), via Filippo Re, 6, I-40126 Bologna, ITALY [E-mail: pbaronio@entom.agrsci.unibo.it]
- Dr. David Barraclough, School of Biological and Conservation Sciences, George Campbell Building, University of KwaZulu-Natal, Durban 4041, SOUTH AFRICA [Tel: 031-260-1612; E-mail: barracloughd@ukzn.ac.za]
- Dr. Robert Belshaw, Department of Biology, Imperial College at Silwood Park, Ascot, Berks SL5 7PY, UK [Tel: +44 (0)20 7594 2367; Fax: +44 (0)20 7594 2339; E-mail: r.belshaw@ic.ac.uk]
- Mr. Christer Bergström, Säves väg 10, S-752 63 Uppsala, SWEDEN [E-mail: christer.bergstrom@zeta.telenordia.se]
- Mr. Jeff Boettner, Entomology Department, Fernald Hall, University of Massachusetts, Amherst, Massachusetts 01003, USA [E-mail: boettner@ent.umass.edu]
- Karel Bolckmans, International Production and R&D Manager, Koppert Biological Systems, P.O. Box 155, Veilingweg 17, 2650 AD, THE NETHERLANDS [Tel. +31-10-514.04.44; E-mail: kbolckmans@koppert.nl]
- Prof. Valerie K. Brown, Director, Centre for Agri-Environmental Research (CAER), Department of Agriculture, The University of Reading, Earley Gate, PO Box 236, Reading RG6 6AT, UK [Tel: +44 (0)118 931 6535; Fax: +44 (0)118 935 2421; E-mail: v.k.brown@reading.ac.uk]
- Hye-Woo Byun, Department of Life Science, Yonsei University, 234 Maeji-ri, Wonju-si, Gangwon-do 220-710, KOREA [E-mail: hwbyun@yonsei.ac.kr]
- Mr. Cezary Bystrowski, Forest Research Institute, ul. Bitwy Warszawskiej 1920 r. nr 3, 00-973 Warsaw, POLAND [E-mail: C.Bystrowski@ibles.waw.pl]
- Dr. Bryan K. Cantrell, 3 Wingarra Street, Yeerongpilly, Queensland, 4105 AUSTRALIA [Tel: 61 7 3848 7904; E-mail: bjkcantrell@ozemail.com.au]
- Dr. Ronald D. Cave, Indian River Research & Education Center, University of Florida, 2199 South Rock Road. Ft. Pierce, Florida 34945, USA [Tel: 772-468-3922 x 145; Fax: 772-460-3673; E-mail: rdcave@ifas.ufl.edu]
- Dr. Pierfilippo Cerretti, Dipartimento di Biologia Animale e dell'Uomo, Università degli Studi di Roma "La Sapienza", Viale dell'Università, 32, 00185, Roma, ITALY [E-mail: pierfilippo.cerretti@yahoo.it]
- Dr. Chao Chien-ming, Institute of Zoology, Academia Sinica, 19 Zhongguancun Lu, Haitien, Beijing, 100080, CHINA [E-mail: chienmingchao@yahoo.com.cn]
- Dr. D.E. Conlong, SASA Experiment Station, Private Bag X02, Mount Edgecombe, 4300, Natal, SOUTH AFRICA [Tel: (031) 593205; Fax: (031) 595406; E-mail: xentdc@sugar.org.za or conlong@iafrica.com]
- Dr. Joan Cossentine, Summerland Research Centre, Agriculture and Agri-Food Canada, Highway 97, Summerland, British Columbia VOH 1Z0, CANADA [E-mail: cossentinej@agr.gc.ca]
- Dr. Roger W. Crosskey, Department of Entomology, Natural History Museum, Cromwell Road, London, SW7 5BD, UK [Tel: 071-938-9123; Fax: 071-938-8937; E-mail: rwc@nhm.ac.uk]
- Dr. Michael L. Cox, CAB International Institute of Entomology, c/o Department of Entomology, Natural History Museum, Cromwell Road, London, SW7 5BD, UK
- Dr. Maria Luisa Dindo, Dipartimento di Scienze e Tecnologie, Agroambientali, via Fanin, 42, 40127 Bologna, ITALY [Tel: +39 051 2096280 2096288; Fax: +51 051 2096281; E-mail: ldindo@agrsci.unibo.it]
