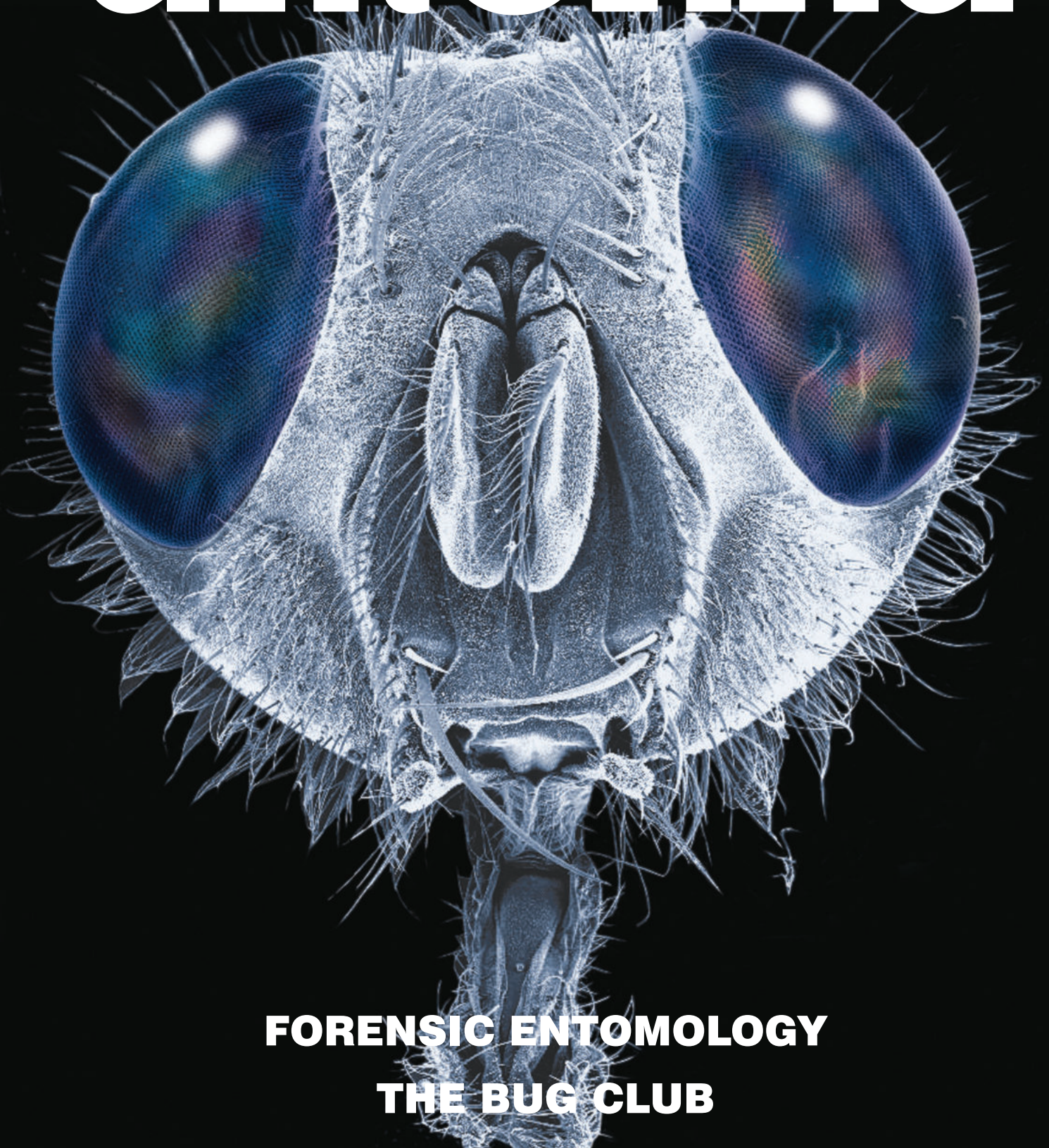


**Bulletin of the Royal Entomological Society Summer 2010 Volume 34 (3)**

# antenna



**FORENSIC ENTOMOLOGY**

**THE BUG CLUB**

**ENTOMOLOGICAL LINGUISTICS**

# meetings of the society

for more information on meetings and contact details see meetings page on [www.royensoc.co.uk](http://www.royensoc.co.uk)

## 2010

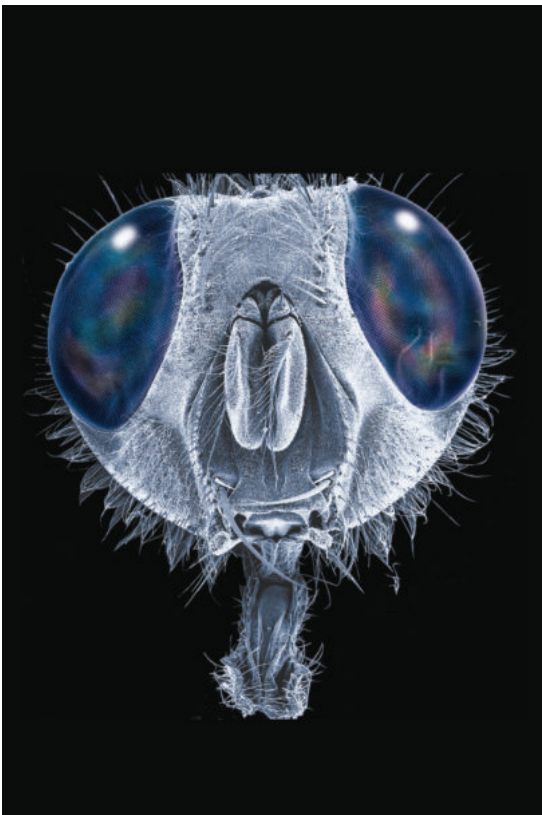
- Oct. 2                    Insects and the changing scene: commemorating the life and work of Peter Skidmore PhD FRES  
**Venue: Doncaster Museum**  
Convenors:    Mr Martin Limbert  
                     Mrs Valerie Holt
- Oct. 27                    Climate Change Special Interest Group  
**Venue: The Food and Environment Research Agency (FERA), York**  
Convenors:    Dr Howard Bell  
                     Dr Richard Harrington
- Nov. 3                    Orthopterists' Special Interest Group  
**Venue: Natural History Museum, London**  
Convenors:    Dr David Robinson  
                     Mrs Judith Marshall
- Nov. 19                    South-West Regional Meeting with Peninsular Invertebrate Forum  
**Venue: University of Plymouth**  
Convenor:     Peter Smithers
- Nov. 26                    Insect Parasitoid Special Interest Group  
**Venue: Biology Department, University of York**  
Convenor:     Dr Peter Mayhew
- Dec. (tbc)                Aquatic Insects Special Interest Group  
**Venue: Glasgow**  
Convenor:     Mr Craig Macadam

## 2011

- Feb. 2-3                    Postgraduate Forum  
**Venue: Royal Hotel, Hull**  
Convenor:     Ms Cathleen Thomas
- March 2                    Verrall lecture  
**Venue: Natural History Museum**  
"The conservation and utilization of entomological interactions" by Prof. Jane Memmott
- April (tbc)                Joint meeting with the Botanical Society of the British Isles on 'Pollination'  
**Venue: Rothamsted**  
Convenors:    Dr Ian Denholm  
                     Prof. Jane Memmott
- May 12                    Conservation SIG  
**Venue: Rothamsted Research, Harpenden, Herts.**  
Convenor:     Dr Alan Stewart
- June 1                    **RES Annual General Meeting**
- Jul 3                      Insect Festival  
**Venue: York Museum Gardens, York**  
Convenor:     Mrs Julie North
- Sept 7-9                    Ento'11 Symposium on 'Chemical Ecology' and National Meeting  
**Venue: University of Greenwich, Medway Campus, Chatham Maritime, Kent**  
Symposium Convenors: Prof. David Hall, Prof. Alan Cork, Prof. Bill Hansson & Prof. John Pickett
- Nov 10                    Insect Behaviour Special Interest Group  
**Venue: Rothamsted Research, Harpenden, Herts.**  
Convenors:    Dr Jason Chapman  
                     Dr James Bell

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## COVER PICTURE

Scanning electron micrograph of the head of the common house fly, *Musca domestica*. Produced in the Electron microscopy unit at the University of Plymouth by Peter Bond and Peter Smithers.

# antenna

**Bulletin of the  
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# Linguistics to the law



Welcome to the latest edition of *Antenna*, we hope we have brought you an interesting selection of news and articles to peruse as the nights draw in and fires spring to life in dusty hearths around the UK. We offer a reflection on variations of the word for butterfly from across the globe, entomology in Irish woodlands and news from the interface between entomology and the law. There is also a history of the Bug club with a call for more entomologists to help inspire the next generation by contributing to the magazine. Entography features an extreme case of phoresy with hitch hikers at several scales.

It is interesting to see that entomology is creeping into the world of mobile phones with an app for butterflies now available for the i phone. This is not the only insect related app as the FSC are making their fold out charts available on i phones with bumblebees and ladybirds already available and more

to follow. This seems like an excellent way to encourage naturalists to take an interest in small groups they are not familiar with by making the information required readily available. It will also help to stimulate an interest in insects among non entomologist. The information is easily accessible and always with you ( as long as you have your phone). Entomology on your phone may be the next big thing so watch this space.

We have experienced a dramatic increase in the number of books sent in for review so we are looking for volunteers to help out. If you would like to review books for *Antenna*, please send me an email listing the areas of entomology you are interested in reviewing.

Finally the editors would like to apologise for the delay in publishing the announcements of new members and fellows from earlier this year.

Peter Smithers

## Guidelines for submitting photographs

To maintain a high quality we suggest that submissions for *Antenna* be presented via e-mail or on CD. Files must be in a PC-compatible format preferably in MS Word.

Electronic images can be embedded in the Word document but we will also require separate electronic images. These images should be at least 300dpi at an image size that is either equal to, or greater than the expected final published size.

Please do not submit images that have been printed from a computer on a domestic inkjet or laser printer. Even if the camera is a good one and photo quality paper is used, the graininess is very hard to deal with. If plain paper is used, the prints are virtually unusable.

Photos taken on film should ideally be submitted as slides or as reasonable sized prints for us to scan or alternatively they can be scanned in by authors provided the scanner is capable of scanning at up to 1200dpi.

If an image is intended for the front cover then the photograph should be in portrait format (i.e. the shape of the final image) and will need to be quite a large file size (at least 5,000kb) or a good quality slide or print.

To give an idea as to what happens when the image is not of sufficient size, take a look at these two photographs. One is 300dpi and the other is 72dpi.



300dpi



72dpi

# CORRESPONDENCE

## More flies on spider webs

There we were, newly arrived in Tanzania and sitting in Bukoba looking out at Lake Victoria. What's this – the lake is on fire or a boat's on fire but no there are several pillars of smoke? Our house, or rather my colleague's house, although we moved just a couple of houses away, was set some way out of town on the side of a hill and the "smoke" seemed inexplicable. Over the next few weeks, we soon learnt the cause, untold millions, even zillions, of lake flies, genus *Chironomus*, in seasonal mating swarms.

Walking in town the air was filled with a high-pitched buzz and so were our throats if we did not keep a handkerchief over our nose and mouth. An evening visit to friends who lived by the lake shore gave us the sight of piles of dead and dying flies littering the ground under every window or security light. Regrettably in those days of 35 mm film to be carefully used and not squandered on frivolous snaps, I took few photos of the phenomenon. However, the distant one from our house shows an amazing dense black cloud obscuring the hillside on the south of Bukoba (Fig 1). The second was taken from a hotel window in Mwanza (Fig. 2). The black smoke somewhere behind the garage looked like burning car tyres or the like but then the cloud went off to the left passing behind the block in the foreground. Not too long later what probably was the same cloud came from the left and came buzzing past immediately in front of the hotel.

There are possibly apocryphal stories of fishermen being suffocated by dense swarms out on the Lake and we were told that some folk harvested them the flies to make a sort of cake or paste. We did get to eat the local seasonal delicacy of fried grasshoppers but never tried lake fly stew. To relate to the recent photos of flies on spider webs, however, my photo of evening on a Bukoba street a few days after a major spate of lake fly swarms shows spider webs covered with lake fly carcasses completely shrouding all the bushes and trees (Fig 3).

Fig. 4 has nothing to do with lake flies but was taken when first local children and then the pictured small vultures invaded our garden together with pied crows and other birds. The attraction was the emergence of winged termites from the soil at one end of the garden. Add that to the cicadas that sat on the garden shrubbery but could not be tracked down as each individual stopped its song when one got near leaving the hunter to move on to the next cicada. I wonder if the chameleon who lived on the same shrubbery was fooled?

Fond memories and, yes, I did do some entomological work on pests and other constraints affecting the production of the staple bananas which are the staple food crops of upland East Africa. No they are not plantains.

Brian Taylor



Figure 1. Smoke over Bukoba – a massive lake fly swarm. Figure 2. Burning tyres in Mwanza? No, another lake fly swarm. Figure 3. Bukoba street scene plant shrouded in spider webs covered in lake fly carcasses. Figure 4. Why are there vultures in our garden?

## Honorary Publications Officer and Honorary Secretary attend Buckingham Palace Garden Party

The Honorary Publications Officer and past-President, Professor Lin Field, and the Honorary Secretary, Dr Archie Murchie were delighted to represent the Society at the Buckingham Palace Garden Party on 22 July. "It was a very convivial affair," commented Archie. "I expected more of a fuss and even bought a plastic sgian dubh in case the police took my real one off me but it was a remarkably good-natured event. Some of the outfits were incredible."





## Professor Christopher Wilkinson

**1936-2010**

### **Malcolm J. Scoble**

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form or another, lay at the heart of Chris' activities, for he exhibited a natural and lifelong capacity to communicate knowledge about insects and, indeed, natural history more widely. His first post (1956-60) was as a science teacher at Kingswood Grammar School in Bristol.

After a spell of four years at Kingswood, Chris studied Zoology, including parasitology, and specialising in entomology, at Imperial College from 1960-63. He also took the opportunity to do some fieldwork in marine biology. After graduation he was appointed Lecturer in Biology at Yeovil Technical College where he remained for two years. In 1965 he gained a position as Lecturer, subsequently becoming Senior Lecturer, at what was then Portsmouth Polytechnic where he remained for twelve years. This period was interposed with a sabbatical, taken in 1970/71, at the Canadian National Collection in Ottawa where Chris had been awarded a Postdoctoral Fellowship. In 1977, he was appointed to the Chair of Animal Systematics and Biodiversity at the Vrije University of Amsterdam, a position that represented the height of his career. He remained in this post until 1985 and from 1986-88 was Professor and Curator of Entomology at the

University of Amsterdam. A final posting (1988-1992) prior to semi-retirement took him and his wife, Diana, to the University of Botswana where he was Professor of Biological Sciences and Head of Department having been charged with developing the department, particularly in appointing academic staff and broadening the subjects taught. On returning to the UK he was Professorial Research Fellow at the University of Exeter from 1993-1996 where he also had a close association with Continuing and Adult Education.

Growing up in the countryside, Chris had always been deeply interested in natural history and had written an early article on discovering a hawkmoth new to Britain (Wilkinson, 1956). He embarked on the research component of his career with a PhD carried out at Imperial College on the taxonomy of SE Asian Drepanidae (hooktip moths). This study made extensive use of the emerging techniques of what was then termed numerical taxonomy, a method promoting the view that classification should be based on 'overall' phenetic similarity without attempting to judge the phylogenetic value of the characters used in the analysis. Although phenetics gave way to cladistics, it was a time when the value of computers in taxonomy became established as did the idea that a greater level of objectivity within the discipline was both desirable and possible. Chris published several papers on the taxonomy of drepanid moths and on numerical techniques (*eg* Wilkinson, 1970, 1973) before his interests shifted from the so-called Macrolepidoptera to the smallest of even the Microlepidoptera – the moths of the family Nepticulidae. The larvae of these moths are mostly miners of the leaf blade, but some mine leaf petioles, winged seeds and even the thin cambium layer of the bark of trees.

