The Tachinid Times

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The Tachinid Times has been in continuous annual distribution since 1988, first as a hardcopy newsletter and later (beginning with issue **9** in 1996) as an electronic document available on the Internet. It was first offered electronically in HTML format but was changed to PDF in 2001 to maintain uniformity between the simultaneously published hardcopy and electronic versions. The newsletter is about to undergo another change, not in appearance but in its URL address. I can no longer offer this newsletter on a Government of Canada website because of strict new regulations governing such sites, so sometime this summer **The Tachinid Times** will be relocated to a brand new Diptera website that I am helping to develop on behalf of the North American Dipterists Society (NADS). Financial support for the new website was recently approved by the Dipterology Fund. This new website will have an appropriate domain name (as yet unregistered) and will offer North American dipterists with a specialized site for their electronic products. I hope to make available on the website all back issues of **The Tachinid Times** and my other electronic Tachinidae products.

As in past years, I encourage all readers who work with tachinids and find this newsletter of interest to send me a note about his or her research for inclusion in next year's issue. Student submissions are particularly welcome, especially abstracts from theses and accounts of studies in progress or about to begin. Submissions on all aspects of tachinid biology and systematics are gladly accepted 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. Colour images are easily incorporated into the newsletter so I encourage contributors to send images to accompany their text whenever possible (please send images and text as separate files).

Please send me your news for inclusion in next year's newsletter before the end of January 2004. This newsletter is simultaneously produced in hardcopy and electronic formats with identical pagination and appearance.

Abstracts from the Fifth International Congress of Dipterology (by J.E. O'Hara)

The Fifth International Congress of Dipterology was held in Brisbane, Australia, from 29 September to 4 October 2002. Below are reproduced the abstracts of the two oral and three poster presentations on the Tachinidae that were given at the Congress. These abstracts were printed in the Abstracts Volume of the Congress (see Tachinid Bibliography in this issue) with the exception of O'Hara's poster presentation that is inexplicably missing from the Volume.

<u>A review of New World *Zaira* Robineau-Desvoidy (Diptera; Tachinidae; Blondeliini)</u> (Oral presentation by D. Hansen)

Zaira Robineau-Desvoidy is a genus of small to moderate-sized tachinid flies that is restricted in distribution to the New World except for the type species, which is widespread in the Palaearctic region. Recorded hosts are adult beetles belonging to the Scarabaeidae, Carabidae and Tenebrionidae. Adults are mostly crepuscular or nocturnal in habit. Fourteen species are currently recognized as valid in America north of Mexico and six are recognized as valid in Mexico and Trinidad. While no species has been described from mainland South America, distributional evidence indicates that the range of *Zaira* is more extensive in the Neotropics than currently reported. Known distributions of *Zaira* species will be reviewed and morphological characters useful for discrimination of species and for phylogenetic analyses will be discussed. Characters useful for discerning the pattern of relationships among *Zaira* and related genera (*Cryptomeigenia*, *Istocheta*) will be discussed. A preliminary assessment of described and undescribed taxa will be presented.

Advances in the phylogenetics of the Tachininae (Tachinidae) (Oral presentation by J.E. O'Hara)

The Tachininae are one of the four subfamilies of the Tachinidae, a family whose members are exclusively endoparasitic on other arthropods during their larval stage. The subfamily is worldwide in distribution and comprises approximately 2000 described species, or about 25% of all Tachinidae. Hosts range from scorpions and centipedes to various orders of Insecta, but are predominantly larval Lepidoptera. A selection of species from the outgroup subfamilies Dexiinae and Exoristinae and over 100 exemplars from within the Tachininae were chosen for a phylogenetic analysis. A large percentage of the ingroup taxa belonged to the tribes Ernestiini, Linnaemyini, Nemoraeini, Polideini and Tachinini in order to develop a revised classification scheme for this large clade within the Tachininae. Exemplars of species belonging to unplaced genera of North American Tachininae were included in the analysis to attempt to elucidate their affinities within the subfamily. The analysis was conducted using PAUP and MacClade and was based on morphological characters of adults, particularly characters of the male terminalia. The results of the analysis will be reviewed, including a discussion of the monophyly of the Tachininae and the implications for a reclassification of the subfamily.

Tachinid parasitoids of Nearctic *Choristoneura* species (Lepidoptera: Tortricidae) (Poster presentation by J.E. O'Hara)

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*), large aspen tortrix (*C. conflictana*), jack pine budworm (*C. pinus*) and obliquebanded leafroller (*C. rosaceana*). Natural control factors that help to keep populations of these pests in check include endoparasitoids of several insect families, in particular the Tachinidae (Diptera), Braconidae (Hymenoptera) and Ichneumonidae (Hymenoptera). There are about 20 species of Tachinidae that have been reported from Nearctic *Choristoneura* species but only about half of these are commonly recorded; the other half represent rare or accidental parasitism of *Choristoneura* species or dubious records. An illustrated identification guide is under preparation to separate the adults and puparia of the confirmed tachinid parasitoids of Nearctic *Choristoneura* species. The guide will include an illustrated key, digitally enhanced images of the adult and puparium of each species, and information on the life history of each species.