- Dr. Agnieszka Draber-Monko, Instytut Zoologii, Polska Akademia Nauk, 00-679 Warszawa, ul. Wilcza 64, P.O. Box 1007, POLAND [Tel: 29-32-21]
- Mr. John S. Dugdale, c/o Landcare Research, Private Bag 6, Nelson, NEW ZEALAND 7001 [Tel: 03 54 50 676; Fax: 03 54 50 671; E-mail: dugdalej@landcare.cri.nz]
- Professeur Claude Dupuis, Entomologie générale et appliquée, Musée National d'Histoire Naturelle, 45, rue de Buffon, 75005 Paris, FRANCE [Tel: 40.79.34.05]
- Dr. Astrid Eben, Departamento de Ecología Vegetal, Instituto de Ecología, A.C., Km 2.5 carretera antigua a Coatepec, Apartado Postal 63, 91000 Xalapa, Veracruz, MEXICO [Tel: +52 / 28 / 42 18 00 ext. 3503; Fax: +52 / 28 / 18 78 09; E-mail: astrid@ecologia.edu.mx]
- Ms. Stephanie Erb, Lethbridge Research Centre, Agriculture and Agri-Food Canada, P.O. Box 3000, Lethbridge, Alberta T1J 4B1, CANADA [E-mail: erbs@agr.gc.ca]
- Dr. Neal L. Evenhuis, Department of Natural Sciences, Bishop Museum, 1525 Bernice St., P.O. Box 19000A, Honolulu, Hawaii 96817-0916, USA [Tel: 808-848-4138; Fax: 808-847-8252; E-mail: neale@bishopmuseum.org]
- Dr. Sheila Fitzpatrick, Agriculture and Agri-Food Canada Research Station, 6660 N.W. Marine Drive, Vancouver, British Columbia, V6T 1X2, CANADA [Tel: 604-224-4355; Fax: 604-666-4994; E-mail: fitzpatrick@agr.gc.ca]
- Mr. John P. Flynn, 274 Hainton Avenue, Grimsby, North East Lincolnshire, DN32 9LS, UNITED KINGDOM [E-mail: jpf@sheltie.co.uk]
- Dr. Serge Gaponov, Voronezh State University, Universitetskaya pl.

- 1, 394000 Voronezh, RUSSIA [Tel: (0732) 566595; Fax: (0732) 566551; E-mail: gaponovs@hotmail.com]
- Dr. Giuliana Giangiuliani, Istituto di Entomologia Agraria, Università Degli Studi di Perugia, Borgo XX Giugno, 72, 06121 Perugia, ITALY [Tel: (075) 5856027; Fax (39) (75) 5856039]
- Mr. David J. Girling, Information Officer, IIBC, Silwood Park, Buckhurst Road, Ascot, Berks SL5 7TA, UK
- Dr. Simon Grenier, Directeur de Recherche INRA, UMR INRA/INSA de Lyon, Biologie Fonctionnelle, Insectes et Interactions (BF2I), INSA, Bât. L. Pasteur - 20, av. A. Einstein, 69621 Villeurbanne Cedex, FRANCE [Tel: +33 (0)4 72 43 79 88; FAX +33 (0)4 72 43 85 34; E-mail: Simon.Grenier@jouy.inra.fr]
- Dr. Horacio Grillo, Laboratorio de Taxonomía, Facultad de Ciencias Agropecuarias, Universidad Central de Las Villas, Santa Clara, Villa Clara, CUBA
- Dr. Ho-Yeon Han, Department of Life Science, Yonsei University, 234 Maeji-ri, Wonju-si, Gangwon-do 220-710, KOREA [E-mail: hyhan@yonsei.ac.kr]
- Mr. Daniel E. Hansen, Minneapolis, Minnesota, USA [E-mail: genbirch@aol.com]
- Dr. Zdravko Hubenov, Bulgarian Academy of Sciences, Institute of Zoology, Boul. "Tsar Osvoboditel" 1, 1000 Sofia, BULGARIA [E-mail: zhubenov@zoology.bas.bg]
- Dr. Ryoko Ichiki, Biosystematics Laboratory, Graduate School of Social and Cultural Studies, Kyushu University, Ropponmatsu, Fukuoka 810, JAPAN [E-mail: leftrcb@mbox.nc.kyushu-u.ac.jp]
- Dr. Daniel H. Janzen, Department of Biology, University of Pennsylvania, Philadelphia, PA 19104, USA [Tel: 215-898-5636; Fax 215-898-8780; E-mail: djanzen@sas.upenn.edu]. When in Costa Rica, Dan can be reached at Guanacaste Conservation Area: tel and Fax 506-695-5598, best to call at night or on weekends.