His interest in this family of moths arose while on sabbatical in Ottawa, with Diana, and their children Kate and Andrew. The sabbatical proved to be an influential experience, not only for the many contacts Chris made, but also because the shift to working on nepticulids was a lasting one for him and, later, his students both in the UK at Portsmouth and in Amsterdam at

Professor Chris Wilkinson, entomologist, taxonomist, teacher, enthusiastic traveller, and all round naturalist, died on 20 January 2010 after several months of illness. Given the great ages reached by both his parents and his apparently robust health when last we met, his passing was as unexpected as it was regretted.

Following his father's profession, Chris trained to be a teacher – in his case in natural sciences and geography – at Westminster College in 1956. The decision was an appropriate start to a career that involved teaching a wide variety of people including school pupils, undergraduate and graduate students in the UK and abroad, and those in adult or continuing education. Teaching, in one

the Vrije University. When Chris returned to Portsmouth following his spell in Ottawa, he brought with him on loan not only nepticulid material from the Canadian National Collection, but also material from the Smithsonian and, notably, the Annette Braun collection from the Academy of Sciences at Philadelphia. Much of the Braun collection of these minute moths had been reared from their larval stages, so provided the additional benefit of a considerable amount of associated host plant information. Most of the initial work was carried out on the North American species (Wilkinson & Scoble, 1979; Wilkinson & Newton, 1981; Newton & Wilkinson, 1982), but when Chris moved to the Netherlands, the Amsterdam group worked on the family worldwide. Papers appeared on nepticulids from many regions (*eg* Japan (Kemperman & Wilkinson, 1985); Europe (Schoorl, Nieukerken, & Wilkinson, 1985); New Zealand (Donner & Wilkinson, 1989) on what has always been regarded as a relatively small family of moths even if with a wide distribution. Although the nepticulid work eventually came to an end at the Vrije, publications continue to flow on the family from Erik van Nieukerken, one of Chris' most prolific students and now based at *Naturalis* in Leiden. The outcome of all this work is that the Nepticulidae are one of the best known families of moths in terms both of their taxonomy and their host plants associations.

Chris coupled research and teaching with his passion for travel. He undertook lecture tours, often associated with research and fieldwork under the auspices of the British Council including to India (1971), South Africa (1977), South Korea (1993), Uganda (1994) and Ecuador (1996). A visit to New Zealand in 1982 led him to form a close and lasting professional relationship and friendship with the prominent antipodean lepidopterist John Dugdale. There were many more excursions besides these – to various African countries, China, Indonesia and Singapore, Australia, Papua New Guinea and several Pacific islands, the Caribbean, extensively around the European continent and Russia. He thrived on the many experiences and enjoyed the cultural diversity he encountered, while remaining very English in character and temperament.

Teaching was not a chore to Chris, as it is to many – quite the reverse. At his core he was an explainer and I suspect that he enjoyed particularly the engagement with groups other than conventional student assemblages in the more formal setting of the lecture theatre. From the time I knew him, he taught adults – about insects or biology and natural history more generally. While lecturing at Portsmouth, for example, he also ran an adult education evening course in Worthing on insect natural history, linked with the University of Southampton, which involved studies in the field as well as in the lecture room. It is telling that while writing this appreciation, several of Chris' mature students contacted me to say how they had been inspired by his courses and his capacity to transmit his knowledge of the natural world both of insects and other organisms.

With a greater mastery over his time after returning from Botswana, Chris embarked in effect on a second, though related, career of teaching interspersed with voluntary advisory work, which he considered to be a means of helping countries with more limited resources. At their home in Devon, he and Diana created a wonderful space for natural history teaching and Chris soon developed an association with the University of Exeter, particularly teaching groups of mature students interested in furthering their knowledge of British insects. It was unsurprising that with Chris' enthusiasm for travel that they extended their interests beyond the UK with an expedition to the Cook Islands to catalogue the insect fauna.

Other 'retirement' activities showed a remarkable diversity of work including teaching biology and ecology to engineering students in Poland, and environmental and conservation courses in Colombia and Ecuador. Chris also wrote a report on the Nicaraguan Government's environmental policy and assessed the extent of damage to tea plantations by termites in Uganda. Only last summer, he visited Borneo where he trained National Parks' guides in insect identification in high altitude rain forest. Poignantly, he was due to return to continue the work in the summer of 2010.

A key characteristic that underpinned and shaped all Chris' work was that alongside his intrinsic

curiosity, he was an excellent observer, not only of insects, but of natural history more widely. He was also a talented photographer. Moreover, he had the invaluable capacity to observe and to transmit his observations to others in ways that engaged them. That Chris accomplished what he did and, indeed, thrived on such a diversity of activity was thanks in no small part to Diana's wonderful support and encouragement and to his having a stable family life. To Diana, Kate and Andrew, and to his brother Ken, we extend our sympathy on the premature loss of a man who had much more to give.

### Acknowledgements

Diana Wilkinson provided me with much helpful detail for this piece. I am most grateful to her, and also to Liz Clayden, Ann Bartlett and Carol Mullin for their thoughts. Carol Mullin kindly provided the photograph.

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# There and back again: the Bug Club returns (partly) to the RES – and it needs YOU



Robin Wootton



Kieren Pitts



Lin Field

## ARTICLE

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On January 1st 2009, after several months of negotiation, the Royal Entomological Society and the Amateur Entomologists' Society entered into partnership, for five years in the first instance but with the intention of continuing indefinitely, in running the Bug Club – the country's foremost organisation for young entomologists. This excellent development completed a loop. The Club began with the RES, joined with, and gave its name to the youth wing of the AES, has remained so ever since, and now returns, in part, to its origins.

The Bug Club, under that name and in its present form, began in the early 1990s in the short-lived Young Entomologists Scheme of the RES. This was launched in 1990 as the Society's Youth Development Scheme, with the appointment of Dr Clive Betts as Youth Development Officer (Fig. 1a). Articles by Richard Harrington and by Clive himself in *Antenna* 14 (4) and 15 (1) show the enthusiasm and energy with which the scheme was envisaged and pursued. Based at Exeter University, and consulting extensively with the University's School of Education, Clive contacted RES Fellows, school and university teachers, wildlife centres, museums and youth groups, seeking active support; worked with teachers in and outside the classroom, developed and trialled resource packs; organised a conference on Insects in Education and three INSET courses for teachers; and publicised the scheme widely, in person and through radio, articles, leaflets and displays and local and national societies. All to little avail. The aim had been to make the scheme self-financing within two years, primarily through sales of



Figure 1 (a) (left). Dr Clive Betts, the Bug Club's founder, in the 1990s. (b) (right). Leonard Tesch, the founder of the AES, with pupils at Harrow School in the 1930s.

resource materials to schools, and it was soon clear that this was pie in the sky. The National Curriculum was new and still changing. Teachers were struggling to adapt, and had little enthusiasm and time to promote extracurricular subjects, particularly at secondary level where Council had decided the scheme should be focussed. With only 6 months remaining income had still not reached £2000, and the future was bleak. Philosophically Clive accepted a staff post at Exeter University, and the scheme closed: YES became NO.

However, one aspect of the scheme was thriving, and continued to do so. In early 1991 Clive had started an insect club, initially for schools, with enthusiastic help from a group of undergraduates in Exeter University's Biological Society. These included Nick Baker, now a well-known television wildlife presenter and author; Gordon Ramel, now a freelance naturalist and author of most of the extensive insect pages on the Earthlife web site; and Kieren Pitts, now a Senior Analyst/Programmer at the University of Bristol and co-author of this article, who has remained with the Club ever since, and co-edits the magazine.

The Club – renamed the Bug Club in early 1992 – was immediately popular, particularly with children of primary and early secondary age, who proved, as Clive had always predicted, to be much more receptive than the older audience at which the YES was targeted. 'Minibeasts' were on the national curriculum for the early key stages, and the response of primary teachers to the YES had always been more positive. For an annual subscription of £4.50 members received a quarterly newsletter, packed with articles, letters, activities and puzzles, to which they could send their own questions and expect answers. Events were specially organised for them, and they could get reductions in the cost of entry to some local attractions, and in the price of Dorling Kindersley books. The organisers ran insect-based activities and demonstrations at the new Crealy Adventure Park near Exeter and at the Devon County Show, attracting great local attention. Although its events were inevitably restricted to the South West, a nationwide membership began to develop, and this was enhanced by coverage in Blue Peter and Radio 5. By the end of 1993, 500 names were on the database. Clive now stood down as Chairman, and was replaced by an

Exeter postgraduate, Simon Bell, who had already markedly improved the newsletter. The future looked good.

However, expenses were rising. The Royal Entomological Society provided some initial financial support after the YES closed, but the cost of producing and mailing the newsletter was soon stretching the Club's resources, and by the end of 1994 it was struggling, though by now self-financing. 1995, however, was a turning point. Nick Baker began to attain celebrity status as presenter of the *Really Wild Show*, and continued to promote the Club. Gordon Ramel, a tireless contributor to the newsletter, created the Club's first web site, the foundation for his later, prolific Internet activity. A glow-worm evening was covered on television, the *Sunday Times* featured the club, and interest and membership increased. Links with Exeter University were still strong, and the original group of Exeter students continued to drive the Club, even when they began to disperse to jobs and higher degrees after graduation, but by 1996 it was clear that stronger, national support was necessary, and an approach was made to the Amateur Entomologists' Society.

The AES had long been involved in activities for young people. The founder, Leonard Tesch, was a



Figure 2. Pond-dipping at RHS Wisley, 2008.

housemaster at Harrow, and actively promoted entomology among the boys (Fig. 1b). The Society had formally established a Junior Section in 1946, and this was still active. In 1996 the Bug Club and the Junior Section coalesced to form the AES Bug Club. The first Chairman was Darren Mann of Oxford's University Museum, who had been leading the Junior Section. The Secretary, Zoe Masters, the Editors, Simon Bell and Kieren Pitts, and the Events Coordinator, Gordon Ramel, were all Exeter-generated Bug Club veterans.

One of the first areas to show the direct support of the AES was the Bug Club Newsletter (as it was known then; it was later changed to the Bug Club Magazine to reflect the increase in quality of the publication). The first newsletter of the AES Bug Club was published in February 1997 and featured a colour cover and central section. The newsletter was now published more frequently under the umbrella of the AES with the number of issues increasing from four to six a year. It has been published six times a year, without a break, ever since and has featured articles on a wide variety

of topics from Goliath beetles to mites and leaf galls to log piles. The magazine also regularly includes articles submitted by members of the club and, to recognise their contributions, the AES makes the Gardiner Award (named after Brian Gardiner FRES and president of the AES 1977/1978) each year for the best article by a Bug Club member to be published in the magazine.

The magazine is just one example of the improvements made to the Bug Club when it became part of the Amateur Entomologists' Society. The Club has had a greater and more regular presence at events and also increased the number of events open to members. The Club has held events at a variety of well-known locations including the Natural History Museum, Oxford University Museum of Natural History, the Royal Horticultural Society headquarters at Wisley (Fig. 2) and London Zoo.

There has also been an increased and integral involvement of the Bug Club at the AES annual members' day. Originally the Bug Club held a series of craft activities and tours. In more recent years, Bug Club members

have given talks as part of the main events programme.

The AES has also published books aimed specifically at young entomologists and these have actively encouraged the entomologists of tomorrow. The first such book was "Butterflies throughout the year" published in 2007 and then followed in 2008 by "A year in the lives of British ladybirds". This second book marked one of the first collaborations between the AES and RES aimed directly at young entomologists, as the RES provided some financial support to help publish the book and the cover features logos of both societies.

More were to follow. In 2006 and 2007 Nick Holford, AES Registrar at the time, made initial approaches to the RES which in due course enabled the then President of the AES, the late Prof Mike Majerus, to lead discussions with a view to RES becoming re-involved with the Bug Club. The Society was pleased to do so. The Bug Club is now formally a 'joint' enterprise and the RES has promised financial support for the Club at 50% of its costs. This support opens new possibilities. It is already allowing the



Figure 3. The 9-and-under age group, with judges, waiting to receive trophies, goody bags and attendance certificates at the Oxford Young Entomologists' Day, February 2010.

Club to improve its services, to expand its activities and to realise some long-held ambitions. The Bug Club Magazine is significantly improved, and will continue to be so. Further evidence is provided by the recent Young Entomologists' Day at Oxford at which eighteen excited young people – the youngest just five years old! – gave talks (most of them using PowerPoint!) about their entomological exploits (Fig. 3) as well as finding time to visit the Hope entomological collections and doing some live insect handling. It is hoped that future development will include outreach to children and schools on a limited scale – see also the article by Archie Murchie in *Antenna* Vol 34 (2).

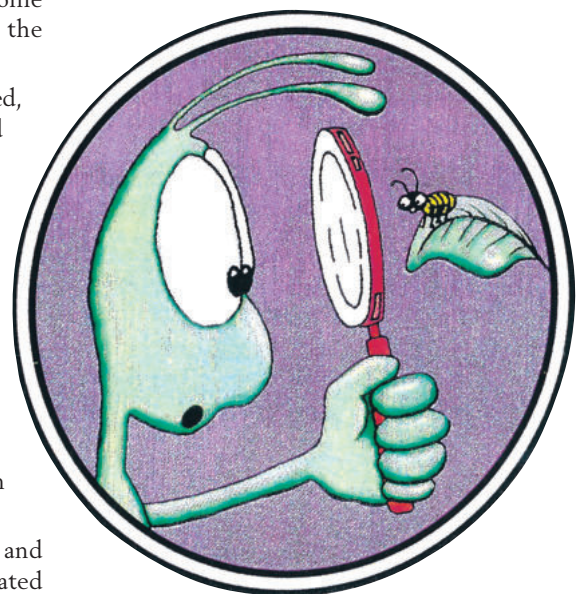
At the present time, the Bug Club has more than 240 members, from all over the United Kingdom and abroad: we have members in the Irish Republic, the USA, Australia and Kazakhstan! In the past there has been a tendency, probably inevitable, for activities to be concentrated in the Home Counties, but this is changing. In the last two

years there have been Bug Club events in Liverpool, Oxford, Cambridge and Worcestershire, as well as many nearer to London. Most recently, the AES has taken out mutual Institutional membership with the Devonshire Association, which has a flourishing Entomology Section, and Bug Club members, with their parents, will be welcome at the Section's many events in the County.

The future of the Club is assured, but if it is to operate and expand as we hope the help of experienced entomologists is badly needed, and this article is partly a Call to Arms. The principal ways in which RES members can help are:

- (1) in association with Bug Club coordinators, suggesting, organising and assisting with events and activities for young people in different parts of the UK;
- (2) writing articles, puzzles etc., and suggesting practical insect-related ideas for the Bug Club Magazine.

Please do consider if and how you can assist – and then get in touch. The immediate point of contact is the AES Youth Secretary, Dr Kieren Pitts, [kieren@amentsoc.org](mailto:kieren@amentsoc.org), or at the postal address which heads this article. Your Club – the next generation of entomologists – needs you!



# New records and rare invertebrate specimens recorded during a decade of forest biodiversity research in Ireland

## ARTICLE

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### Background

Ireland has been subject to extensive deforestation in the past two millennia, and only 1% of the country now consists of native or semi-natural woodlands (Forest Service, 2000a; Forest Service, 2000c). During the last century, approximately 10% of the land area was afforested, primarily through an increase in commercial plantations comprised of non-native conifers, particularly Sitka spruce (Joyce & O'Carroll, 2002). In addition, the Irish government aims to increase total forest cover to 14.5% by 2030, with this target mainly being met through plantation establishment. Traditionally, Irish forestry has been under the domain of the semi-state body Coillte, which planted extensively in upland areas. In more recent years there has been a policy shift with the government supporting private afforestation schemes on land more typically used for agriculture (Forest Service, 2007), whilst Coillte concentrates on harvesting and restocking its forests. Since 1998, Ireland has been committed to ensuring that all forestry development complies with the principles of Sustainable Forest Management (SFM), and as a result both new and restocked forests have been affected by changing policy aiming to create more diverse plantations (UNECE/FAO, 2003). This includes a suite of measures, from planting fewer monocultures and even-aged stands, to including more species of native provenance and leaving over-mature trees and deadwood *in situ* at the time of harvest (Forest Service, 2000a). Forests in Ireland are relatively small in size (on average 8-10 hectares), and



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Two methods of collecting. Left: pitfall trap and right: canopy fogging.

are typically embedded in a landscape of intensive agriculture. In light of this and the low native woodland cover it is vital that the potential of plantations to support native flora and fauna is determined.