Forest fragmentation: its impact on food webs and biodiversity in an urban environment: a study using Lepidoptera and Tachinidae (Poster presentation by F.R. Schnitzler)

Flies of the family Tachinidae otherwise known as parasitic flies represent a very diverse, advanced and useful group of parasitoid flies. Tachinidae parasitise a variety of insects such as butterflies, moth and beetle larvae. New Zealand's Tachinidae are a very varied group with possibly more than 190 species. Endemism in New Zealand is over 90% at the generic and species level.

Despite the importance of tachinid flies as natural enemies, the lack of the work on this group in New Zealand is striking. Many hosts of New Zealand's Tachinidae are unknown as well as the effects different landscapes have on tachinid fly populations. Also very little is known about the relationship between urban habitats such as forest fragments and bush remnants in relation to tachinid density and diversity.

Alteration of plant diversity and introduction of exotic plant species, as well as pollution and stress on trees all have their impact on insect populations. Furthermore, landscape effects such as different habitat types (composition) and their arrangement in space (context and connectivity) influence the diversity of insects. Few studies have linked those relationships to the trophic relationships between Lepidoptera and Tachinidae.

The research project will investigate how differing urban forest and bush remnants impact on tachinid fly populations and their relationship with their butterfly and moth hosts. Lepidopteran larvae will be sampled as well as their diversity and density altered experimentally to establish Tachinidae parasitism.

The main questions I would like to address in this study are: How does forest fragment size, composition, context or connectiveness relate to plant, butterfly/moth and Tachinidae diversity? The study will relate different densities and diversities between each of these groups. A "Multiple Species Habitat Conservation Plan" (MSHCP) (Scott, 2000) for urban environments will be established using Wellington as a model. This plan will incorporate the variety of species and the trophic relationships across the levels plant, butterfly/moth and Tachinidae. The aim of this plan is to make recommendations towards the implementation and management of habitat reserves and forest fragments, for the maintenance of natural enemy diversity as a bio-control agent of plant pests.

[Editor's Note: Rudi Schnitzler is conducting the above study as part of a Ph.D. program at Victoria University in Wellington, New Zealand. The study has since been expanded to include hymenopteran parasitoids of Lepidoptera.]

Summit conference: hilltopping behaviour of male tachinid flies (Tachinidae) at higher elevations of the European Alps (Poster presentation by J. Ziegler)

The larvae of Tachinidae are endoparasitoids of arthropods and the family has considerable importance in landscape ecology. The author has been investigating for a number of years the biodiversity, habitat preference and behaviour of Tachinidae in the European Alps. The phenomenon of hilltopping behaviour, where males form mating aggregations on hilltops and summits, is known from various insect groups. The ecological basis for the development of this behaviour is probably low population density and this is true too for tachinids living at higher elevations. In general about a quarter of the tachinid species with an alpine or arcto-alpine distribution pattern aggregate on summits. In contrast, less than 10% of all evaluated tachinid species of the Alps exhibit specific hilltopping behaviour. In a few species with relatively large body size nearly all males are found exclusively on hilltops and not in other areas, and are scarce on flowers. Typical for this group with obligatory hilltopping behaviour is *Peleteria prompta* (Meigen), a large species found only at higher elevations. By marking individuals with fluorescent dust, the author observed that males of *P. prompta* from the surrounding area with a horizontal distance of 1000 m and a vertical distance of 450 m gathered on the summit. The flies travelled these distances in 40 minutes (400 m) to 120 minutes (1000 m). On the summit the males perched on stones in full sunshine and occupied small territories. They would fly off repeatedly on short patrolling flights, usually following a loop pattern. Whenever a female, a rival, or another insect crossed a perching site, the male would take off and pursue it for a short distance. Aerial combat with a rival often ensued, with the males gripping each other with their legs and sometimes falling heavily to the ground. During nine days all the marked flies without exception perched on the summit. Apparently male *P. prompta* spend their whole lives as members of a "summit conference."

Notes on tachinids *in copula* from hilltops in Carnarvon N.P., Queensland, Australia (by D.E. Hansen)

Last October, I participated in a post-Congress (ICD5) field trip in Queensland, Australia and was quite amazed and delighted with the results of our hilltop collecting. The abundance and diversity was incredible on the hilltops we visited, especially when contrasted with the very low level of tachinid activity off-peak. Prior to this trip, in June 2002, I had my first significant hilltop collecting experience on the very productive Mt. Rigaud, near Montreal, Canada with Dr. Monty Wood (see Tachinid Times **9**, 1996, for more about Mt. Rigaud). My flat-lander perspective on sampling tachinid diversity will never be the same since these two collecting trips.

Figure 1. Fly Hill, Carnarvon N.P., from approximately 2km away.

The most productive and diverse locality in Carnarvon National Park that I visited one day between 9 a.m. and 3 p.m. was "Fly Hill" (24°58.5'S 147°59.6'E), an unnamed hill of minor stature (Fig. 1) that was nicknamed Fly Hill by ranger Craig Eddie. Although it would be nice if the next revision of the Carnarvon topographical map formally cites this feature as Fly Hill, one will nevertheless require a GPS or knowledgeable guide to find it as it is inland nearly 2km from the nearest road. Whether the productivity of Fly Hill can be attributed to its topographical and relational position in the landscape or to its pattern of sparse and relatively low vegetative cover (Figs. 2-3), it is similar in both these regards to the most well documented and diverse temperate hilltop, Mt. Rigaud. Despite the unimpressive stature of Fly Hill, there was a significant draw to the summit from all directions.