- Dr. Kenan Kara, Gazi Osman Pasa University, Ziraat Fakültesi Bitki, Koruma Bölümü, Tokat, TURKEY [E-mail: kkara@gop.edu.tr]
- Dr. Ulrich Kuhlmann, Head Agricultural Pest Research, CABI Bioscience Centre Switzerland, Rue des Grillons 1, CH-2800 Delémont, SWITZERLAND [Tel: +41-32-421 4882; Fax: +41-32-421 4871; E-mail: u.kuhlmann@cabi.org]
- Dr. Pradip Kumar, Eastern Empress Silk SDN BHD, Menara SEDC, Jln. Tunku Abdul Rahman, P.O. Box 400, 93902 Kuching, Sarawak, MALAYSIA [Tel: 011-212503, 082-410808; Fax: 082-711137]
- Mr. A.R. Lahiri, Asst. Zoologist, Diptera Section, Zoological Survey of India, Prani Vigyan Bhavan, 'M' Block, New Alipur, Calcutta - 700 053, INDIA
- Dr. Gerlind U.C. Lehmann, Freie Universität Berlin, Institut für Zoologie, Königin-Luise-Straße 1-3, D-14195 Berlin, GERMANY [E-mail: gerlind.lehmann@t-online.de]
- Dr. Gerardo Liljeström, Museo de La Plata, Paseo del Bosque S/N, 1900 La Plata, ARGENTINA
- Dr. Richard L. Lindroth, Department of Entomology, 1630 Linden Drive, University of Wisconsin, Madison, Wisconsin 53706, USA [Tel: 608-263-6277; Fax: 608-262-3322 [E-mail: lindroth@entomology.wisc.edu]
- Dr. Rolando López, USDA-ARS vegetable laboratory & CREC-Clemson University, 2700 Savannah Hwy., Charleston, South Carolina 29414, USA [Tel: 843-402-5392; E-mail: rgutier@clemson.edu]
- Dr. Jean-Michel Maes, Museo Entomologico, AP 527, Leon, NICARAGUA [Tel: 505-3116586; Fax: 505-3110126; E-mail: jmmaes@ibw.com.ni]
- Dr. Steve Marshall, Department of Environmental Biology, University of Guelph, Guelph, Ontario N1G 2W1, CANADA [Tel: 519-824-4120, ext. 2720; Fax: 519-837-0442; E-mail: smarshal@evb.uoguelph.ca]
- Dr. Peter G. Mason, Invertebrate Biodiversity, Agriculture and Agri-Food Canada, 960 Carling Avenue, Ottawa, Ontario K1A 0C6, CANADA [Tel: 613-759-1908; Fax: 613-759-1927; E-mail: masonp@agr.gc.ca]
- Dr. Bernhard Merz, Muséum d'Histoire Naturelle, C.P. 6434, CH-1211 Genève, SWITZERLAND [Tel: ++41 (0)22 418 6312; Fax: ++41 (0)22 418 6301; E-mail: bernhard.merz@mhn.ville-ge.ch]
- Dr. Andrew Mitchell, Agricultural Scientific Collections Unit, OAI, NSW Department of Primary Industries, Forest Road, Orange, New South Wales 2800, AUSTRALIA [Tel: +61 (0)2 6391 3848; Fax: +61 (0)2 6391 3899; E-mail: andrew.mitchell@dpi.nsw.gov.au]
- Dr. Kevin Moulton, Department of Entomology and Plant Pathology, University of Tennessee, 2431 Joe Johnson Drive, 205 Ellington Plant Sciences Bldg., Knoxville, Tennessee 37996-4560, USA [Tel: 865-974-7950; Fax: 865-974-4744; E-mail: jmoulton@utk.edu]
- Dr. Satoshi Nakamura, Japan International Research Centre for Agricultural Sciences, 1-2 Ohwashi, Tukuba, Ibaraki, 305, JAPAN [Tel: 0298-38-8318; Fax: 0298-38-6316; E-mail: tachinid@jircas.affrc.go.jp]