### The importance of invertebrates to Irish forests

Invertebrates are an important component of forest biodiversity, inhabiting all areas from the soil and litter layers, to herb and under-storey layers, and the canopy. They have functional importance in food webs acting as herbivores, predators, as a food source for mammals and birds, and also as decomposers and pollinators (Buse & Good, 1993; Kevan, 1999; Barton *et al.*, 2009).

Until recently, few studies had focused on invertebrate diversity in Irish forests and little information was available on species typical of semi-natural woodlands, providing a baseline of the 'ideal' forest biota or on what fauna are supported in plantation forests. In the past ten years several large-scale research projects have been established to address some of these issues. The BIOFOREST project (2001-2006) examined over 100 sites across Ireland which included Sitka spruce and ash plantations at various stages of

structural development, open habitats which are commonly used in afforestation (lowland bogs, heaths, managed grasslands etc.) and open space within mature plantations (Iremonger *et al.*, 2006a). At each site Araneae were sampled with pitfall traps, while Syrphidae were sampled with Malaise traps (Gittings *et al.*, 2005; Oxbrough *et al.*, 2005; Gittings, 2006; Gittings *et al.*, 2006; Oxbrough *et al.*, 2006a; Oxbrough *et al.*, 2006b; Oxbrough, 2007a; Oxbrough *et al.*, 2007b; Oxbrough *et al.*, 2010a). Additionally, data on ground vegetation and birds were collected (Wilson *et al.*, 2006).

The PLANFORBIO Research Programme (2007-2013) was initially conceived to in part follow on from the BIOFOREST project but has a much broader focus being comprised of four research projects: i) FORESTBIO which aims to examine the biota of Ireland's future forests including second rotation Sitka spruce and mixed species stands, but also obtain a 'baseline' of species in Ireland's native woodlands through extensive survey of oak and ash woodlands. Target taxa include ground-dwelling plants, canopy epiphytes, and a range of invertebrates and birds. Deadwood volumes have also been calculated (Sweeney *et al.*, 2010); ii) HEN HARRIER which uses

radio tagging and nest cameras to examine this species' behaviour and habitat use in landscapes containing plantation forests (Wilson *et al.*, 2009); iii) RHODO which is investigating effective control measures for *Rhododendron ponticum* L.; and iv) BIOPLAN, which involves the implementation of an assessment and monitoring programme for biodiversity in Irish and Scottish forests. The overall aim of these projects is to form a set of management recommendations for improving biodiversity in plantation forests, by combining diversity data on a wide range of taxa from a variety of forest habitat types.

Invertebrate groups studied in detail on the BIOFOREST and FORESTBIO projects included Lepidoptera and Syrphidae, ground-dwelling Araneae and Carabidae, and canopy-dwelling Araneae, Coleoptera, and Opiliones, all of which were identified to species level. Methodologies employed included pitfall traps, Malaise traps, suction samplers, light traps and canopy fogging. The lack of previous invertebrate research in Ireland coupled with the geographically extensive and diverse range of sites sampled has led to a host of new records and rare specimens being recorded since 2001.

**Rare species and new county records of Syrphidae:**

Hoverflies (Diptera, Syrphidae) were sampled during BIOFOREST using Malaise traps. A total of 49,279 hoverflies of 112 species were identified, which represents 61% of the Irish hoverfly fauna. The majority of the species we recorded in mature spruce plantations were associated with open space habitats rather than closed-canopy forest (Gittings *et al.*, 2006).

One species new to Ireland was recorded: *Lapposyrphus lapponicus* (Zetterstedt, 1838) from a mature Sitka spruce plantation in Co. Kerry (Gittings, 2006). The project produced 134 new country records involving 64 different species, some of which were published (Gittings *et al.*, 2005; Speight & Gittings, 2006). Nine decreasing/threatened species were recorded (Table 1). These were mainly associated with three types of habitat features: conifer plantations, surface water habitat features and *Salix* scrub.

One of the most notable features of this survey was the general scarcity of conifer-associated syrphids (although

two rare species were recorded; Table 1). There are eleven Irish species of syrphids with larvae that typically feed on aphids associated with conifer foliage (*Dasyrphus hilaris* (Zetterstedt), 1843, *D. pinastri* (DeGeer), 1776 *sensu* Doczkal (1996), *Didea alneti* (Fallen), 1817, *Eriozona syrphoides* (Fallen), 1817, *Lapposyrphus lapponicus*, *Megasyrphus erratic* (L.), 1758, *Melangyna compositarum* (Verrall), 1873, *Parasyrphus annulatus* (Zetterstedt), 1838, *P. lineolus* (Zetterstedt), 1843, *P. malinellus* (Collin), 1952 and *P. vittiger* (Zetterstedt), 1843) and some of these species have been quite widely recorded in Ireland (Speight, 2008a). However, only single records of three of these species were recorded during the BIOFOREST project (*L. lapponicus*, *M. erraticus* and *P. vittiger*). Therefore, it appears that commercial Sitka spruce plantations in Ireland are missing a habitat component that is required for these species, although what this habitat component is remains unknown.

By contrast with the conifer-foliage species, the one Irish saproxylic conifer-associated species (*Xylota*

*jakutorum* Bagatshanova, 1980) was very widespread in the Sitka spruce plantations surveyed. It was recorded from 30 sites and was common or abundant in some sites. Prior to this survey, this species was regarded as infrequent in Ireland (Speight, 2000). It may be that the species has recently undergone a major increase in Ireland, coinciding with the maturing and harvesting of the major post-war established plantations. Another saproxylic species, *Sphegina clunipes* (Fallen), 1816, was also very common and wide-spread in the conifer plantations surveyed. This species was previously thought to be restricted to deciduous woodlands in Ireland (Speight, 2000) and its apparent habitat shift may also have been a response to the increased availability of suitable habitat in harvested plantations. Since completion of the BIOFOREST survey, another saproxylic conifer-associated species, *Sphegina sibirica* Stackelberg, 1953, has been recorded in Ireland for the first time in conifer plantations (Speight, 2008b).

Table 1. Records of decreasing/threatened Syrphidae, sampled using Malaise traps. Nomenclature follows Speight (Speight, 2008a).

County	Species Name	Year captured	Irish status <sup>1</sup>	Likely habitat source <sup>2</sup>
Kerry, Kilkenny	<i>Epistrophe nitidicollis</i> (Meigen), 1822	2004	Threatened/Decreasing	<i>Salix</i> swamp/conifer plantation
Kerry	<i>Lapposyrphus lapponicus</i> (Zetterstedt, 1838)	2003	Threatened	Conifer plantation
Kilkenny, Fermanagh, Tipperary	<i>Parasyrphus nigratarsis</i> (Zetterstedt), 1843	2002, 2004	Threatened/Decreasing	<i>Salix</i> swamp
Clare <sup>3</sup> , Kerry	<i>Platycheirus amplus</i> Curran, 1927	2001, 2003	Threatened	Wet flushes in oligotrophic grassland
Carlow <sup>3</sup> , Wicklow	<i>Xylota florum</i> (Fabricius), 1805	2001, 2003	Threatened	Unknown
Leitrim	<i>Meligramma guttta</i> (Fallen), 1817	3004	Decreasing	<i>Salix</i> swamp/ <i>Fraxinus excelsior</i> treeline
Galway <sup>3</sup> , Laois	<i>Orthonevra geniculata</i> (Meigen), 1830	2002, 2004	Decreasing	Acid fen and brook edge in <i>Salix</i> swamp
Kerry	<i>Orthonevra nobilis</i> (Fallen), 1817	2005	Decreasing	Acid fen
Kerry	<i>Parasyrphus vittiger</i> (Zetterstedt), 1843	2004	Decreasing	Conifer plantation

<sup>1</sup> Source: Speight (2008a)

<sup>2</sup> Based on habitat associations described by Speight (2008a) and the available habitats within the vicinity of the site

<sup>3</sup> Details of records published (Gittings *et al.*, 2005; Gittings, 2006)



Pure NS ground layer.

#### Rare species and new records of Araneae:

During the BIOFOREST project 65,063 adult spiders were identified from 219 species. This represents over half of the known Irish spider fauna. These were predominantly sampled from the ground layer (using pitfall traps) though some vegetation-dwelling species were collected using suction samplers and from the residue of Malaise traps (Oxbrough *et al.*, 2010a). The ground-dwelling spider fauna differ markedly between plantation forests and open habitats, with most rare species lost during the first five years after plantation establishment due to changes in vegetation cover and drainage and more generalist open species lost around the time of canopy closure (8–12 years) (Oxbrough *et al.*, 2005; Oxbrough *et al.*, 2006a; Oxbrough *et al.*, 2007b). Rare or notable ground-dwelling spiders were sampled predominantly from unplanted peatland habitats with fewer in the more intensively managed grasslands (Table 2). One new spider species record for Ireland *Meioneta mollis* (O.P. – Cambridge 1871) was collected in a blanket bog in the south west of Ireland (Oxbrough, 2007a).

In the plantation forests, the spider fauna was distinguished by both canopy species (conifer or broadleaf) and by structural development of the forest, which was primarily related to the amount of forest cover. There were no rare or notable species sampled in the closed canopy plantation forests, however there were over 20 species associated with forested or shaded habitats, some of which were found to be highly abundant including *Asthenargus paganus* (Simon, 1884), *Ceratinella scabrosa* (O.P. Cambridge, 1871) and *Lepthyphantes tenebricola* (Wider, 1834) (Oxbrough 2005).

A high number of new county records were found during BIOFOREST: 696 new records from 173 species (Oxbrough, 2007). This is due to both the large scale nature of this project (102 sites covering 21 counties) and the lack of previous research on Irish spiders, particularly those in forest plantations. For example, *Agyneta ramosa* (Jackson, 1912), has only recently been added to the Irish list (Fahy and Gormally 2003), but was sampled extensively in the more structurally developed plantations (434 individuals from 44 sites across 16 counties) whereas *L.*

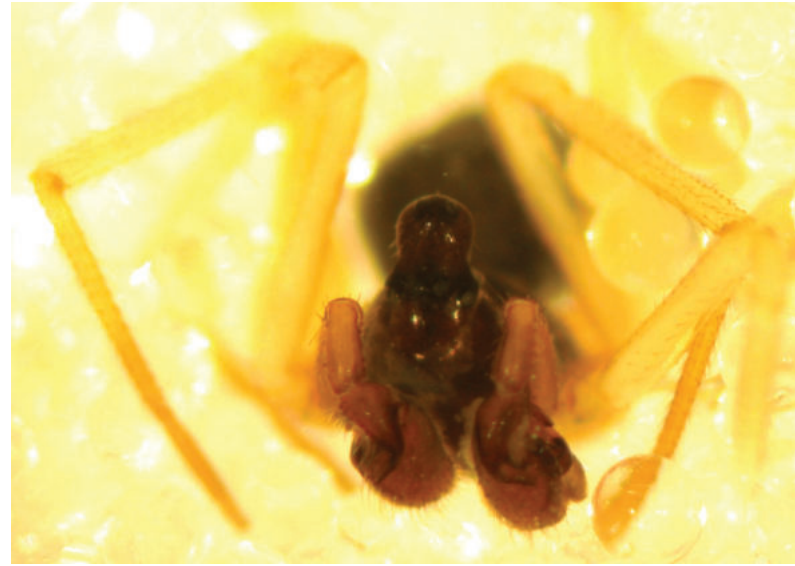
*tenebricola* had only been sampled previously in three Irish counties but was encountered commonly during BIOFOREST (723 individuals in 44 sites across 18 counties). Both of these species are known to be widespread across Britain (Oxbrough, 2007). Despite no rare species being sampled it is evident that a combination of both Sitka spruce and ash stands at various stages of structural development will enhance overall plantation biodiversity by supporting a diverse spider fauna. This is particularly important in Ireland where plantations are embedded in a landscape of intensively managed grassland (Oxbrough *et al.*, 2005; Oxbrough *et al.*, 2006a; Oxbrough *et al.*, 2007b).

Data of ground-dwelling spiders is currently being analysed from the native woodlands surveyed during the FORESTBIO project which is hoped will provide a baseline of expected species in Irish forests. Preliminary results suggest a different spider fauna between exotic conifer plantations and native woodlands and species sampled include *Pachygnatha listeri* (Sundevall 1830), which is associated with deciduous woodland habitats. This species was not sampled in over





Ash canopy.



Linyphiid spider, *Entelecara acuminata* (Top: male).

100 mature plantations across the island of Ireland during BIOFOREST and FORESTBIO but was found in three native woodlands which are scattered widely across Ireland.

Canopy-dwelling spiders were sampled from forests of coniferous and mixed plantations and native woodland dominated by oak or ash using thermal fogging during the FORESTBIO project. Thermal fogging disperses an aerosol insecticide into the tree canopy and invertebrates fall onto an arrangement of plastic sheets on the ground underneath where they are then collected. One new spider species record for Ireland was verified from FORESTBIO samples (Table 2) ; a Linyphiid spider, *Entelecara acuminata* (Wider 1834), which was captured using thermal fogging in a native oak woodland (WN1) (Martin, 2009).

Canopy spider species assemblages from native Irish ash and oak woodlands differed from those found in plantations, with *Clubiona brevipes*, *Araneus diadematus*, *Entelecara acuminata* and *Hahnina montana* being found exclusively in

native woodlands, while *Porrhomma convexum* was found only in Sitka Spruce plantations and *Lepthyphantes obscurus* only in coniferous plantations of Sitka spruce, Norway spruce or a mixture of Norway spruce and Scots pine (Martin *et al.*, unpublished). These faunal differences may be related to differing microhabitat conditions between native woodlands and coniferous plantations such as leaf and branch structure and prey availability.

#### Rare species and new records of canopy-dwelling Coleoptera:

Canopy-dwelling Coleoptera were also collected using thermal fogging at the site types detailed above for the FORESTBIO project. Over 4000 specimens from 28 families and 106 species were identified. To date, one new species record for Ireland has been verified from the Anobiid beetle family, *Anobium inexpectatum* (Lohse 1954). *A. inexpectatum* is on the UK Red-list for Coleoptera (Table 3) and was found in the canopy of a native

oak forest during the FORESTBIO project (Martin, unpublished). This species is known to be xylophagous on a variety of wood types, and is generally specific to deciduous woodlands in association with old *Hedera helix*. A number of the species in Table 3 are associated with specific woodland types: *Coeliodes transversealbofasciatus* is phytophagous on *Quercus* woodland, *Kyklioacalles roboris* is xylophagous and is found in deciduous and oak woodlands, *Malthodes guttifer* is predatory in deciduous and coniferous woodlands, *Mniophila muscorum* is phytophagous and is found in moss on a variety of trees, and *Orchestia minor* and *Tetratoma ancora* are mycetophagous and associated with fungus on deciduous trees. However, although all species in Table 3 were found in various woodland types, *Athous campyloides* and *Stenichnus poweri* are not woodland-associated species, and are more commonly found in open grassland habitats where *A. campyloides* is phytophagous and *S. poweri* is an active hunter (Buckland & Buckland, 2006).

Table 2: Araneae species identified to date from the BIOFOREST and FORESTBIO projects which occur in ≤5 Irish counties and are considered rare or notable in Britain. Nomenclature follows Roberts (Roberts, 1993).