Figure 2. Fly Hill, showing open vegetation on summit (*Opuntia* cactus to left of center).

The other hilltop in Carnarvon N.P. that I twice visited, from approximately 8 a.m. to 3 p.m., was Mt. Moffatt (25°03.6'S 148°02.6'E). A conspicuous and well marked locality, Mt. Moffatt is topped by an elongate domed ridge of approximately 100m in length with substantial vegetative cover (Figs. 4-5). Despite the cover, moving back and forth along the ridge was quite easy and afforded several very good tachinid "playgrounds". I had the pleasure on Mt. Moffatt of collecting alongside Dr. Thomas Pape (Swedish Museum of Natural History, Stockholm) who had carried a wallaby leg (road-kill) to the summit as a bait item for sarcophagids. Though the bait was not vigorously attended, there was substantial sarcophagid activity atop Mt. Moffatt.

Figure 3. Another view of the summit of Fly Hill (large cycad to right of center).

Figure 4. Mt. Moffatt, Carnarvon N.P.

As has been related in Jim O'Hara's account of these hilltops (see this issue of Tachinid Times), the tachinid activity was quite intense. During the excitement of buzzing flies, on four occasions I had the opportunity to net pairs of quietly copulating, inconspicuous tachinids. Despite the purpose of mating that hilltops apparently serve for flies which exhibit hilltopping, females are rarely encountered. Virtually all the specimens I collected on Fly Hill and Mt. Moffatt were males except for the four females collected with their mates. I must confess that with all of the potential for action at hand, and for fear of losing the mating pairs, I can only offer a cursory description of the situations and the attitudes of the pairs.

Figure 5. Tree cover on summit of Mt. Moffatt.

Mt. Moffatt

Between about 11am and noon while I was searching the ridge of Mt. Moffatt for other, less obvious, areas of tachinid activity, I pushed through some vegetation toward a small clearing beside a large *Opuntia* cactus. A pair of tachinids *in copula* flew upward from what seemed to be ground level. They moved slowly in tandem and alighted on a twig at shoulder height. They disengaged from one another only after I swept them into my net. Within a couple of minutes and in the same area I encountered another pair at about shoulder height flying slowly and steadily upward at a 60° angle. I swept these in flight and they rapidly disengaged in the net. These two collections turned out to be different species of the tribes Tachinini and Parerigonini: *Cuphocera* sp. (nr. *setigera* Malloch) and *Zita* sp. (prob. *aureopyga* Curran), respectively. Following these spectacular collections, I spent about 20 minutes in that area paying special attention to slow moving pairs, though I did not encounter more.

I collected an *in copula* pair of the leskiine, *Sipholeskia certima* (Curran), apparently hovering under a tree, near one of the "hot-spots" of tachinid action. I cannot recall the time of day, but it was between 9 a.m. and 3 p.m. during a sunny period.

Though the summit was exceedingly dry and there was very little flush vegetation, the area where I encountered the first two mating pairs was relatively well protected and thick with branches and twigs. I collected one more male of *Zita* and no further *Cuphocera* specimens on Mt. Moffatt. It is unlikely that the solitary male *Zita* was captured near the location of the *in copula* pair because this area was not to be frequented by cruising males. Circumstantial evidence suggests that the first two mating pairs I captured had actively sought a protected, non-busy place in which to copulate.

Fly Hill

Within an hour of my arrival on "Fly Hill," which was my final hilltop opportunity in Carnarvon N.P., I noticed a pair of *Prosena* sp. (nr. *nigripes* Curran) *in copula* on a slightly angled rock surface. Since they were relatively still, I chanced a few photographs before capturing the pair (Figs. 6a-6b). The pair maintained the stance shown in the figures for about five minutes, though they shifted and walked a few steps during that time. Their stance was very stable with the male mid- and hind-legs in contact with the rock and the tarsal claws of the forelegs hooked onto vein CuA_1 near the *bm-cu* crossvein. The tarsal claw position was medial and basal on the longitudinal plane of the slightly downwardly deflected female wings. As seen in lateral view (Fig. 6a), the longitudinal axis of the male body was almost 90° to that of the female. The large median marginal bristles on abdominal tergites 3 & 4 are slightly longer and stouter in the female and during copulation they supratended an angle of 90° to the abdominal tergal surface. In the pinned and dried condition, these individuals have bristles subtending an angle of about 60°. This observation is suggestive, for these bristles, of a role in positioning the individuals for efficient and "comfortable" copulation. There does not appear to be sexual dimorphism in the size (short) of the tarsal claws.

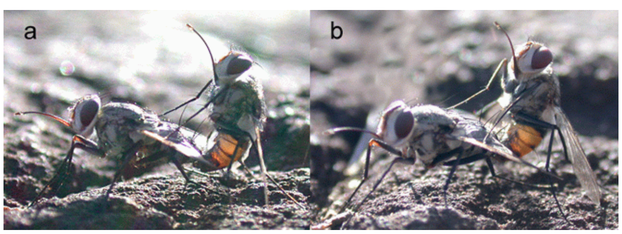

Figure 6. Mating pair of *Prosena* sp. on Fly Hill. **Fig. 6a.** Lateral view. **Fig. 6b.** Oblique view.