- Dr. Bhanu C. Nandi, Assistant Professor of Zoology, Presidency College, 86/1, College St., Calcutta 700073, INDIA [Tel: 311350]
- Dr. Vincent Nealis, Pacific Forestry Centre, Forestry Canada, 506 West Burnside Road, Victoria, British Columbia V8Z 1M5, CANADA [Tel: 250-363-0663; Fax: 250-363-0775; E-mail: vnealis@pfc.cfs.nrcan.gc.ca]
- Dr. Fathi H. Negm, Plant Protection Research Institute, Nadi El Seid St., Dokki-Giza, EGYPT
- Dr. William C. Nettles, Jr., 25 Admiral Lane, Salem, South Carolina 29676, USA [Tel: 864-944-8401; E-mail: bill29676net@yahoo.com or wcnettles@earthlink.net]
- Dr. Silvio S. Nihei, Coleção de Entomologia – Diptera, Museu de Zoologia, Universidade de São Paulo, Avenida Nazaré, 481, Ipiranga, São Paulo-SP, CEP 04263-000, BRAZIL [Tel: +55 11 61658135; Fax: +55 11 61658113; E-mail: silvionihei@gmail.com]
- Mr. Enio Nunez, Departamento de Entomologia, Museu Nacional do Rio de Janeiro, 20940-040, Rio de Janeiro, BRAZIL [E-mail: enionunez@mn.ufrj.br]
- Dr. James E. O'Hara, Invertebrate Biodiversity, Agriculture and Agri-Food Canada, 960 Carling Avenue, Ottawa, Ontario K1A 0C6, CANADA [Tel: 613-759-1795; Fax: 613-759-1927; E-mail: oharaj@agr.gc.ca]
- Dr. Michael Orazé, National Biological Control Institute, USDA, APHIS, OA, 4700 River Road, Unit 5, Riverdale, Maryland 20737-1229, USA [Tel: 301-734-4329; E-mail: moraze@aphis.usda.gov]
- Dr. Imre Otvos, Pacific Forestry Centre, Forestry Canada, 506 West Burnside Road, Victoria, British Columbia V8Z 1M5, CANADA [Tel: 250-363-0620; Fax: 250-363-0775; E-mail: iotvos@pfc.cfs.nrcan.gc.ca]
- Marcelo Pansonato, Coleção de Entomologia – Diptera, Museu de Zoologia, Universidade de São Paulo, Avenida Nazaré, 481, Ipiranga, São Paulo-SP, CEP 04263-000, BRAZIL [E-mail: marcelopansonato@hotmail.com]

- Dr. Thomas Pape, Entomology Department, Zoological Museum, Universitetsparken 15, DK-2100 Copenhagen Ø, DENMARK [Tel: +45 3532 1106; Fax: +45 3532 1010; E-mail: tpape@snm.ku.dk]
- Dr. Christopher J.H. Pruett, Universidad Autónoma “Gabriel René Moreno”, I.I.A. “El Vallecito”, Casilla 702, Santa Cruz de la Sierra, BOLIVIA [Tel: 422130; Fax: 342317; E-mail: crinel@bibosi.scz.entelnet.bo]
- Dr. Hosagavi P. Puttaraju, Professor in Sericulture, Department of Sericulture, Bangalore University, Bangalore-560 056, INDIA [Tel/Fax: 0091-80-3301238; E-mail: puttarajuhp@hotmail.com]
- Dr. F. Wolfgang Quednau, Laurentian Forestry Centre, P.O. Box 3800, 1055 PEPS Street, Sainte-Foy, Quebec G1V 4C7, CANADA [Tel: 418-648-5804; Fax: 418-648-5849; E-mail: fquednau@exchange.cfl.forestry.ca]