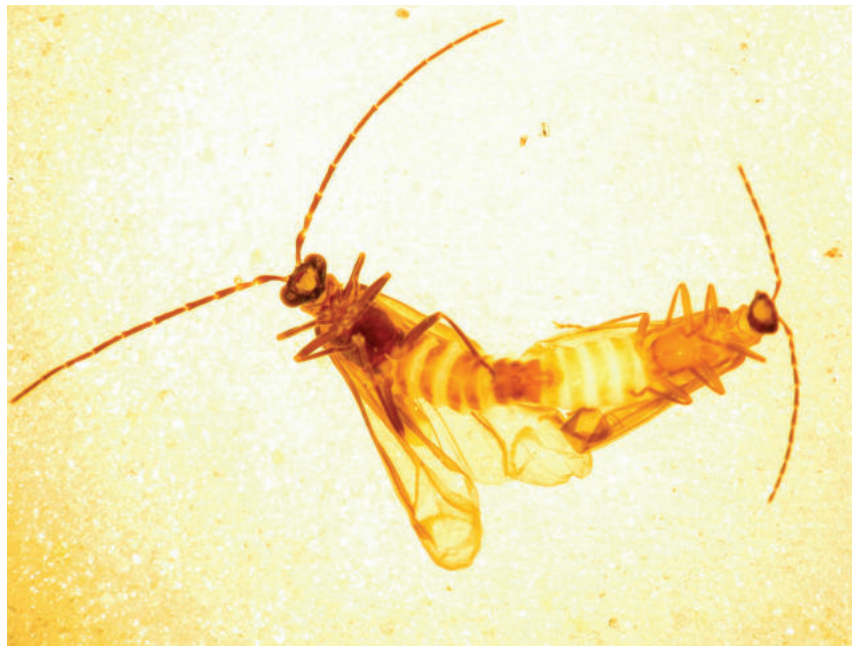
County	Family	Species Name	Sampling Method	Year captured	British status (Harvey et al., 2002)/New Irish Record**	Habitat Type Sampled	No. of Males/ Females
Clare, Galway	Linyphiidae	<i>Baryphyma gowerense</i> (Locket, 1965)	Pitfall trap	2002, 2004	Red Data Books - Insufficient data	Wet grassland, acid fen	4 Male: 1 Female
Donegal, Kerry, Mayo	Linyphiidae	<i>Satilatlas britenni</i> (Jackson, 1913)	Pitfall trap	2004	Nationally scarce in Britain – Notable B	Blanket bog	37 Male: 42 Female
Kerry	Linyphiidae	<b><i>Meioneta mollis</i> (O.P Cambridge 1871)</b>	Pitfall trap	2004	<b>New Irish Record**</b>	<b>Blanket bog</b>	<b>19 Males</b>
Kerry	Dictynidae	<i>Nigma puella</i> (Simon, 1870)	Pitfall trap	2004	Nationally scarce in Britain – Notable A	Lowland blanket bog	1 Male
Kerry	Gnaphosidae	<i>Zelotes lutetianus</i> (L. Koch, 1866)	Pitfall trap	2004	Nationally scarce in Britain – Notable B	Lowland blanket bog	1 Male
Kilkenny	Linyphiidae	<b><i>Entelecara acuminata</i> (Wider, 1834)</b>	Canopy fogging	2008	<b>New Irish Record**</b>	<b>Native oak woodland</b>	<b>1 Male: 1 Female</b>
Limerick, Tipperary	Linyphiidae	<i>Saloca dicerus</i> (O.P.-Cambridge, 1871)	Pitfall trap	2002, 2004	Nationally scarce in Britain – Notable B	Wet grassland	6 Male
Mayo	Linyphiidae	<i>Maro sublestus</i> (Falconer, 1915)	Pitfall trap	2004	Nationally scarce in Britain – Notable A	Blanket bog	2 Male

**Rare species and new records of canopy-dwelling Coleoptera:**

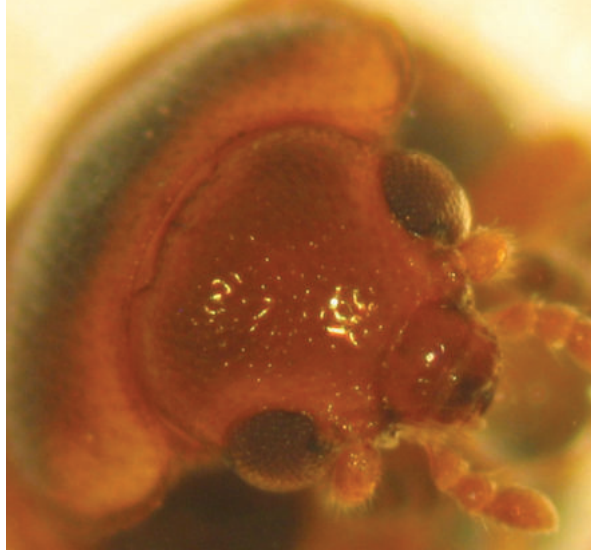
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*poweri* are not woodland-associated species, and are more commonly found in open grassland habitats where *A. campyloides* is phytophagous and *S. poweri* is an active hunter (Buckland & Buckland, 2006).



Malthodes mating.



Top left: *Anobium inexpectatum*;  
Middle: *Tetratoma ancora*; Top right:  
*Athous campyloides*.

Table 3. Details of Coleoptera sampled with canopy fogging during the FORESTBIO project. Nomenclature and Red-List status follows Bugs Coleopteran Ecology Package (Buckland & Buckland, 2006).

County	Family	Species Name	Year captured	Status (Buckland & Buckland, 2006)	Forest Canopy Type Sampled (Fossitt, 2000)	No. of specimens
Cork, Galway	Anobiidae	<i>Anobium inexpectatum</i> Lohse	2008, 2009	**New Irish record Nationally scarce in Britain - Notable B	Native oak woodland	4
Clare, Cork, Laois, Leitrim, Offaly, Tipperary	Elateridae	<i>Athous campyloides</i> Newman	2008, 2009	Nationally scarce in Britain – Notable B	Native Ash woodland, pure Norway spruce plantation, Norway spruce: Oak mixed plantation, Sitka spruce plantation	29
Cork	Curculionidae	<i>Coeliodes transversealbofasciatus</i> (Goeze)	2009	Nationally scarce in Britain – Notable B	Native oak woodland	1
Kilkenny, Tipperary, Wicklow	Curculionidae	<i>Kykliaocalles roboris</i> Curtis	2008, 2009	Nationally scarce in Britain – Notable B	Native oak woodland, native ash woodland	7
Antrim, Cork, Fermanagh, Galway, Roscommon	Cantharidae	<i>Malthodes guttifer</i> Kies.	2008, 2009	Nationally scarce in Britain – Notable B	Native ash woodland, native oak woodland, Sitka spruce plantation	54
Antrim	Chrysomelidae	<i>Mniophila muscorum</i> (Koch)	2008, 2009	Nationally scarce in Britain – Notable B	Native oak woodland	2
Donegal, Fermanagh, Leitrim, Roscommon, Tipperary	Melandyriidae	<i>Orchesia minor</i> Walker	2008, 2009	Nationally scarce in Britain – Notable B	Native ash woodland, Norway spruce: Scots pine mix plantation	16
Cork, Offaly	Scydmaenidae	<i>Stenichnus poweri</i> (Fowler)	2008, 2009	Red Data Books - insufficient data	Native Oak woodland, pure Norway spruce plantation	2
Roscommon	Tetratomidae	<i>Tetratoma ancora</i> F.	2008, 2009	Nationally scarce in Britain – Notable B	Native ash woodland	3

Red-listed status is taken from the UK Red-list as detailed records of many Coleopteran species distributions and rarity are still relatively unknown in Ireland (www.jncc.gov.uk, 2010). Identification of voucher specimens was confirmed by Dr. Tom Gittings, University College Cork, Dr. Stephen Mc Cormack, Co. Waterford, Ireland and Dr. Roy Anderson, Belfast, N. Ireland. Voucher specimens have been deposited in the Museum in the Department of Zoology Ecology and Plant Science, University College Cork, Ireland.

## Conclusions

Plantation forests have an important role to play in maintaining biodiversity in countries such as Ireland and Britain where landscapes are dominated by agriculture and cover of natural woodland is low. However further research is needed to assess their potential to support a diverse array of flora and fauna. For invertebrates, the importance of small scale habitat features within a stand such as litter layers and ground vegetation needs to be examined. In particular priority should be given to specialist groups, which are integral to ecosystem function. For instance, the role of saproxylic species in plantation forests in comparison with that in native woodlands is an area of research which is recognised internationally (Jonsell *et al.*, 2007; Richardson *et al.*, 2009). Deadwood volumes quantified during the FORESTBIO project indicates that Irish forests (both plantation and native) are lacking the large diameter logs and snags characteristic of high biodiversity old-growth forests, but the effect of this on saproxylic floral and faunal biodiversity has yet to be

quantified. However, it is clear that management practices need to be modified so that deadwood volumes can be increased in both plantation forests and native woodlands (Sweeney *et al.*, 2010).

The extensive research in Ireland carried out in recent years is in stark contrast to that of previous times, which is exemplified by the new Irish Araneae and Syrphidae species record and new Irish county records of Araneae and Syrphidae from the BIOFOREST project, as well as new Irish Araneae and Coleopteran species records, and the large number of rare Coleopteran species from the FORESTBIO project. Canopy fogging samples collected during FORESTBIO, including, for example, the Hemiptera, Hymenoptera and Diptera and the Lepidoptera species data are currently being analysed, and analysis of biodiversity indicators and habitat associations for all other taxa sampled during FORESTBIO are underway. Results of these analyses will directly contribute to the management policies of Irish planted and native forests so that biodiversity in these habitats can

be optimised. This has led to a build-up of taxonomic expertise and has laid the foundations for continuing work on Irish forest research and the improvement of biodiversity and forest management practices.

With historical forest cover being reduced to <1% around the last century, many forest species may have been lost, thus a key element to forest biodiversity research is finding out what the 'true' flora and fauna of Irish woodlands is and whether it is particularly specialised. Research carried out on the Forestbio project examining the invertebrate fauna of native woodlands aims to begin to examine some of these issues.

See <http://BIOFOREST.ucc.ie/> for more information on the BIOFOREST project including final technical reports (funded by the EPA and COFORD under the National Development Plan 2001-2006). See <http://www.ucc.ie/en/planforbio/Projects/FORESTBIO/> for more details on the FORESTBIO project (funded by COFORD and IRCSET under the National Development Plan 2007-2013).

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# Maggots, Murder and Microbes: uncovering the potential of carrion- feeding insects

## ARTICLE

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I stumbled into the world of Forensic Entomology through my postgraduate research project several years ago. I remember being amazed by how much information could be derived from the humble blowfly larva. This creature can, for example, give practitioners an idea of the toxicological content of a corpse, link suspects to crime scenes and, most importantly, provide an estimation of the minimum time since death. The field of Forensic Entomology has grown slowly but surely from its ancient beginnings in thirteenth Century China and today studies are conducted by a number of researchers around the world to support the use of insects as evidence in crime investigations. Forensic Entomology has also reached a wider audience through popular television shows such as “CSI”, which has its own Forensic Entomologist on hand to offer advice on authenticity. However, the reality is not quite as glamorous as these actors would have you believe; the outfits are not as beautiful, the hours are long and often unsocial and the

odours can be rather offensive to the nasal passages, but, if you can overcome these aspects of the work, then you just might encounter some rather beautiful and fascinating insects along the way!

In the UK we do not have a facility like the ‘Body Farm’ at the University of Tennessee in the USA, which enables researchers to study the decomposition sequence of a human corpse. Instead, we have to conduct our research on the next best thing - pigs. A pig carcass is a good substitute for the human body as it has similar hair coverage, the body cavity and organs are about the same size and the odours released are similar to a decomposing human corpse (Dekeirsschieter *et al.*, 2009). These odours change as the body goes through a number of biological, chemical and physiological changes and each is attractive to a specific set of arthropods (Méglin, 1894 ; Rodriguez & Bass, 1983). Some come to colonise a corpse for feeding and breeding purposes whilst others are there to prey on or parasitize those



Figure 2. Lincolnshire woodland site where experiment was conducted; cages contained five pig carcasses and there were three bottle traps and four pitfall traps around the site. Figure 3. Blowflies laying eggs on a pig carcass. Figure 4. Blowflies amongst rafts of eggs on one of the forehead of one of the pig carcasses. Figure 5: Larval mass consuming body tissues of a pig carcass. Figure 6. Pig carcass reduced to skeleton and dried skin. Figure 7. Blowfly puparia amongst skeletal remains of a pig carcass

already established in the corpse. Each species modifies the corpse environment in some way, facilitating the arrival of the next group of colonisers. The different waves of insect species visiting the corpse throughout the decomposition sequence are known collectively as 'insect succession' and can be used to give an estimation of the minimum time since death. In general, flies dominate the initial wetter stages and beetles dominate the later, drier stages of decomposition.

In a recent research project in a Lincolnshire woodland I collected the insects that visited a pig carcass through the decomposition sequence. The results from this study will provide a better understanding of the insect species, which a practitioner might encounter in this specific type of habitat and how they vary throughout the decomposition sequence.

Within the first hour of placing the pigs outside, numerous adult blowflies brought the airspace above the carcasses to life with their loud buzzing. Flashes of metallic blues and greens could be seen as the flies partook in the acrobatics of mating dances and the females found a suitable place on the corpse to lay their eggs. Over the first few days, blowflies built up rafts of eggs on the outside of the body whilst the bacterial activity inside the gastrointestinal tract produced waste

gases, causing the carcasses to bloat. During this time, the frantic blowfly activity was supplemented by the arrival of other diptera, such as Muscids and Faniids, arriving to consume the body fluids leaching from the bodies. Blowfly larvae hatched from eggs and established themselves in the dark moist areas of the carcass ready to start their work as chief decomposers. When the carcass was lifted, predatory Staphylinidae and Silphidae scattered as they made a mad dash for the shadows.

After several days waste gases started to escape from the carcass and it entered active decay. This stage was dominated by writhing masses of feeding larvae that stripped the carcass of its tissue. Armies of Staphylinidae and Histeridae gathered under the bodies and Silphidae could still be found in the soil. Occasionally Carabidae would visit the carcasses for an opportunistic snack.

As the remaining skin started to dry out and the skull bones were exposed, decomposition moved into advanced decay. Feeding blowfly larvae and predatory adult beetles remained on the small pig carcasses and were joined by Silphid larvae. The last stage of decomposition sampled was skeletonisation and whilst the larger blowflies had lost interest, smaller diptera were found skimming around the remains in large numbers. On the bones themselves, tiny Sphaeroceridae were observed

moving amongst the last departing blowfly larvae and puparia. After I had finished sampling, I knew that the arthropod sequence would live on in the soil under the carcass for many months or years if allowed to, influenced by the body fluids that had leached from the pigs. However, I would not get a chance to witness these colonisers; instead I would be kept busy with the monumental task of identifying all the insects I had collected!

As a researcher I am interested in the forensic potential of carrion-feeding insects, but I am also interested in how these insects are able to survive in bacterially-dense environments such as a human or animal corpse. Therefore, another aspect of my work is concerned with studying the competitive interactions between the insects and the microbes found in the corpse environment. I study a set of insects that are representative of the decomposition sequence and use bacterial species that have previously been isolated from a dead body to investigate these interactions. Using standard microbiological techniques I have found that these insects produce substances with antibacterial activity in their larval secretions. This research demonstrates that carrion-feeding insects are not only useful as forensic indicators; they are also potentially useful in the medical world.