I did not encounter any other mating tachinids on Fly Hill for the remainder of the day. Partly because of the lack of substantial tree cover, the summit of Fly Hill was more windy than that of Mt. Moffatt. If mate encounters for most species are characterized by reduced flight activity relative to the observed activity levels of individuals, and since I failed to notice tachinids mating on the ground under the veritable flurry of tachinid activity, then 'waiting' species (*sensu* Wood, Tachinid Times **9**, 1996) may actively seek refuge from the hilltop situation when *in copula* by flying downwind and downslope.

Hilltopping for tachinids in areas of significant topographical relief should be regarded as a potential gold-mine of information on regional faunal compositions. Considering the extraordinarily high ratio of males to females, the opportunity for collecting series of both common and "rare" taxa, ease of collecting (the flies come to you!) and the sometimes wonderful vistas and high excitement -- hilltops make ideal study sites, and tachinids, the ideal study organisms. I will never again pass a hilltop in the spring, summer or fall, and not wonder what I am missing.

The tachinid fauna of Carnarvon National Park, Queensland, as revealed by hilltop collecting (by J.E. O'Hara)

The 5th International Congress of Dipterology (ICD5) was held last year in Brisbane, Australia, from 29 September to 4 October 2002. The timing of the Congress coincided with the onset of spring in southern Queensland, thereby providing delegates with an excellent opportunity to collect Diptera in Australia before or after the meetings. I joined one such collecting trip, and this account will focus on the last three collecting days of that trip to illustrate the value of hilltopping as a strategy for collecting tachinid flies and to provide insights into the amazing tachinid diversity of Carnarvon National Park in eastern Australia.

A year before ICD5, Dr. Jeff Skevington joined the Diptera Unit in Ottawa as a Postdoctoral Fellow, having recently completed his Ph.D. at the University of Queensland in Brisbane under the direction of Dr. David Yeates. Jeff collected extensively in Queensland during his three years in Australia and generously offered to organize and lead a 10-day collecting expedition to several sites in southern Queensland after the Congress. I enthusiastically embraced this idea, as Jeff promised me that the hilltopping in Carnarvon N.P. would be the most productive of my career – a bold claim but one that I was hopeful would prove true. Jeff arranged for the collecting permits needed for the national parks we planned to visit and the export permits necessary to legally remove specimens from the country.

The composition of our collecting party, our itinerary and adventures have already been admirably documented by Jade Savage under the title, "Bush flies and billabongs: collecting in the Australian Outback," in Fly Times **29**: 7-10 (2002). Hence, I will only concern myself here with the part of our trip that was the most rewarding for me in terms of tachinid collecting, i.e. the several days spent in the Mt. Moffatt section of Carnarvon N.P.

Carnarvon N.P. comprises about 300,000 hectares of varied Eucalypt woodland in southeastern Queensland on the Great Dividing Range of eastern Australia. The park is underlaid by sedimentary and volcanic rocks which form a rich mosaic of gorges and valleys, cone-shaped mountains, undulating flats and rugged tablelands. The park's varied habitats are among the most diverse in all of inland Australia. We visited one of the more remote parts of the park, the Mt. Moffatt section, which is reachable only by dirt roads from the small town of Injune to the east of the park.

Our convoy of three 4WD vehicles pulled into the ranger station of Mt. Moffatt section in the early evening of October 9th, having managed to avoid collision with any of the numerous kangaroos and wallabies that had frequented the roads since dusk. For the next four days our party of 10 would break into smaller groups to collect in the most desirable habitats for the taxa we sought: dolichopodids, empidids, agromyzids, pipunculids, muscids and tachinids. For our home base we had the use of a small house near the ranger's headquarters that Jeff had arranged well in advance of our visit. Those of us who needed hours of pinning time each night were thankful for the opportunity to prepare our specimens indoors (Fig. 3) after camping for three nights in Great Sandy N.P. on the coast and one night in Cania Gorge (en route to Carnarvon N.P.).

Figure 1. Mt. Moffatt, Carnarvon N.P. (summit 1100m).

We collected as a group for the first morning in Carnarvon N.P. at "The Tombs," a sacred site where in past times the Aboriginal inhabitants had used the natural caves in the sandstone cliffs as burial chambers for their dead. All human remains have since been removed, but numerous examples of stencil art are still visible on sheltered walls. Our visit coincided with an exceptionally dry period in eastern Australia and a waterhole at The Tombs that was generally thought to be a permanent source of water was completely dry. Consequently, collecting was only moderately productive for most groups. I collected fewer than 10 species of tachinids (mostly Dexiini), none in the open woodland but some on the sand at the base of the cliffs and others on rocks at the mouth of a broad but shallow cave about 10 metres above the ground. That afternoon I had little success collecting at "top Moffatt camp," a campsite near the base of Mt. Moffatt.

Figure 2. Mihály Földvári and Jeff Skevington on summit of Fly Hill (900m). Approximately half of the small summit is visible in this picture.