- Dr. S. Ramani, Project Directorate of Biological Control, Hebbal, Bangalore - 560 024, INDIA [Tel: 3511982; Fax: 341 1961; E-mail: s_ramani@vsnl.net]
- Mr. Chris Raper, c/o Tachinid Recording Group, <http://tachinidae.org.uk/> [E-mail: chris.raper@tachinidae.org.uk]
- Dr. Stuart Reitz, USDA-ARS Center for Biological Control, Florida A&M University, Tallahassee, Florida 32307, USA [Tel: 850-412-7062; Fax: 850-412-7263; E-mail: sreitz@nettally.com]
- Mr. Anthony Rice, CRC For Sustainable Production Forestry, GPO Box 252-12, Hobart, Tasmania 7109, AUSTRALIA [E-mail: anthony.rice@ffp.csiro.au]
- Dr. Vera A. Richter, Zoological Institute, Russian Academy of Sciences, St. Petersburg, 199034, RUSSIA [Tel: 812 218 0011; Fax: 7 812 1140444; E-mail: ciala@zin.ru]
- Dr. Knut Rognes, Havørnbrautene 7a, N-4049 Hafersfjord, NORWAY [Home tel: (+47) 51 59 06 96; Home E-mail: knut@rognes.no; Office tel: (+47) 51 83 35 43; Office Fax: (+47) 51 83 35 50; Office E-mail: Knut.Rognes@lu.his.no]
- Dr. Jens Roland, Department of Biological Sciences, University of Alberta, Edmonton, Alberta T6G 2E9, CANADA [Tel: 403-492-1180; Fax: 403-492-9234; E-mail: jroland@gpu.srv.ualberta.ca]
- Luiz Antonio B. Salles, EMBRAPA, Centro de Pesquisa Agropecuária de Clima Temperado, Caixa Postal 403, CEP 96001-970 Pelotas, RS, BRASIL [Tel: (0532) 212122; Fax: (0532) 212121]
- Dr. Vicente Sánchez, USDA, Center for Biological Control of Northeastern Forest Insects and Diseases, Northeastern Forest Experiment Station, 51 Mill Pond Road, Hamden, CT 06514, USA [Tel: 203-773-2021; Fax: 203-773-2183]
- Mr. Ted A. Sawinski, Southern Crop Protection and Food Research Centre, Agriculture and Agri-Food Canada, 1391 Sandford Street, London, Ontario, N5V 4T3, CANADA [Tel: 519-457-1470, ext. 231; Fax: 519-457-3997; E-mail: sawinskit@agr.gc.ca]
- Mr. Rudi Schnitzler, Victoria University, P.O. Box 600, Wellington, NEW ZEALAND [E-mail: bug_me@globe.net.nz]
- Prof. Dr. Ulrich Schulz, Fachhochschule Eberswalde, Fachbereich Landschaftsnutzung und Naturschutz, Fachgebiet Angewandte Tierökologie und Zoologie, Friedrich Ebertstr. 28, 16225 Eberswalde, GERMANY [E-mail: uschulz@fh-eberswalde.de]
- Mr. Peter Sehnal, Naturhistorisches Museum, 2. Zoologische Abteilung, Burgring 7, A-1014 Wien, AUSTRIA [E-mail: peter.sehnal@nhm-wien.ac.at]
- Ms. Lorraine Seymour, Department of Plant, Soil and Entomological Sciences, University of Idaho, PO Box 442339, Moscow, ID 83844-2339, USA [Tel: 208-885-5637; E-mail: seym6131@uidaho.edu]
- Dr. Hiroshi Shima, Biosystematics Laboratory, Graduate School of Social and Cultural Studies, Kyushu University, Ropponmatsu, Fukuoka 810, JAPAN [Tel: 092-771-4161; Fax: 092-712-1587; E-mail: shimarcb@mbox.nc.kyushu-u.ac.jp]