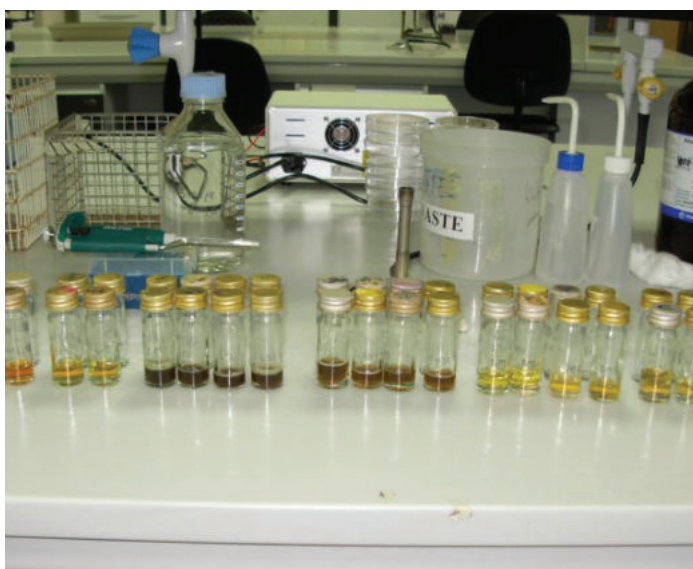


Figure 8: left hand-side shows secretions being collected from blowfly larvae and picture on right hand-side shows larval secretions being used in a liquid culture assay.



Figure 9: *Lucilia sericata* flies on porcine liver at Lincoln University.



Figure 10. Common green bottle fly pictured in my back garden in Lincoln.

Today, the most well-known biomedical application of insects is probably Maggot Debridement Therapy, which has seen a revival in modern-day medicine over the last fifteen years (Thomas *et al.*, 1998). For those patients suffering from problematic or chronic wounds, medical staff can now apply larvae of an initial coloniser *Lucilia sericata* (Meigen) to consume necrotic tissue, eradicate bacteria and aid healing. This reintroduction of Larval Therapy into Western medicine has initiated studies assessing the healing properties and antibacterial capacity of *L. sericata* larvae. The research has demonstrated that larval secretions contain an array

of proteolytic enzymes that contribute towards the effective debridement of necrotic tissue (Chambers *et al.*, 2003) and enhance new tissue formation (Horobin *et al.*, 2003). The secretions are also active against several types of bacteria including antibiotic resistant strains such as Methicillin-Resistant *Staphylococcus aureus* (MRSA) (Bexfield *et al.*, 2008a). The antibacterial activity has been attributed to small, novel compounds that have recently been isolated from larval secretions and haemolymph (Bexfield *et al.*, 2008b; Anderson *et al.*, 2010; e ovský *et al.*, 2010).

My research has shown that other insect species colonising similar

environments to those colonised by *L. sericata* also produce antibacterial secretions. Their spectrum of activity and potency seems to be related to the insects' colonisation times on a corpse and is only apparent during certain stages of their development. The work is still in its early stages but has potential to help in the fight against antibiotic resistant infections by providing novel antibacterial compounds. So, next time you encounter a lowly blowfly, before you swat it, look at it in admiration and think of the part it plays in benefitting both our forensic and biomedical worlds!

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The lime butterfly (*Priniceps demoleus*) occurs over a large part of South and South-East Asia, as well as in Australia. Each language within the species' broad range has its own name for "butterfly".

# A Rose by any other name

## ARTICLE

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Pol (Paul) was sitting at a computer in a so-called internet shop in north-eastern Thailand when I first met him. "You are not going to harangue me about the EU?" he enquired suspiciously in perfect English. I assured him that I felt the best place for politics was an infertile field. "Look here," I suggested, "Kjarri and his family are coming along to my in-laws' house warming party tomorrow, loads of monks and so forth, also (flashing an involuntary look at Paul's more than ample midriff), "as much chilli as you can manage." Kjarri is the internet shop's owner and IT expert. He comes from Iceland and speaks fluent Thai.

My wife's family's party was a huge success, the Buddhist monks departed clutching money in envelopes, the Thai helpers busied themselves clearing up, occasionally whispering an unsolicited warning to me about the unreliability of most of the relatives I had had a conversation with (much can be hid behind a perpetual smile) – and a replete Pol and I sat out in the dusty street quaffing a welcome beer after all the mouth-stretching activity.

The habit of darting glances hither and thither is common to the petty criminal casing the joint and the entomologist similarly engaged. It has the same effect: it tends to arouse

suspicion. "It's the butterflies," I placated him, "one of my passions, I'm afraid."

"Actually, well, I too am interested in butterflies – or to be more precise, in the word for butterfly in every possible language or dialect," replied Pol, "I have reached the 4,000 mark."

"And you can remember them all?" "Well, yes." Right, thought I, let's test this off-beat entomologist; I have lived in Finland for over 40 years and the winter makes one mean. "*Perhonen*" replied Paul without hesitation. That is an example of an *ideophone*, a word imitating the insect's sound and character."

"Sounds reasonable, I guess. Finnish having the trilled "r", like Spanish, the word would work out as "*Perrr-hoe-nehn*, or one of its 16 derivatives based on the noun case."

I could just about see how a person living up a thorn tree a couple of million years ago might have had time to listen to the sound made by the wings of a passing butterfly down in the Olduvai, though obviously the warming up hawk moth emits a far higher 'purring noise'. Impressed, I began to dig into my companion's knowledge of butterfly name origins. "Go on".

"The second origin, the *metaphor*, is based more on a description of the insect itself" supplied Paul. "The jolly old brimstone, the famous "*butter-fly*," I put in, smugly. That failed to rock him on his linguistic pedestal, however. "Well, there are other theories concerning your English '*butter-fly*'", he counteracted.

"The word *butterfly* could well be a metaphor equivalent to the German *Schmetterling* (*schmetter* = an old word, meaning cream) and to a Flemish dialect word for butterfly, *beuterskiete* (one who ejects butter)." "It's true that butterflies' excrement (meconium) is a whitish substance," I concurred, "although a scientist would hardly use the "s" word that you did."

"To move on to other languages, in Norwegian and Danish the word is *Sommerfugl* (summer bird), in Jiddish it is similar: *Zomerfeigele*. In some Indian languages like Gujrati (India) they say *phulpakhri* (flower bird), in Tamil *vannatapoochi* (coloured insect), in Telugu *sitakokachiluka* (the bird of the goddess Sita). In Peulh, a West-African language, some say *puchu allah* (the horse of Allah),



A popular conception is that the English name "butterfly" comes from the flash of yellow from a passing brimstone (*Gonepteryx rhamni*).

A lot of names for "butterfly" contain either r or l, or p, b, v, or f. The word is often at least partially duplicated:

Hebrew: *Par-par* (the language of Eden?)

Amharic (Ethiopia): *birra-birro*

Kurdish: *pur-pürük*

Yoruba (Nigeria): *bala-bala*

Wolof (Senegal, Gambia): *lepa-lep*

Nahuatl (Mexico): *papalo-tl*

Finnish: *perhonen*

Farsi (Iran): *parvaneh*

Arabic: *farasha*

Manx: *foi'llycan*

Dutch: *vlinder*

others *deftereh allah* (the book of Allah). In Hausa the word is *mallam bude littafi*."

"Good grief!" I exclaimed, feeling faint. But there was no stopping him, not even the ice cold Singha. Now I knew why he ate well; it gave him something to clasp his hands over. Unstoppable as a cataract, the monologue eddied into an ideophonic backwater.

"The *ideophone* group often shows words with a (partial) reduplication to imitate the two wings: *rama-rama* (Malay), *kupu-kupu* (Indonesian), *iki-nyugy-nyugu* (Rwanda), *ki-pe-peo* (Swahili), *farfalla* (Italian), etc." I had been to a butterfly farm in KL called Rama-rama; lucky it was not in Rwanda.

"Even in faraway languages like Samoan the word is *pepe* (reduplication), or *pepén* in Maya.

"In the Indo-European language family (6,000 years old), the old root for flying was \*pl and this can still be seen in words like *papilio* (Latin), *papillon* (French), *papallona* (Catalan), as well as *pepela* (Georgian) and *pili-pala* (Welsh).

"Some linguists, called the Nostraticists, say that the Indo-European language family was itself a subfamily of a wider language family, called the *Nostratic* languages (12,000 years old). This macrofamily would include most languages of Northern Africa, Asia and some Indian languages of America. The root for flying was \*pr.

"Consider this: an "r" can easily change into an "l"; "p" can mutate to "b", "v" or "l" and "v" into "f". Similarly p > b > v > l : that is, a "p" can change into a "b", a "b" into a "v", and a "v" into an "f".

"If we search for butterfly words containing either r or l and p, b, v or f, we'll come across a lot of examples in a wide variety of languages. Often there is also a (partial) reduplication (see Box 1).

"Others will say that the similarities are just a coincidence, that similar sounds or structure is not evidence of a common origin. Still, I find it quite fascinating. Here in Surin Province I met some Kuy people (also called Suay). They are the people going around with the begging elephants. In their language the word for butterfly is ...*laaplaap*, a perfect ideophone!"



A popular conception is that the English name "butterfly" comes from the flash of yellow from a passing brimstone (*Gonepteryx rhamni*).

## Some examples of the metaphorical origin of the local name for butterfly:

Arabic from Sudan, Cairo: *abu diqiq / abu daqeek* means 'father of wheat flour', which may refer to a white butterfly only, but Pol's Sudanese informant told him this was the general word for butterfly in his area).

Basque (Navarra): *sorgin-oilo* ('witch hen').

Basque (Navarra): *jainkoaren oilo / jankoilo* (God's hen)

Bangali/Oriya: *projapathi* (lord of animals)

Cherokee (US): *kamama* (refers to the flapping ears of the elephant)

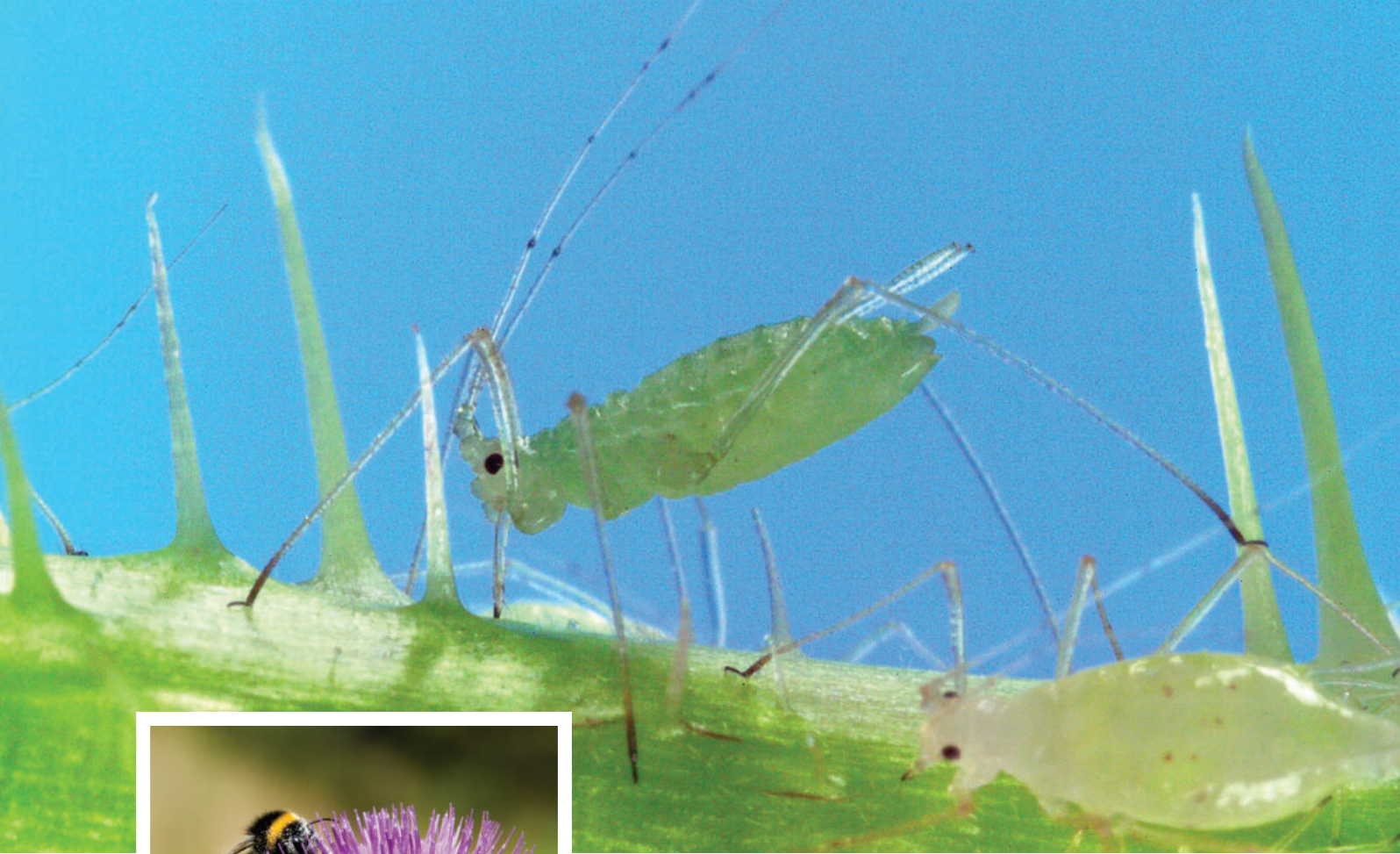
Chinese: *hudie* (messenger of flowers)

Fulfulde, Adamawa: *mallum-ngel* ('little Muslim teacher' - the flapping wings suggest the turning of the leaf of a book such as the Holy Koran)

Mpade, Cameroon: *malim malim* (teacher + reduplication)

Gaelic, Scots: *dealbhan-de* (fire of God)

Touareg: *ad'egal n ehod* (father-in-law of the night)



Top: The European large raspberry aphid (*Amphorophora idaei*) is attracted to plants by plant virus induced volatiles, but subsequently migrates from the plant and thereby spreads the virus onto new hosts.

Inset. Vertebrate grazing has significant effects on pollinator assemblages in Scottish birch woodland.

Bottom. The aphid *Myzus persicae* has many different genotypes, which appear to be very different morphologically, but also possess different traits such as insecticide resistance.



# Meeting Reports

## Scottish Regional Meeting – Insect-plant biology: from genome to the landscape

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The 2010 Scottish Regional Meeting of the Society was held on the 30 June 2010 at the Scottish Crop Research Institute (SCRI), just outside Dundee. Forty five delegates from all over Scotland descended on SCRI to attend the meeting, which was the first to be held at SCRI for over 10 years. After welcoming everyone to the meeting, the keynote speaker, **Professor Sue Hartley** from the University of Sussex (above) opened the meeting with her talk 'The impacts of hemi-parasitic plants in plant-insect interactions: hosts, herbivores and higher trophic levels'. Sue was well known to many of the audience as this year's presenter of the Royal Institution Christmas Lectures 'The three hundred million year war' which was televised on More4. Sue talked about the influential role that a small hemi-parasitic plant (*Rhinanthus minor*) had on a myriad of insect herbivores and their natural enemies, illustrating the tight linkages that operate in many terrestrial systems.

**Dr Brian Fenton** from SCRI spoke afterwards, explaining the remarkable progress in aphid research climaxing in an almost complete genome sequence. This sequence has allowed many of the genes present within an aphid to be identified for the first time and it has established some remarkable new aphid facts that translate to the landscape. **Dr Jon**

**Pickup** from Science and Advice for Scottish Agriculture (SASA) continued the aphid theme, describing the work of the agency in monitoring and forecasting populations of aphid pests. Next up was **Dr Andy Evans** from the Scottish Agricultural College (SAC) who discussed new approaches that can be used to alter the behaviour of phytophagous and predatory insects to reduce pest damage on agricultural and horticultural crops.