For collectors seeking hilltopping insects in Australia, one of the most famous sites is the high and cone-shaped Mt. Moffatt (Fig. 1). Several of us were eager to collect on the summit of this mountain, but we also recognized that it was better to have only a few people there at a time. We divided ourselves into hilltopping groups to avoid congestion on this hilltop and two others, with the two tachinid specialists Dan Hansen (a graduate student at the University of Minnesota, Minneapolis) and myself in different groups (see Dan's article in this issue of Tachinid Times). I was teamed with Jeff Skevington and Mihály Földvári (a graduate student at the Hungarian Natural History Museum, Budapest), both pipunculid specialists, and Jade Savage (a graduate student at McGill University, Montreal), a muscid specialist. During the next three days we collected on three different hilltops, Mt. Sugarloaf, Fly Hill and Mt. Moffatt, with Jade collecting elsewhere on our Fly Hill day.

The three hilltops we sampled are each within the Eucalypt woodlands that blanket most of the park, though the flora in the immediate vicinity of each has a slightly different composition. The first that we ascended, Mt. Sugarloaf (24°53.9'S 147°56.8'E), has an elevation of 1150m but its actual vertical relief is only about 100m. The day we collected on Mt. Sugarloaf was partly overcast and as a consequence there were only a moderate number of hilltopping tachinids. The next day we collected on "Fly Hill" (24°58.5'S 147°59.6'E, elevation 900m), another low hilltop that rises only 100m above the surrounding woodland. It was given the nickname Fly Hill by a ranger, Craig Eddie, who had climbed it and discovered an impressive number of flies at the summit. The conical shape of Fly Hill is perfect for attracting tachinids and the small summit with relatively short vegetation (consisting of grasses, shrubs and low trees, an *Opuntia* cactus and a cycad) is ideal for the easy capture of tachinids (Fig. 2).

We had low hopes of good collecting on Fly Hill because there were no flies on the hilltop when we arrived at 9:30 a.m. and it rained shortly thereafter, but by 10:30 a.m. the sky had cleared and the sun was shining, and for the next 4-5 hours the hilltop was alive with tachinids. Our last hilltopping adventure was the steep and formidable Mt. Moffatt (25°03.6'S 148°02.6'E), which rises to a height of 1100m with a vertical relief of about 350m. To one side of Mt. Moffatt is a small tract of dry rainforest, potentially contributing some hilltopping species not to be found on Mt. Sugarloaf or Fly Hill. The summit of Mt. Moffat covers a large area about 100m long and 10-30m wide and is densely covered with tall trees. It is quite possible that more tachinids usually frequent Mt. Moffatt than Fly Hill, but they are more elusive due to the size of the hilltop and the inaccessibility of the high canopy.

Table 1. Results of tachinid collecting on three hilltops in Carnarvon National Park, Queensland, Australia, 11-13 October 2002.

	Mt. Sugarloaf	Fly Hill	Mt. Moffatt
Species unique to each hilltop	9	43	26
Species collected on all 3 hilltops	8		
Species shared with Mt. Sugarloaf		5	7
Species shared with Fly Hill	5		12
Species shared with Mt. Moffatt	7	12	
Number of species collected on each hilltop	29	68	53
Number of specimens collected on each hilltop	84	219	119
Total number of species collected	110		
Total number of specimens collected	422		

The results of my three days of collecting on Mt. Sugarloaf, Fly Hill and Mt. Moffatt are shown in Table 1. Specimens were sorted to morphospecies, with some of these placed into described genera using Crosskey (1973). A few of the more striking species are shown in Figs. 4-5. The numbers of specimens (422) and species (110) far exceeded any of my past hilltopping experiences, as Jeff had predicted. In the American Southwest where I have hilltopped extensively, 25 species on a hilltop in a single day is a very high number. Yet even Mt. Sugarloaf was more productive than this on a cloudy day, and Fly Hill yielded a phenomenal 68 species. One-quarter of all specimens collected represent a different species, and 44 of the 110 species taken on the three hilltops are represented by only a single specimen each. On Fly Hill, tachinid activity was so high on all parts of the hilltop simultaneously that it was impossible to collect all the specimens available even by continually rotating through all the microhabitats (tree trunks, ground, rocks, top of shrubs, inner branches, leaves, cactus, etc.). Similarly, on Mt. Moffatt the size of the summit and height of the trees made good sampling of the available species quite difficult, though 53 species were collected. On Fly Hill and Mt. Moffatt, more species were unique to each hilltop (43 and 26, respectively) than were shared by them (20 species). It is unlikely that the faunas of the three hilltops differ dramatically so I suggest that my collecting results are due to under-sampling on each hilltop. The recorded total of 110 species is undoubtedly low compared to the full complement of tachinid species present on the hilltops during my collecting events. I hope to test this hypothesis in the near future by identifying the hilltopping tachinids collected by Jeff Skevington (whose specimens are in the Canadian National Collection) on the same three hilltops and determining how many of his species are the same as or different from those that I collected. I also hope to have an opportunity someday to compare my hilltopping tachinids with those collected by Dan Hansen on Mt. Moffatt and Fly Hill.

Figure 3. Jim O'Hara and Jeff Cumming pinning flies with the aid of magnifying visors after a day of collecting in Carnarvon N.P. [Photo by J. Skevington.]

<u>How many tachinid species are in Carnarvon N.P.?</u>

One cannot determine with any precision the tachinid diversity of Carnarvon N.P. based on three hilltopping events. However, it is possible to make a rough estimate. The number of species that I recorded from the hilltops was 110, and this number represented only a portion of the total number of hilltopping species. Quite likely, the actual number was 150 species or more. If one then factors in the number of species that do not hilltop, the number that are active at different times of the year, and the number restricted to other habitats within the Park, then one might suppose that the total number of tachinid species in the whole of Carnarvon N.P. is conservatively twice this number, or 300 species. I suggest that this number should serve as a reference point for tachinid diversity in the park until more statistically valid sampling can be carried out.