- Mr. Liekele E.N. Sijstermans, Buiksloterbreek 98, NL - 1034 XE Amsterdam, THE NETHERLANDS [E-mail: liekele@worldaccess.nl]
- Dr. Ana Maria M. Ávila Simões, Departamento de Ciências Agrárias, Secção da Protecção das Plantas, Terra-Chã, 9702 Angra, Terceira, PORTUGAL [Tel: 351 95 31111; Fax: 351 95 32605; E-mail: asimoes@angra.uac.pt]
- Dr. Mike Singer, Department of Biology, Wesleyan University, Hall-Atwater Labs, Rm.259, Middletown, Connecticut 06459, USA [Tel: 860-685-2548; E-mail: msinger@wesleyan.edu]
- Dr. Jeffrey Skevington, Invertebrate Biodiversity, Agriculture and Agri-Food Canada, 960 Carling Avenue, Agriculture and Agri-Food Canada, Ottawa, Ontario K1A 0C6, CANADA [Tel: 613-759-1647. Fax: 613-759-1927; E-mail: skevingtonj@agr.gc.ca]
- Dr. Cecil L. Smith, Museum of Natural History, University of Georgia, Athens, Georgia 30602, USA [E-mail: clsmith@arches.uga.edu]
- Mr. Matthew Smith, 24 Allnatt Avenue, Winnersh, Berks RG41 5AU, UK; also Tachinid Recording Group, <http://tachinidae.org.uk/> [Tel.: 0118 979 4313; E-mail: matt.smith@tachinidae.org.uk]
- Dr. Rob F. Smith, Agriculture and Agri-Food Canada, 32 Main St., Kentville, Nova Scotia B4N 1J5, CANADA [Tel: 902-679-5730; E-mail: smithr@agr.gc.ca]
- Dr. John O. Stireman III, Assistant Professor, Department of Biological Sciences, 3640 Colonel Glenn Highway, 235A, BH, Wright State University, Dayton, Ohio 45435, USA [Tel: 937-775-3192; e-mail: john.stireman@wright.edu]
- Dr. John Strazanac, Plant and Soil Sci. / Entomology, West Virginia University, P.O. Box 6108, Morgantown, West Virginia 26506-6108, USA [Tel: 304-293-6023, ext. 4345; Fax: 304-293-2960; E-mail: jstrazan@wvu.edu]
- Dr. Xuekui Sun, 81 Waterton Crescent, Richmond Hill, Ontario L4B 4L3, CANADA [Tel: 905-326-8091; E-mail: xuekuisun@hotmail.com]
- Dr. Takuji Tachi, Biosystematics Laboratory, Graduate School of Social and Cultural Studies, Kyushu University, Ropponmatsu, Fukuoka 810, JAPAN [Tel: 092-726-4818; Fax: 092-726-4644; E-mail: tachircb@mbox.nc.kyushu-u.ac.jp]
- Dr. Ronaldo Toma, Museu de Zoologia, Universidade de São Paulo, Caixa Postal 42694, Cep 04299-970, São Paulo, SP, BRASIL [E-mail: rtkuna@hotmail.com]
- Dr. Hans-Peter Tschorsnig, Staatliches Museum für Naturkunde, Rosenstein 1, D-70191 Stuttgart, GERMANY [Tel: (0711) 8 93 60; Fax: 49 711 8936100; E-mail: tschorsnig.smns@naturkunde.museum-bw.de]
- Mr. Godard Tweehuysen, Librarian, Library Netherlands Entomological Society, Plantage Middenlaan 64, NL-1018 DH Amsterdam, THE NETHERLANDS [Tel: + 31(0)20 5256246; Fax: + 31(0)20 5256528; E-mail: biblionev@science.uva.nl]