The meeting then broke for lunch, which took advantage of the glorious summer weather (typical for Dundee it has to be said!) by being held in a marquee on the front lawns of SCRI (left). Delegates had the opportunity to sample Angus grown strawberries and cream, before returning to the meeting for the afternoon session, which kicked off with **Professor Pat Willmer** from the University of St Andrews. Pat spoke about her groups work on pollinator systems, and in particular the challenges posed by keeping ants out of flower structures. Continuing with pollinators, **Dr Adam Vanbergen** from the Centre of Ecology & Hydrology (Edinburgh), talked about the effects of vertebrate grazing on plant-pollinator assemblages in birch woodlands.

**Emily Clark** from the University of Dundee and SCRI spoke to the meeting about her PhD research project examining the role of bacteria in the cabbage aphid (*Brevicoryne brassicae*), and in particular how different bacteria affected aphid fitness. **Dr Rob Hancock** from SCRI went on to

discuss local and systemic responses in plants to aphid attack, focusing on *Arabidopsis* and *Myzus persicae*. The final talk of the day was given by **Dr Alison Bennett** from SCRI who explained the important role played by arbuscular mycorrhizal fungi in shaping the plants interaction with herbivorous insects.

The poster session and afternoon tea were held at the **Living Field Study Centre** at SCRI, which is an educational outreach programme that aims to introduce students to plant related sciences. **Professor Geoff Squire** (SCRI) gave a brief introduction and tour of the Living Garden, explaining the many aspects of insect interactions with crops, ranging from pest management to ecosystem services.

The organisers would like to extend their warmest thanks to all the speakers and participants at the meeting together with SCRI for sponsoring the event. In particular, I would like to thank my research group (Katy Clark, Lindsay McMenemy and Carolyn Mitchell) for assisting with the meeting on the day, and especially Sheena Lamond for those lovely strawberries!



# Ento '10: A student's perspective

**Cathleen Thomas**

**Croeso i Prifysgol Abertawe!  
Welcome to Swansea University!**

During 25th-28th July, 200 entomologists descended on Swansea for this year's RES National Science Meeting, Ento '10. I arrived late Sunday evening, and decided to stretch my legs a little bit before I went up to the bar to meet the others. I crossed the road at the university entrance, snuck through some bushes and emerged on lovely golden sand dunes that stretched out along the bay to both sides of me. I must admit the seaside location was a huge draw for me to attend this conference, and as I walked I wondered how many others were enticed by it. I then headed off to the bar to find quite a crowd of eager entomologists had already arrived. After catching up with a few friends I headed off to bed, checking for bed bugs of course – potentially my first insects of the trip. Alas there were none, so I would have to wait until the following day to see any bugs!

The first day of the conference got us off to a very early start. I'd

like to say a huge thank you to the team from RES HQ who were in place at the registration desk from 7am, while I still lay in bed! After a hearty breakfast, the conference began with the introduction from Professor Richard Davies, the Vice Chancellor of Swansea University, who welcomed us to the university – the only UK member of the very exclusive seaside universities club. He also spoke about the importance of conferences for forming collaborations and how impressed he was that this conference was not just about blue skies research, but also covered applied topics. He then gave us a brief background to the university, from its beginnings 90 years and one week ago due to a call from industry, which has resulted in its world-renowned engineering background, to today, with their reputation as a research-led, ambitious university, and their latest achievement is the opening of their new medical school.

Next up, the current president of the RES, Prof. Stuart Reynolds, talked about how fantastic it was to see so many people here, and echoed the VCs comments about collaborations, and the interdisciplinary nature of entomology, and said that he was expecting a 'cornucopia of good stuff'. I'm sure all his expectations over the next few days were met – mine certainly were.

The first plenary of the conference was given by Prof. Norman Ratcliffe, who spoke about the beneficial role of insects. In contrast to many people's first reaction to insects, which is to squash, splat, spray or run away from them, insects can actually be very important and useful to us, particularly when it comes to our health. Although many of the drugs we use are natural products extracted from plants, insects can also play an important role in medicine, and as around 75% of all animal species are insects, it seems there could be a vast untapped reservoir. Studying insects has also helped us to understand how our own immune system works, as by linking the adaptive immunity characteristic of vertebrates with the innate immunity characteristic of insects scientists have managed to identify toll-like receptors (TLRs), which they have then found in humans. Insects are being used in modern medicine – you can now get maggots on NHS prescription, and this is estimated to save them around £500 million, so is beneficial to all concerned. Perhaps if we could exploit other insect species in modern medicine they could help the NHS through the recession! Norman concluded his talk by singing the praises of National Insect Week for making people



The RES PG reps (l-r: Duncan, Nina, Cathleen, Toby)

more aware of biodiversity and conservation of insects, but also gave a plea to let people know that by studying the insect immune system we can develop new therapeutics. I found this talk fascinating, as I didn't realise that insect natural products were still being used in modern medicine and that the scientific basis of their applications were now well understood.

After the plenary talk, the conference then split into two parallel sessions, both very applied: one continued along the theme of Norman's plenary on the use of insect products for medical purposes, while the other dealt with the use of semiochemicals for insect control, including for prevention of disease. As I don't really have an affiliation to either subject, I was able to flit between sessions and sat in on some very good talks. I learnt about the work Dr James Logan is doing at Rothamstead, to identify attractant chemicals for tsetse flies to create traps and reduce the incidence of sleeping sickness. Conversely, he is also trying to identify repellent chemicals for Scottish midges to try to develop a better mosquito repellent and understand why only certain people seem to be attractive to midges. I am very fortunate to not be attractive to midges, but I hope that James' work will offer some respite to those who are. Sandra Ronca spoke about her work, using the latest molecular techniques to investigate pollination behaviour of bees, and has found temporal and spatial differences in the types of flowers visited by bees, with differences not only among bee species, but between the sexes. This research really highlights how the development of modern molecular techniques such as 454 sequencing can shed light on foraging behaviour in a unique way that would otherwise be very difficult to do. Martin Hall spoke about forensic entomology and how insects can be employed in the criminal justice system to help convict criminals. I imagine that must be satisfying work! Listening to these talks really impressed upon me the huge diversity of insects out there, and that we are only just beginning to exploit them to our own ends.

After such an exciting and thought provoking morning, it was

high time to head off to lunch a little early to beat the crowds. We were greeted by a huge table full of very nice buffet food, with jelly for dessert. One delegate commented that they hadn't had jelly since their 6<sup>th</sup> birthday party!

After lunch, there were more talks, followed by coffee and posters. There were around 32 poster presentations on a wide variety of subjects, from air entrainment devices to gene silencing technology for insect vectors of disease. Everyone presenting a poster did very well at manning their poster, despite the temptation to sneak off and have some of the lovely pastries that were offered with the coffee. Soon after the poster session was the President's wine reception – some protested it was a little early to be drinking at 4.40pm in the afternoon, but soon got in the 'spirit' of things when the first bottle was opened! Thank you very much to the President for hosting this event, and providing the wine. After sufficient refreshments had been taken, delegates then headed to dinner.

After dinner, it was time for the first RES student event (fanfare please). Duncan Allen, Toby Fountain, Nina Stanczyk, and myself are the postgrad reps for the RES and we were very keen to make sure all the students felt welcome in the society, and knew other students at the conference, as it can often be a little daunting arriving on your own. So, on Monday evening, the 4 of us managed to round up about 30 students (and 1 post-doc) and we headed to the beach. This was a really good opportunity to get to meet the other students, and judging by how many people turned up we weren't the only ones that thought an event of this type was useful. I personally also had an extra reason to try to get everyone together: I am organising the next RES PG Forum, and I wanted to make sure that as many people as possible know about it, so we can build on previous conferences to make this one the best so far! I got some good responses from people so I'm quite hopeful... We then headed to the Pub on the Pond in the park next to the University. I think it worried the locals a little when they

saw 30 students heading towards them, as they must have been thinking that they'd only just got rid of them all at the end of term. We managed to placate them by sitting outside by the pond, and actually they were very friendly when they realised we weren't there to cause trouble! As we chatted some of us noticed the mini golf and pedalos next the pub, and it was decided that there would be a student golf tournament for all those that were not able to go on the morning trip to the botanic garden. I'm sure I speak for all the reps when I say that this evening event went much better than we could have hoped for, and gave a real sense of community to the student body of the society. We would really like to have another student event at Ento'11, so please watch out for news about that, or let us know if you have any suggestions of things you'd like to do or find out about. You can also join our Facebook group (RES PostGrads) to keep updated with the news and upload your Ento '10 photos.

The next day I headed down to the crazy golf course with some of the other students, though I think we may have been a little keen! We'd heard that the course opened at 10.30am, and of course we got there a little earlier than that to beat the queues, but then had to wait around for the person running the course to get everything set up. After waiting for what we seemed like an age we finally headed towards the course, and the anticipation was tangible. The 6 of us played 18 holes with various levels of difficulty and obstacles, ranging from a humpback bridge, to a ferry boat, to what looked like plastic triangles of cheese. At the end, the scores were added up and I can exclusively announce that the winners of the student crazy golf tournament 2010 were Alex Dittrich and Louise Cuttiford with a joint score of 46. Hurrah! We don't need to mention who came last...

Strangely, some people managed to resist the lure of the student golf tournament and headed off to the National Botanic Garden of Wales instead. Upon arrival, delegates were given 3 options: 1) moth trapping, 2) bee garden, 3) guided



Moth and bee trapping at the botanic gardens.

the gardens. Three moth traps had been set up around the gardens, 2 mercury vapour lights, and one UV tube trap, and we are very grateful to Chris Mabley for doing this for us. There were lots of elephant hawkmoths, buff tips, large yellow underwings and drinker moths in the traps. The highlights were the bordered beauty in the UV tube trap, and the scarce burnished brass in one of the mercury vapour light traps, which was the first record of this species for the area. Apart from the entomologists, there was also a baby robin that was eager to see what had been caught in the moth traps, as it kept trying to eat the moths while Chris was taking them out of the traps. The robin then waited until everyone had gone, and managed to pinch a moth and flew off with it. The group that went to see the bees also had an exciting morning, as a bee swarm was found on a silver birch. A bee keeper lady in a full beekeeper's outfit lopped the branch off the tree and put it in a willow basket called a skit, and then proceeded to smoke out the rest of the bees. The botanic gardens were set in a rural location, and were an entomologists paradise, with dragonflies around the pond, nice views across the valleys, and the great greenhouse was most impressive – it was a Mediterranean habitat with many different plants, and fitted nicely with the applied entomology theme of the meeting as thrips from Koppert were used for biocontrol of pests in there, along with pheromone traps.

After the excitement of the morning everyone headed back for a buffet lunch, before going to more talks. Tuesday afternoon's sessions were on general entomology, pest

control, and vaccines. The highlights for me were Dr. Remy Ware's talk on native natural enemies of the harlequin ladybird (*Harmonia axyridis*), as studying how native British parasites are adapting to using this invasive species as a host is a fantastic way to see evolution in action. It is also a great way to get members of the public involved in scientific research, as a survey has been set up to allow them to make their own observations of ladybird pupae to see whether any natural enemies emerge, and Remy, along with collaborators, has worked hard to ensure this citizen science project is successful, and that the results feedback to the public, so they can see that their efforts have been worthwhile. Also, Nina Stanczyk gave an interesting talk about the behavioural insensitivity of *Aedes aegypti* mosquitoes to DEET. Although DEET has been used as a repellent for a long time, we are only just beginning to understand how it works.

The next plenary lecture was delivered by Dr. Sharmila Bhattacharya, a scientist from NASA! Sharmila spoke to us about how insects can be used in a space environment, and as their immune systems are well understood, insects can be used to look at the effect of space travel on physiology, which will hopefully allow scientists to understand the effect of space travel on astronaut's bodies. I found this talk to be fascinating, as I have always been interested in space travel and the universe, and I had no idea that insects were regularly being sent up to space for experiments – it sounds like a very cool job. In fact, insect experiments in space have been going on since

the 1960s, to look at longevity, aging, behaviour, development, and gene mutation rates. Studies are only limited by the number of flights that are going up, which unfortunately could be decreasing due to budget cuts. It seems that space flights are seen as a luxury by some people! Sharmila spoke to us about two projects that she had been involved with. Firstly, she has looked at immune changes shown by *Drosophila* due to space flight. Astronauts exhibit immune changes when returning to Earth, for example, in phagocytic activity, cytokine levels, and leuokocyte proliferation, so *Drosophila* can be useful to help us understand what is going on, because its biology is well known. Several populations of *Drosophila* were sent up to space, and compared with the same experimental set up of populations that remained on the ground. There were changes in gene expression in the *Drosophila* that experienced space flight, and this was similar to those found in humans, including decreased expression of a gene encoding an antimicrobial peptide. A decrease in fat body content was also found, which is important as it produces proteins involved in the immune response. *Drosophila* sent up to space also experienced lower population numbers, lower emergence of pupae, and reduced larval phagocytosis. Interestingly, the life stage of an insect when it experiences space flight is important, as it affects how they can cope with it. If an insect goes into space before it pupates it is better able to cope with it, as compensation may occur in the body, during the changes that it undergoes during pupation on the



ground. It is vital to understand the pathways involved in the molecular changes that occur during space flight, due to the lack of available medical help - if an astronaut gets ill on a long mission it can be catastrophic. Sharmila also spoke about the use of stick insects to understand the combined effect of radiation and microgravity on the body. This can lead to larval abnormalities, when experienced during the early stages of embryonic development, though again, it is dependent on life stage, as if the insects pupate in space but eclose on the ground it seems that they can 'repair' these abnormalities during development. The effect of radiation has also been found to be reversible through the activity of *wnt5* in the mushroom body (equivalent to the insect's hippocampus). The *wnt5/ catenin* pathway is important for patterning of the body during development, and regulates stem cell activity so allows damaged areas of the mushroom body to repair themselves. Sharmila finished up by stressing how understanding genetic and molecular changes occurring during space flight help increase our understanding of space biology. After this talk, I will never quite look at fruit flies the same way, knowing that their brethren are being sent up to space!

After the plenary we were then lead to two bee hives that had been set up just outside the biology building, where we were treated to the first concert of the Bee Choir. This was not a group of specially trained bees, but a group of local residents who wanted to express their concern at the declining bee population. It was definitely, shall we say, a unique experience to hear people singing to the bees, though where I was standing a wasp started to get very agitated at the sound – perhaps he was jealous that the bees were getting all the attention! Hmmm...

It was then time for a quick change before the conference dinner. We were served mushroom soup, followed by roast beef and Yorkshire puddings, then panacotta. This was followed by the prize giving, where honorary fellowships of the Society were presented to Prof. Chris Haines, Prof. Janet

Hemingway and Prof. John Pickett. Dr. Remy Ware received an award for the best paper in the Ecological Entomology journal, and Louise Cuttiford received £300 and a book on forensic entomology for her winning student essay on the same subject. Finally, Dr. Roger Keys was presented with £1,000 for his work on insect conservation, which he graciously said he would use to buy more equipment for his work. Then it was time for the long awaited ceilidh to begin! Despite initial reluctance, the ceilidh band eventually managed to get sufficient entomologists to pair up and start dancing. A great time was had by all, though the lady trying to teach us how to do the dance steps certainly had her work cut out for her!

Wednesday started with two plenary lectures, the first given by Prof. Eloi Garcia on the innate immune systems of insects, and how our knowledge of its function is increasing, but there is still much we do not know about cellular immune reactions to the microorganisms that can survive in insects. Prof. John Pickett then spoke about the exciting stories that unravel when you combine entomology and chemistry. For example, by combining electroantennography with gas chromatography you can look at the response of single neurons to pheromones, and identify chemical components that illicit physiological activity. This work is increasing our understanding of olfaction. Bees can also be trained to associate a smell with a reward, and this is used by a company called Inscentinal, so that bees can be used to detect pheromones at Heathrow airport. Chemical ecology can also help us understand the mechanisms underlying repellents. For example, the Theatrum Botanic of 1640 talks about the use of citrus for repellents, but it is only recently that we have begun to understand why, and how, they work.