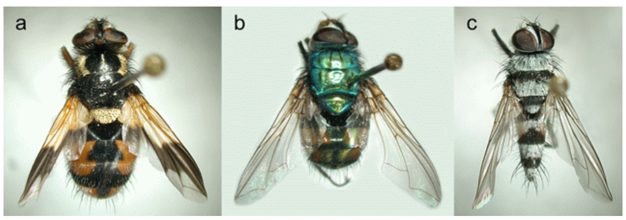

Figure 4. Hilltopping tachinids in Carnarvon N.P. **Fig. 4a.** *Neximyia* sp., body length 7.5mm. **Fig. 4b.** *Rutilia (Donovanius)* sp., 13mm. **Fig. 4c.** *Trigonospila* sp., 8mm.

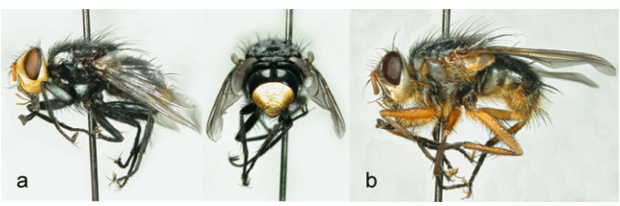

Figure 5. Hilltopping tachinids in Carnarvon N.P. **Fig. 5a.** Lateral and posterior views of *Zita* sp., body length 10mm. **Fig. 5b.** Paregonini sp., 9mm.

How diverse is the tachinid fauna of Australia?

Can one extrapolate from three days of hilltopping in Carnarvon N.P. to the diversity of Tachinidae in the whole of Australia? Certainly not in any rigorous fashion, but obviously the collection of a high number of species in three days from one location has some implications for a country as large and diverse as Australia. Crosskey (1973) recorded only 420 described species for Australia in his "Conspectus of the Tachinidae of Australia" and the number of described species is now probably about 500. In light of my estimate of 300 or more tachinid species for Carnarvon N.P., the total number of species in Australia must surely be at least several times that of the number of described species. This is not a new revelation, since Crosskey noticed quite a few undescribed species during the preparation of his Conspectus and made the prediction that "when fully worked out the Australian Tachinidae will muster some 1500-2000 species" (Crosskey 1973: 4). In my opinion, Crosskey's remarks about the high percentage of undescribed Australian tachinids in collections coupled with the high tachinid diversity I have demonstrated for Carnarvon N.P., suggest that the actual tachinid fauna of Australia is larger than Crosskey's higher estimate of 2000 species. One could advance further arguments that might increase or refine this figure, but in truth the evidence available at this time is too meagre to permit a better prediction of the size of the Australian tachinid fauna.

Reference

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Higher abundance of *Ernestia rudis* in transformed pine forests of Germany and search for the diversity of hosts (by U. Schulz & F. Dreger)

Pure stands of Scots pine (*Pinus sylvestris*) are grown on 66% of all forested areas in Brandenburg, one of the most densely wooded federal states in Germany. It is the aim of a 'forest transformation program' to reduce pure coniferous forests to 45% by 2045 and to increase mixed forests to 37% during the same period. Some areas have already been changed to mixed forest (e.g. pine trees with an undergrowth of young oaks in Fig. 1), among other things to reduce outbreaks of forest pests and to encourage biodiversity. Since 2000, these changes are the subject of a research project comparing arthropods in pure and mixed stands (funded by the Federal Ministry of Education and Research, BMBF-Fö.Kzch. 0339975). One focus of the investigations concentrates on the forests of southern Brandenburg (administrative district Dahme-Spree) which suffer from attacks by pine-defoliating larvae of the pine beauty moth *Panolis flammea* (Denis & Schiffermüller) on a regular basis. In 2000 this species had an outbreak on approximately 40,000ha of public forests. For recording the frequency of *Panolis flammea* and its parasitoid antagonists in two locations, different systems of traps and methods were used which complemented each other:

1) Search for hibernation phases (pupae of *Panolis flammea* and of tachinids) during the winter of 2000/01 on 11 plots of 1m² each within both forest stands.
2) Six stem-eclectors (2m height) with a trapping liquor in both forests (Fig. 1).
3) Six window traps of two transparent plastic panes (each 60 x 40cm) and a can or bottle with a trapping liquor at approximately 2m height (Fig. 1).
4) The breeding of some parasitoids of *Panolis flammea* was achieved under laboratory conditions.
5) Additionally, the diversity of noctuid butterflies was investigated with light traps at different heights in both forest stands.