- Dr. Jaromír Vanhara, Department of Zoology and Ecology, Faculty of Science, Masaryk University, Kotlářská 2, 611 37 Brno, CZECH REPUBLIC [Tel: 420 549 497 979; Fax: 420 541 211 214; E-mail: vanhara@sci.muni.cz]
- Dr. Philippe Vernon, UMR 6553, CNRS, Université de Rennes 1, Station Biologique, 35380, Paimpont, FRANCE [Tel: +33 (0)2.99.61.81.69; Fax: +33 (0)2.99.61.81.87; E-mail: philippe.vernon@univ-rennes1.fr]

- Dr. Thomas J. Walker, Department of Entomology & Nematology, University of Florida, Gainesville, Florida 32611-0620, USA [Tel: 904-392-1901; Fax: 904-392-0190; E-mail: tjw@gnv.ifas.ufl.edu]
- Dr. Robert A. Wharton, Department of Entomology, Texas A&M University, College Station, Texas 77843-2475, USA [Tel: 409-845-7972; Fax: 409-845-7977; E-mail: rawbaw2@tamu.edu]
- Dr. Terry A. Wheeler, Department of Natural Resource Sciences, McGill University, Macdonald Campus, Ste-Anne-de-Bellevue, Quebec H9X 3V9, CANADA [Tel: 514-398-7937; Fax: 514-398-7990; E-mail: wheeler@nrs.mcgill.ca]
- Dr. D. Monty Wood, Invertebrate Biodiversity, Agriculture and Agri-Food Canada, 960 Carling Avenue Agriculture and Agri-Food Canada, Ottawa, Ontario K1A 0C6, CANADA [Tel: 613-996-1665; Fax: 613-947-5974; E-mail: wooddm@agr.gc.ca]
- Dr. Norman E. Woodley, Systematic Entomology Laboratory, SEA, U.S. Department of Agriculture, c/o U.S. National Museum NHB 168, Washington, D.C. 20560, USA [Tel: 202-382-1802; Fax: 202-786-9422; E-mail: nwoodley@sel.barc.usda.gov]
- Mr. Nigel Wyatt, Department of Entomology, Natural History Museum, Cromwell Road, London, SW7 5BD, UK [Tel: 071-938-9123; Fax: 071-938-8937; E-mail: npw@nhm.ac.uk]
- Dr. Erick Yabar L., P.O. Box 115, Cusco, PERU [E-mail: e_yabar@yahoo.com]
- Dr. Stephen P. Yanoviak, Florida Medical Entomology Lab, 200 9th Street SE, Vero Beach, Florida 32962, USA [Tel: 561-778-7200; E-mail: yanoviak@terra.com.pe]
- Mr. Dekang You, No. 58 North Yellow River Street, Shenyang, 110034, P.R. CHINA [Tel: 0086 24 6800330]
- Mr. Theo Zeegers, Eikenlaan 24, NL 3768 EV Soest, THE NETHERLANDS [Tel: + 35 5885858; E-mail: th.zeegers@tref.nl]
- Dr. Chuntian Zhang, Institute of Entomology, Sun Yat-sen University, 135 West Xingang Road, Haizhu District, Guangzhou 510275, CHINA [E-mail: zhangct2003@yahoo.com.cn]
- Dr. Joachim Ziegler, Humboldt-Universität zu Berlin, Museum für Naturkunde, Institut für Systematische Zoologie, Invalidenstrasse 43, 10115 Berlin, GERMANY [Tel: 049 / (0)30 / 2093-8509; E-mail: joachim.ziegler@museum.hu-berlin.de]
- Mr. Manuel A. Zumbado, Unidad de Atrópodos, Instituto Nacional de Biodiversidad (INBio), 22-3100, Santo Domingo, Heredia, COSTA RICA. [Tel: 506-507-8222; Fax: 506-507-8274; E-mail: mzumbado@inbio.ac.cr]