The plenaries were followed by a further session on general entomology, and one on biocontrol. Richard Shaw spoke about control of Japanese knotweed, by introducing a Japanese psyllid that feeds on the plant and could keep it under control in the UK. The psyllid

has been released at two sites already, but its effect on native British species is unknown, and the biology of the psyllid seems to be poorly understood. For me, this brings to mind a cautionary tale I was taught as an undergraduate about the introduction of carnivorous snails to an island in the south pacific to control giant African lands snails, which were themselves introduced to the island. Unfortunately, the carnivorous snails predated on the native *Partula* snails instead, leading to them now becoming threatened species. This teaches us to be careful about purposely transporting species without knowing what impacts they might have, and has been seen with other species, such as the harlequin ladybird, but Richard seems confident though that if anything were to go wrong with the psyllids it would be possible to easily remove all of them from the test site.

Further sessions in the afternoon covered surveillance, monitoring and management, pests, and immunity. It covered topics from James Schofield's talk on using the sounds larvae make to identify whether imported wood might be infected with wood-boring beetles, to Dr. Steven Sinkins talk on the effect of *Wolbachia* infection on mosquito immunity.

After the last talk, Stuart Reynolds gave out the student prizes. The prizewinners for the best poster were: 1st) David Prince, 2nd) Asgar Mohammed Beigi, 3rd) Vicky Hunt. The best talk prizes went to: 1st) Emma Weeks (for the 2nd year running), 2nd) Elizabeth Franklin, 3rd) Jennie Garbutt. During our student event we spoke about also giving two unofficial prizes. One went to Remy Ware for best talk title, as it works on several levels (Alien versus predator (or parasite): interactions between the invasive coccinellid *Harmonia axyridis* and native natural enemies), and one to James Logan, for best dressed speaker! Congratulations to all prize winners.

The very last item on the meeting agenda was for next year's organisers to tell us about the next meeting, Ento '11, which will be held at the Natural Resources Institute at Chatham Maritime,

which is part of Greenwich University. Ento '11 will run from 7th-9th September next year.

This year's meeting was really fantastic, and I'm sure I'm not the only person to be heading back to work with a brain buzzing with ideas. On my way home, I was also reminded that what we all do does not just concern us academics, but has further repercussions, as I heard the meeting mentioned on Radio 4's Material World, with particular

focus on the plight of the bees. Norman Carreck spoke to Quentin Cooper about colony collapse disorder and summarised the research that was presented to us, along with some coverage of the bee choir. I think it's vital for us to publicise our work, and ensure that we communicate with the public about what we are doing.

I would just like to finish by saying a huge thank you to the organisers for arranging such a

fantastic meeting with a diverse array of topics. Diolch yn fawr!

#### Acknowledgements

I would like to thank Dr. Remy Ware who filled me in on events at the Botanic Garden while I was at the student golf tournament, and also to everyone who attended the conference, particularly the students, for making it a trip to remember.

## Moth Trapping

Chris Manley

National Botanic Gardens of Wales. Night of 26/27 July 2010  
Humid, 18 degrees @ 7 am. 2 x 125 mv lamps, 1 x 40 w actinic

Log. No.	Taxon	Vernacular Quantity	Log. No.	Taxon	Vernacular Quantity	
453	<i>Ypsolopha dentella</i>	Honeysuckle Moth	1	1981 <i>Laothoe populi</i>	Poplar Hawk-moth	4
658	<i>Carcina quercana</i>		2	1981 <i>Laothoe populi</i>	Poplar Hawk-moth	4
706	<i>Agonopterix nervosa</i>		1	1991 <i>Deilephila elpenor</i>	Elephant Hawk-moth	7
1002	<i>Lozotaenia forsterana</i>		1	1994 <i>Phalera bucephala</i>	Buff-tip	3
1036	<i>Acleris forsskaeana</i>		1	2003 <i>Notodonta ziczac</i>	Pebble Prominent	4
1126	<i>Ancylis badiana</i>		1	2008 <i>Ptilodon capucina</i>	Coxcomb Prominent	2
1293	<i>Chrysoteuchia culmella</i>	Garden Grass-veneer	6	2011 <i>Pterostoma palpina</i>	Pale Prominent	3
1294	<i>Crambus pascuella</i>		2	2035 <i>Thumatha senex</i>	Round-winged Muslin	2
1303	<i>Agriphila selasella</i>		1	2037 <i>Miltchrista miniata</i>	Rosy Footman	1
1313	<i>Catoptria pinella</i>		2	2044 <i>Eilema griseola</i>	Dingy Footman	20
1334	<i>Scoparia ambigua</i>		2	2050 <i>Eilema lurideola</i>	Common Footman	1
1354	<i>Cataclysta lemnata</i>	Small China-mark	4	2064 <i>Phragmatobia fuliginosa</i>	Ruby Tiger	10
1388	<i>Udea lutealis</i>		1	2102 <i>Ochroleura plecta</i>	Flame Shoulder	5
1390	<i>Udea prunalis</i>		4	2107 <i>Noctua pronuba</i>	Large Yellow Underwing	75
1392	<i>Udea olivalis</i>		1	2112 <i>Noctua interjecta</i>	Least Yellow Underwing	4
1398	<i>Nomophila noctuella</i>	Rush Veneer	1	2127 <i>Xestia ditrapezium</i>	Triple-spotted Clay	2
1405	<i>Pleuroptya ruralis</i>	Mother of Pearl	4	2128 <i>Xestia triangulum</i>	Double Square-spot	4
1439	<i>Trachycera advenella</i>		1	2130 <i>Xestia baja</i>	Dotted Clay	3
1640	<i>Euthrix potatoria</i>	Drinker	9	2155 <i>Melanchnra persicariae</i>	Dot Moth	3
1648	<i>Drepana falcataria</i>	Pebble Hook-tip	1	2160 <i>Lacanobia oleracea</i>	Bright-line Brown-eye	6
1653	<i>Habrosyne pyritoides</i>	Buff Arches	3	2176 <i>Cerapteryx graminis</i>	Antler Moth	4
1702	<i>Idaea biselata</i>	Small Fan-footed Wave	4	2193 <i>Mythimna ferrago</i>	Clay	3
1708	<i>Idaea dimidiata</i>	Single-dotted Wave	3	2198 <i>Mythimna impura</i>	Smoky Wainscot	10
1713	<i>Idaea aversata</i>	Riband Wave	2	2199 <i>Mythimna pallens</i>	Common Wainscot	4
1722	<i>Xanthorhoe designata</i>	Flame Carpet	1	2289 <i>Acronicta rumicis</i>	Knot Grass	6
1724	<i>Xanthorhoe spadicearia</i>	Red Twin-spot Carpet	3	2311 <i>Ipimorpha retusa</i>	Double Kidney	6
1725	<i>Xanthorhoe ferrugata</i>	Dark-barred Twin-spot Carpet	1	2318 <i>Cosmia trapezina</i>	Dun-bar	5
1738	<i>Epirrhoe alternata</i>	Common Carpet	3	2321 <i>Apamea monoglypha</i>	Dark Arches	9
1755	<i>Eulithis testata</i>	Chevron	2	2322 <i>Apamea lithoxylaea</i>	Light Arches	2
1759	<i>Ecliptopera silaceata</i>	Small Phoenix	11	2326 <i>Apamea crenata</i>	Clouded-bordered Brindle	1
1777	<i>Hydriomena furcata</i>	July Highflyer	4	2335 <i>Apamea scolopacina</i>	Slender Brindle	4
1803	<i>Perizoma alchemillata</i>	Small Rivulet	3	2336 <i>Apamea ophiogramma</i>	Double Lobed	2
1807	<i>Perizoma albulata</i>	Grass Rivulet	1	2341 <i>Mesoligia furuncula</i>	Cloaked Minor	8
1835	<i>Eupithecia tripunctaria</i>	White-spotted Pug	1	2343 <i>Mesapamea sp.</i>	Common/Lesser Common Rustic	10
1858	<i>Chloroclystis v-ata</i>	V-Pug	3	2360 <i>Amphipoea oculaea</i>	Ear Moth	1
1860	<i>Pasiphila rectangulata</i>	Green Pug	2	2361 <i>Hydraecia micacea</i>	Rosy Rustic	2
1862	<i>Gymnoscelis ruffasciata</i>	Double-striped Pug	3	2379 <i>Coenobia rufa</i>	Small Rufous	1
1887	<i>Lomaspilis marginata</i>	Clouded Border	1	2389 <i>Paradrina clavipalpis</i>	Pale Mottled Willow	1
1906	<i>Opisthographis luteolata</i>	Brimstone Moth	7	2435 <i>Diachrysis chryson</i>	Scarce Burnished Brass	1
1907	<i>Epione repandaria</i>	Bordered Beauty	1	2441 <i>Autographa gamma</i>	Silver Y	2
1917	<i>Selenia dentaria</i>	Early Thorn	2	2443 <i>Autographa jota</i>	Plain Golden Y	2
1919	<i>Selenia tetralunaria</i>	Purple Thorn	2	2450 <i>Abrostola tripartita</i>	Spectacle	2
1921	<i>Crocallis elinguarina</i>	Scalloped Oak	7	2469 <i>Scoliopteryx libatrix</i>	Herald	1
1931	<i>Biston betularia</i>	Peppered Moth	3	2474 <i>Rivula sericealis</i>	Straw Dot	2
1947	<i>Ectropis bistortata</i>	Engrailed	2	2477 <i>Hypena proboscidalis</i>	Snout	3
1956	<i>Cabera exanthemata</i>	Common Wave	2	2484 <i>Schrankia costaestrigalis</i>	Pinion-streaked Snout	1
1961	<i>Campaea margaritata</i>	Light Emerald	1	<b>Total moths, approx.</b>		<b>380</b>

1



2



3



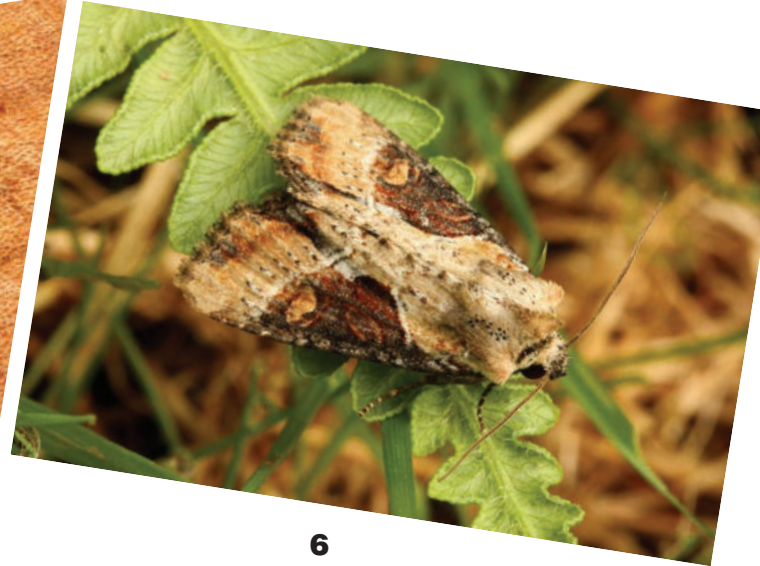
4



5



6



7



Selection of moths caught on 26/27 July 2010,  
National Botanic Gardens of Wales.

1. Drinkers f. & m.
2. Bordered Beauty.
3. Antler
4. Slender Brindle.
5. Engrailed, melanic, ab.
6. Double Lobed
7. Scarce Burnished Brass

# ENTO '10

Swansea University 26th – 28th July 2010

## **Emma Weeks**

Chemical Ecology Group  
Biological Chemistry Department  
Rothamsted Research

This year's annual meeting of the Royal Entomological Society was held at Swansea University in South Wales. ENTO '10 was organised by Miranda Whitten, Alyson Bexfield, Ed Dudley and Norman Ratcliffe. The meeting comprised of a fantastic scientific programme, with over 200 delegates and presenters from laboratories across the world. Whilst this year's meeting had no formal symposia the meeting definitely had a theme, 'the challenges and applications of entomology in the 21<sup>st</sup> century'. In particular, exploring the use of beneficial insects and alternative methods for control of pest species. Unlike many past meetings attended mostly by academic delegates, this meeting involved a broader spectrum of entomologists, for example, those from industry were unusually well represented. Networking was promoted to the highest degree, as well as a trip to the botanical gardens, poster session, presidents wine reception and conference dinner there was also a 1-2-1 networking workshop, defined in the programme as "the entomologist's equivalent of speed dating!" The workshop, which was organised by Allancia and sponsored by the Natural Environment Research Council (NERC), offered a more structured approach to networking through the organising meeting of delegates with the aim of exploring potential collaborations or partnerships.

### **Monday 26th July**

The meeting was officially opened by the Vice Chancellor of Swansea University, Richard Davies and RES President, Stuart Reynolds. The vice chancellor spoke of not feeling guilty for taking the time out of research to attend conferences. He reminded the delegates that without the networking that undoubtedly occurs at conferences, few collaborations would ever be

formed, which would have a detrimental effect on the impact of our research.

The first plenary lecture was given by Norman Ratcliffe, a professor of Swansea university and a meeting conveyor, on "Natural products and processes from insects: raising the profile of beneficial species". Norman's talk covered various examples where insects or insect products have or will in the future be used to benefit humans, for example, the use of honey to enhance tissue repair or the development of insect antimicrobial peptides as drugs to treat human diseases. Norman talked in depth of his work with maggots and maggot therapy (MT), for improved wound healing and of the more recent developments involving isolation of the protective products from maggots as part of the project 'Natural products CYMRU (Cynhyrchion Naturiol Cymru)'. Norman retires this year and following his talk he was presented with a retirement gift, however, he, like most scientists after retirement, will remain active in research for many years to come and has accepted a fellowship to continue his work in Brazil.

### ***Semiochemicals and exploiting insects and novel products***

Following the plenary I attended the first of two 'Semiochemical' sessions, which was chaired by John Pickett of Rothamsted Research. The session included talks by two invited speakers, Owen Jones from AgriSense BCS Ltd and James Logan (Rothamsted Research). Owen revealed the recent advances in the use of sex pheromones for monitoring and control of pest moth species. Owen's talk gave valuable insight into the difficulties with formulating and deployment of volatile chemicals, such as pheromones, that manufacturers of

these technologies face. After Owen, James Logan gave his talk on the use of such technology for management of haematophagous insects. James discussed the research being completed in this area at Rothamsted Research with emphasis on the phenomenon of host and non-host interactions, citing examples of his work with tsetse flies, mosquitoes and midges. James also informed us that stress could be one of the factors that could make a person less attractive to mosquitoes than others. I then joined the 'Exploiting insects and novel products' session that was chaired by Yamni Nigam of Swansea University. The talks in this session were all invited talks on the subject of beneficial insects, the first of which was given by Arnold van Huis of (Wageningen University) on "Edible insects: food for thought?". Arnold advocated the need for the western world to consider the introduction of insects into our diets, ideally directly, but potentially indirectly through feeding of livestock on insect diets or extraction of insect protein for incorporation into food. Later in the session, Martin Hall (Natural History Museum) presented another unusual topic, the use of insects in forensic science. In his talk "Fly on the wall – exploiting insect evidence in criminal investigations", Martin discussed the research that is being done at NHM to improve the ability of forensic entomologists to estimate accurately the time of death in criminal investigations. The other two talks in the session were on MT. First, John Church of Zoobiotic, a dedicated fly culture laboratory in nearby Bridgend, talked of maggot debridement therapy (MDT) or the removal of decomposing tissue using fly larvae. In particular, he discussed areas of research into MDT that enhanced knowledge is vital, for example, the investigation of the enzymes that

maggots use to inhibit biofilm formation during MT. Recent research into this topic was then discussed by Llinos Harris (Swansea University). Llinos presented her work on the identification of factors present in the secretions of *Lucilia sericata* larvae that are capable of disrupting *Staphylococcus epidermidis* biofilms.