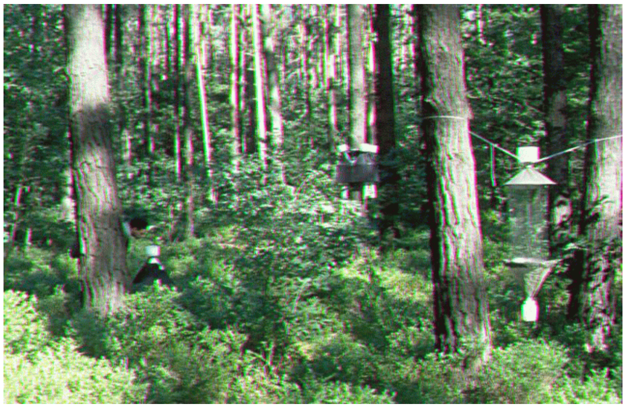

Figure 1. Mixed stand with old pine trees and young oaks in southern Brandenburg (Germany) and some of the traps used (stem eclector and window trap).

The studies showed that a high percentage of *Panolis flammea* larvae were parasitised by the larvae of *Ernestia (Panzeria) rudis* (Fallén). *Ernestia rudis* is known as one of the most effective parasitoids of the pine beauty moth, which can cause a breakdown of a *Panolis* population (Prell 1915; Schwerdtfeger 1935).

The results of the different traps in southern Brandenburg show a significantly higher abundance of *Ernestia rudis* in mixed forests, whereas its host *Panolis flammea* does not differentiate between pure and mixed stands (Table 1). For example, the mean number of individuals of *Ernestia rudis* is five times higher in stem eclectors in the mixed forest than in the pure stand (the results of all three investigations were significant with a two-tailed permutation test at a 5% significance level).

Changes of the following ecosystem conditions after the plantation of broadleaf trees in coniferous stands could be possible reasons for these differences:
a) changed soil conditions, which might improve over-wintering conditions for the tachinid pupae,
b) improved availability and quality of food for adult tachinid flies, or
c) a higher diversity of plant and animal species, which could be indirectly beneficial for the tachinid fly, as will be discussed below.

More moth species (especially Noctuidae) were caught in the mixed pine forest of southern Brandenburg. The deciduous trees which have been brought into or are tolerated in the scope of forestry within the mixed forest seem to attract a higher diversity of phytophagous animals. The parasitic fly *Ernestia rudis* could profit from this increased diversity since it is not obligatory monophagous on the pine beauty moth. It also parasitises other butterfly species (Herting 1960, 1965; Ford & Shaw 1991; Ford et al. 2000), which do not feed on pine needles but on leaves of different deciduous trees or undergrowth (Hargreaves & Carter 1986). *Orthosia stabilis* (Denis & Schiffermüller), *Xestia c-nigrum* (Linnaeus) and *Xylena vetusta* (Hübner) have been verified as other hosts for *Ernestia rudis* (Herting 1960, 1965; Ford & Shaw 1991, Ford et al. 2000). According to Herting (1965) it is doubtful whether *Achlya flavicornis* (Linnaeus) serves as a host for *Ernestia rudis* as reported by Lundbeck (1927). Nevertheless, it is likely that more larvae of Noctuidae serve as hosts for *Ernestia rudis* (Tschorsnig & Herting 1994; Ziegler, pers.comm.).

Table 1. Abundance of *Ernestia rudis* and of *Panolis flammea* in different trap systems in a pure stand of pine forest and in a mixed stand with oak (* = significant with a two-tailed permutation test at a 5% significance level).

Ernestia rudis		Number of individuals											p
Window trap	pure stand	29	61	28	22	13	18						
	mixed stand	53	62	218	34	144	169						0.0108*
stem eclector	pure stand	163	5	174	28	46	34						
	mixed stand	714	272	378	538	235	176						0.0022*
hibernation phases	pure stand	11	3	0	2	5	0	0	3	5	3	8	
	mixed stand	8	12	4	11	3	4	8	5	22	13	7	0.0135*
Panolis flammea													
hibernation phases	pure stand	2	1	0	1	1	1	0	4	3	0	10	
	mixed stand	3	3	0	3	0	1	0	0	0	4	4	0.7726

To back our hypothesis we would be very happy to hear about further host records of *Ernestia rudis* or about similar observations in other pine forests of Europe. We hope to get in touch with researchers working with *Ernestia rudis*.

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PERSONAL NOTES

Dan Hansen writes: In the summer of 2002, I began work toward a revision of the blondeliine genus *Zaira* Robineau-Desvoidy rather than the exoristine genus *Chetogena* Rondani as previously planned (see Tachinid Times **15**: 9, 2002). All described species of *Zaira* (except *Z. cinerea* of the Palaearctic) have New World distributions and based on available host data, they are apparently restricted to adult beetles (there are eclosion records from Carabidae, Tenebrionidae and Scarabaeidae). Of the 21 species currently placed in *Zaira*,13 species have been described from America north of Mexico, five species are known from type specimens from Mexico and two species were described by Thompson from Trinidad. I have also seen apparently undescribed species of *Zaira* from southeastern Brasil (Santo Espirito). It seems likely that the true range of *Zaira* spp. in the New World exceeds that which is now known. It is my hope to visit collections in southeastern Brasil this year to sort specimens from undetermined holdings for inclusion in my thesis effort. I have been learning Portuguese this past year and I am eager to put it to use. This spring I will complete the course work requirements of my program at the University of Minnesota in St. Paul, Minnesota (USA) and will thereafter devote my time fully to my thesis effort.

An electronic rendering of *Zaira georgiae* (Brauer & Bergenstamm) by Dan Hansen using Adobe Photoshop® and Adobe Illustrator®. [Based on a specimen collected at blacklight in the Animas Mtns. of New Mexico by J.E. O'Hara on 13-14.viii.1999.]

Jim O'Hara writes: The "Catalogue of Tachinidae of America north of Mexico" by myself and Monty Wood has been completed and will be published as a hardcover book in the series Memoirs on Entomology International. The catalogue is currently out for review and hopefully will be ready for publication in the 3rd or 4th quarter of 2003. The catalogue will include approximately 307 genera and 1364 species with updated distributions, revised classification, and complete type and nomenclatural information. My next projects include the development of a Diptera website for the North American Dipterists Society and the completion of a manuscript on the tachinid parasitoids of North American *Choristoneura* species (Lepidoptera: Tortricidae).

John Stireman writes: Although I have not had much of an opportunity to work with tachinids recently, much of my thesis work on the ecology and evolution of host associations in tachinids is now coming out in print. I thought I might give a very brief overview of the work and point to some articles that have been published recently or are soon to be published.

Perhaps many of the readers of this newsletter have seen my recent paper in Systematic Entomology concerning the phylogenetic relationships of Exoristinae (Syst.

Ent. **27**: 409-435, 2002). This phylogenetic analysis was based on a molecular data set of two genes (Ef1-alpha, 28S rDNA), and I think it was the first attempt at using molecular data to try to establish some of the relationships within this difficult group. Although my analyses provided support for some recent classification schemes (e.g. Herting, Wood), I found that many relationships remained difficult to resolve even with these new data. Despite these problems, I think that numerical phylogenetic analyses using morphological and molecular characters could go a long way in helping us understand the evolution of tachinids. One interesting result from this analysis is that I failed to resolve the Goniini (those species possessing microtype eggs) as a monophyletic group. I hope that some of my speculations in this paper inspire others to gather and analyze data to prove me wrong (or right).

I have had two relatively simple papers concerning host location and selection behavior of *Exorista mella* Walker come out in print in the past year. The first (Ent. Exp. et Appl. **103**: 23-34, 2002) deals with trying to figure out the types of cues that might be important in host location by a generalist tachinid such as *E. mella*. In general, I found that females appear to respond to some very general cues that may be associated with hosts including non-specific plant volatiles and host motion. In a second paper (J. Insect Behav. **15**: 689-706, 2002) I found that *E. mella* was able to learn color cues associated with hosts, and this may allow this generalist tachinid to become more efficient at locating hosts and perhaps result in a pattern where individual females my become relatively host specific while the species as a whole attacks a wide range of hosts.

In two papers that should be published this year (one in *Ecology*, and one in *Oecologia*) I, in collaboration with Mike Singer (primarily a lepidopterist), analyzed patterns of host use by tachinids in a community of caterpillars in southeastern Arizona. In the first paper, we examined what characteristics of hosts (caterpillars) determine the diversity of tachinids that attack them. The abundance, food-plant range, and morphology (hairy vs. smooth) of caterpillars significantly influenced how many tachinid species attacked them and in some cases the parasitism rates by tachinids that they experience. In the second paper, we focussed on patterns of host range in the tachinids. We found a number interesting patterns including an association of specialist tachinids with food-plant specialized hosts and an association between indirect (e.g. microtype eggs) oviposition strategies and the use of gregarious host species.

I hope that these studies are of interest to the readers of this newsletter and I would be pleased to provide reprints (or at least pdfs of the papers) to people who are interested.

My current work is mostly concerned with host race formation of herbivorous insects on goldenrods, and host race formation of parasitoids (Hyms, mostly chalcidoids) onto these herbivorous insects. My portion of this project is primarily focussed on using mitochondrial DNA to examine genetic differentiation in these insects. I am pretty excited at the prospect of applying some of the phylogeographic techniques that I am becoming familiarized with to tachinids. For example, many tachinid species appear to be fairly generalized, and in some cases this is certainly due to truly polyphagous species (e.g. *Lespesia aletiae, Compsilura concinnata*), but many cases of apparently generalist species could turn out to be genetically differentiated populations that are locally specialized. Analyzing population differentiation of a widespread tachinid species may also provide clues to the processes that drive speciation in this most interesting and diverse group of parasitoids.

Theo Zeegers writes: Tachinidae from several Malaise traps (col. T. van Harten) from Yemen have recently become available to me. For this reason, I plan to work on an article on the Tachinidae of Yemen. The fauna is mainly Afrotropical, with however some interesting influences from the Palaearctic region. In February 2003 I will be visiting the Natural History Museum in London to cooperate with Roger Crosskey on the identification of the Yemen material. I would be very interested to learn of any Tachinid material from Yemen or adjacent areas in other collections. Please contact me by email.

An updated version of my checklist of Dutch Tachinidae (Zeegers, 1998) has recently been published in "Checklist of Dutch Diptera" (P. Beuk, ed.).

Joachim Ziegler, formerly of Deutsches Entomologisches Institut, Eberswalde, has accepted a position as Curator of Diptera and Siphonaptera with the Museum für Naturkunde, Humboldt-Universität, Berlin, effective February 2003. Joachim will continue his work on Tachinidae in his new position. His new e-mail and postal addresses are given in the Mailing List.

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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 which have not appeared in previous issues of this newsletter. The complete bibliography will be available on the Web in the near future. I would be grateful if omissions or errors could be brought to my attention.

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