### **Semiochemicals and biocontrol**

After lunch, I attended the second 'Semiochemical' session (Chair: John Pickett, Rothamsted Research). David Hall of the Natural Resources Institute (NRI) gave his invited talk "Sex pheromones of plant feeding midges". To the delight of the few chemists in the audience, David focused on the characteristics of midge pheromones and patterns that can be seen in their chemical structures. I then gave my presentation of the research I have completed during my PhD on the chemical ecology of the common bed bug, with the view to identify pheromones that could be used to attract these insects into monitoring devices or traps. Swansea is a university close to my heart as it is where I first discovered my passion for entomology, so the opportunity to present back where I started was something I really appreciated and I would like to thank the RES for the funding that made it possible. Alan Cork, also from NRI, followed me with the use of pheromone-based IPM technology for control of the eggplant fruit and shoot borer, as an alternative to GM eggplant. After Alan's talk I switched sessions in order to see the contributed talk by Minshad Ansari (Swansea University) in the first 'Biocontrol' session, which was chaired by Willem Ravensburg of Koppert Biological Systems. Minshad discussed the potential for the use of entomopathogenic fungi (*Metarhizium anisopliae*) for control of *Culicoides* midges. In his laboratory studies, Minshad has shown 100% infection of adult midges with the fungus and a significant reduction in longevity and survival post-infection.

### **Posters and networking**

The poster session, followed by the RES Presidents wine reception, gave

the delegates ample opportunity to view the 30-40 excellent posters on display. Running simultaneously was the 1-2-1 networking workshop. Prior to the conference, meetings had been selected and a timetable had been sent to all participants. Armed with this list, delegates were able to make sure they were seated at the correct table for their meetings, which could be anything from networking for collaborations, to looking for industrial partners for commercialisation of research or even just catching up with old acquaintances. Walking amongst the tables I overheard all sorts of conversations most of which seemed to be profitable and useful. For example, one of my meetings was with a fellow student of chemical ecology and although I was unable to give him any specific advice having little knowledge of his ecological system, I was able to put him in contact with a colleague that had worked with that species earlier in her career and who was able to help him. Despite being a structured system involving a high degree of organization, the workshop ran very smoothly and I think gave people a new experience.

### **Tuesday 27th July**

#### **National Botanical Garden of Wales**

Tuesday morning got off to a nice start with a trip to the National Botanic Garden of Wales ([www.gardenofwales.org.uk](http://www.gardenofwales.org.uk)). At least 50 delegates participated on this visit to the 560 acres of wonderful gardens, set in the Welsh valleys, in the former site of Middleton Hall. The garden is relatively young (in botanical garden terms), at just ten years but despite this, the 8000 different plant varieties are well established and flourishing. Probably due to the fact that at the garden they concentrate on planting only those species that are able to grow in the particular microclimate characteristic of South Wales, such as those from the cool temperate regions of Chile and the Western Himalayas. Our designated tour guide took us around the grounds pointing out the many features of the gardens. The double walled garden was fantastic, ordered to represent evolutionary linkage

rather than plant types, the gardens were just as much a science lesson as they were beautiful. All around the site evidence of outreach activities and involvement with children and schools is evident. In one corner of the double walled garden is an area that local schools can rent out as small allotments for growing fruit and vegetables and just outside, a den making area for children. We were lucky enough, before entering the double walled garden, to see a bee swarm. This was something that many of us had never seen before. A queen bee leaves an overcrowded hive to find a suitable home for a new colony. Whilst waiting for the scouts to locate somewhere, the queen waits surrounded by a protective swarm of worker bees as a superorganism and in this case, luckily for us, she waited in a tree close to the path. Also, to the delight of the lepidopterists amongst us, last night's moth trap was opened to display its species diverse catch. Our guide, a pest control expert, frequently pointed out problem areas where intervention was necessary. In particular, in the greenhouses where biocontrol agents were used to control all manner of pest organisms to protect the exotic species growing there. This garden promises to go from strength to strength, with plantations up on distant hills of tree species from temperate countries (Woods of the World) acting as a gene bank for the future and new areas opening up all the time as they expand to fill their borders.

#### **Pests, emerging pests and their control**

We returned at lunchtime, reluctant to leave the beautiful gardens but eager to get back to the conference. In 'Pests, emerging pests and their control I' chaired by Janet Hemmingway (LSTM), the first invited talk was given by Jolyon Medlock of the Health Protection Agency (HPA). Jolyon explained how, at the HPA, they use ecological and entomological approaches to inform public health policy and risk assessments of emerging vector-borne zoonoses. In particular, Jolyon discussed the impact of climate change and how he believes the greatest impact of all will be due to

these changes in climate and the need to understand the affect of these changes on the spread of vectors and the diseases they transmit. The second invited speaker, Flaminia Catteruccia of Imperial College, spoke of the molecular basis of *Anopheles gambiae* reproductive biology and its potential for control through manipulation of female fertility. In particular, she spoke of work completed in collaboration with Miranda Whitten, one of the meeting conveyors, on the mating plug of Anopheline mosquitoes and the ultrastructural changes that occur in the female post-mating. The molecular basis of these changes has since been investigated at Imperial College and the results have been verified in two strains of field mosquitoes in Burkina Faso. This talk was followed by three contributed talks, Sophie Pointeau (Université d'Orléans), Nina Stanczyk (Rothamsted Research) and Andrew Crossthwaite (Syngenta Crop Protection Research). Sophie discussed the potential for poplar strains that are resistant to feeding damage caused by the poplar woolly aphid (*Phloeomyzus passerinii*). Using electrical penetration graphs (EPG), Sophie showed that both antibiosis and antixenosis are involved in host tree resistance to the aphid. Nina then moved on to talk about *Aedes aegypti*, the dengue and yellow fever mosquito, and its behavioural insensitivity to the repellent N,N-Diethyl-m-tolumide or DEET, as its more commonly known. During her PhD, Nina has shown that insensitivity to DEET is a dominant, genetically determined trait and using single sensillum recordings she has demonstrated that this is due to changes in sensillum function in the mosquito antennae. Finally, Andrew moved back to phytophagous insects, focusing on insecticide

resistance. Andrew discussed work using a radioligand based approach to try and understand the potential for diamide-type insecticides to be used in aphid control.

### Vaccines

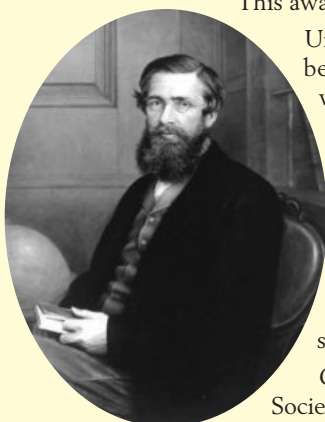
The 'Vaccines' session, which was chaired by Pat Nuttall (Centre for Ecology and Hydrology), consisted of four invited talks. Firstly, Marcelo Jacobs Lorena (John Hopkins) discussed the progress that has been made towards an anti-malaria vaccine. Currently the most likely candidate is Anti-AgAPN1. In field trials in Cameroon this vaccine has decreased transmission of *Plasmodium falciparum* and *P. vivax* with local parasites and mosquitoes. Additionally, in Thailand, using the same vaccine, inhibition of *P. vivax* transmission by *Anopheles dirus* has been demonstrated. Promising results from the field! Marcelo's final slide contained an advert for a Gordon Research Conference in Texas (March 13-18<sup>th</sup> 2011), Tropical infectious diseases: from bench to field. Marcelo was followed by Jesus Valenzuela (NIAID, NIH) and his talk "Vector-based salivary vaccines: a neglected component of a neglected disease." Using reverse antigen screening of 35 candidate molecules in dogs, 2 antigens were selected. Dogs that were immunised with these antigens have shown enhanced immune responses when challenged with Leishmania. Field trials of this vaccine for canine Leishmania will soon be completed in Brazil. Pat Nuttall then gave a talk in her own session. Pat's talk on the development of transmission-blocking anti-ectoparasitic vaccines focused mainly on the development of an anti-tick vaccination. As with sandflies and Leishmania, progress has been made with vector saliva. As many arthropod-borne pathogens exploit the

pharmacological properties of their vectors saliva, vaccines developed against salivary proteins could have detrimental affects on both the vector and the pathogen. Proteins isolated from the tick cement cone (i.e. 64TRP) when tested in mice have been shown to decrease tick attachment, feeding, longevity and also virus transmission (Tick-borne encephalitis) and ultimately increase host survival. Additionally, these proteins have been found to occur in many tick species and other vector species (e.g. mosquito). Finally, the last talk of the session was given by Cicero Mello (Universidade Federal Fluminense) on transmission blocking effects of antiserum for *Rhodnius prolixus* perimicrovillar membranes.

### Conference dinner

That evening, the plenary lecture "Using fruit flies to evaluate the space flight environment" was given by Sharmila Bhattacharya from NASA Ames Research Center. Sharmila gave us an insight into a unique use of *Drosophila melanogaster* to evaluate the impact of the space environment on the physiology of insect and human astronauts. The effect of microgravity and radiation on immunity and development of fruit flies was discussed with respect to improving the safety of human space exploration. The evening plenary was followed by a slightly unusual visit to the bee hives. Swansea University has two honey bee hives and throughout the summer a Bee Choir is singing to them "For the bees" a song of will in a time of environmental crisis. The delegates were lucky enough to catch the choir's performance that evening. "For the bees" is part of the world-wide celebrations of the International Year of Biodiversity.

# Wallace Award



This award is made annually for postgraduate work leading to a Ph.D degree, with no age limit.

University supervisors are now invited to nominate postgraduate students who have been awarded their PhD during the academic year October 2009 – September 2010, and whose work they considered to be exceptional. The research involved should be a major contribution to the science of entomology. The assessment will be based on the candidate's thesis, plus a one-page submission from the candidate explaining in layman's language how his or her work has "moved entomological science forward"

Nominations should be sent to the Registrar, on a form which is downloadable from the Society's website. The deadline for submissions for this year's Wallace Award is 1st October 2010. Applications should be routed through heads of department. Please do not send any theses or supporting documents until asked to do so by the Registrar.

Comparative assessment of the candidate's work will be done by a panel of Fellows of the Society, and the result will be announced in April 2011. The winner of the Wallace Award will receive a certificate plus a cash sum of £750, and one year's free membership of the Society.

The winner's university department will also receive a certificate. The winner will be invited to give a presentation of their work at an appropriate meeting of the Society.

## Ants and Epiphytes

### The 2008-2009 RES Wallace Award goes to Tom Fayle



One of the most hotly debated ecological topics in recent years, and one which is central to all studies of biodiversity and conservation, is the question of whether species require different niches in order to maintain their co-existence. Research into highly diverse insect communities can help to answer this question, and is particularly opportune when the habitats being studied are under threat. The Insect Ecology Group led by William Foster at Cambridge has an ongoing interest in the high levels of insect biodiversity in the tropical rain forests of South East Asia, and

has come to recognise that epiphytic bird's nest ferns (*Asplenium* spp.) provide an ideal model microcosm on which to focus such research, as highlighted in a 2008 article in *Antenna* (32(1): 34-37). The senior author of that article, Dr Tom Fayle, has now received the Society's Wallace Award, for the outstanding research that led to the award of his PhD degree in September 2009.

Tom Fayle concentrated his studies on the highly diverse ant communities utilising the decomposing mass of leaf litter that accumulates in bird's nest ferns. He found 71 species of ant from 27 genera in 87 ferns, with an estimated 414 ant colonies in every hectare of forest using the ferns as nest sites. A large fern could support up to 12 ant colonies. He demonstrated the existence of strong intraspecific and intrageneric competition, and used simulation-based species assembly models to show that these levels of competition were vital for the maintenance of the high ant diversity. When ferns cleared of their ants were left to recolonise naturally, the composition of the ant community changed with time,

indicating the existence of temporal niches. By sorting and identifying large numbers of canopy, leaf-litter and fern-dwelling ants from both forests and oil palm plantations he was able to show that, although the impact of habitat conversion was severe, the plantations and particularly their epiphyte communities supported more ant species than had previously been supposed. Encouraging the growth of epiphytes would therefore be one way of maintaining species diversity.

This year's entries for the Wallace Award were all of a particularly high standard, and on a wide variety of topics ranging from systematics of fossil Orthoptera to the chemicals that attract aphids to bean plants, so that the assessment panel had a difficult task in choosing between them. A special mention should perhaps go to Lee Haines, a strong runner-up for her innovative and highly significant contributions to several aspects of tsetse fly research.

Applications are now invited from supervisors of students being awarded their PhDs in the academic year 2009-2010 (see above box).

# National Insect Week – The Launch...

**Richard Harrington**  
(Rothamsted Research)



...or perhaps it should be the emergence, or the eclosion? National Insect Week is hemivoltine, with eggs being laid as the life of the previous adult comes to an end. The egg stage was quite protracted this time but the larval stage very rapid with the caterpillar gorging itself on a crop of great new ideas. The pupal stage was exceptionally short and the adult emerged resplendent at Butterfly World on a magnificent midsummer's day.

The stars of the event were the insects themselves, these being admirably presented to the media and guests by NIW Co-ordinator Chris Haines, NIW Advisor Roger Key, President Stuart Reynolds, a host of RES Fellows and Staff, NIW Partner Organisations and celebrities: RES Vice Patron Lord Selborne, One Show Presenter Mike Dilger, the inimitable Butterfly World Patron and Jolly Green Giant (the title of his autobiography) David Bellamy and, of course, Butterfly World's creator Clive Farrell.

After the opening speeches, held in the Education Centre (a building sponsored by the Society) Lord Selborne, David Bellamy and Clive Farrell were made Honorary Fellows of the Society for their unique and immense contributions to entomology, especially in relation to raising awareness to the public and politicians of the importance of insects.

A photo call followed, during which the Society's other contribution to Butterfly World, the giant ant sculpture, survived the escapades of the remarkably agile Dilger and Bellamy (who has written a ballet and looked as though he could perform in one).

The Society hosted an excellent lunch at the Mansion House before everybody dispersed to enjoy and contribute to NIW's week in the adult stage and produce the eggs that will lead to a fresh new specimen in 2012.







# Postgraduate Forum

## 2010 Report

Endcliffe Village, University of Sheffield  
3th - 4th February 2010

### **Toby Fountain**

Postgraduate Representative  
(t.fountain@sheffield.ac.uk)

Those who came to the 2009 PG Forum will recall the wintry conditions that delegates battled through in order to get to York. Here in Sheffield we are used to the perils of snow. Sheffield is a very hilly city and during the winter life can quickly become more akin to the South Pole than South Yorkshire and I had been worried that arctic conditions were to become a tradition of the forum. However, we remained optimistic and were rewarded with a cold but sunny start to the 2010 meeting. We once again experienced an excellent turnout with over 40 delegates attending, with 16 platform presentations and 14 posters covering a diverse range of topics in entomology and even a foray into limacology (the study of slugs).

The PG Forum gives the opportunity for students in all fields of insect science to come together and discuss their work in a friendly atmosphere. The first day consisted of two sessions of student talks and a poster session with the quality of both being exceptional. As the second platform presentation progressed however Sheffield became caught in the grips of a heavy snowstorm and as the day closed we were forced to battle our way back to the accommodation for overnight delegates. With the invited speakers due to arrive the next day I was panicking that they wouldn't make it. However, luckily the snow soon subsided and the second day got off without a hitch.

We were treated to another session of student talks and a poster session before this years invited speakers arrived. Each year the forum organisers give the event a theme with 2010's being 'Careers Outside of Academia'. We were extremely fortunate to get three great speakers, Myc Riggulsford, Dr Richard Lilley and Dr Richard Handley. Myc works as a science communications consultant. After working as a journalist he now operates his own consultancy 'The Walnut Bureau' and runs highly successful communications workshops with both NERC and University's across the country. Myc gave a very engaging and entertaining talk about the world of science journalism, potential career paths and how best to get your research into the public domain. Dr Richard Lilley is the director of Tracksys Ltd who offer solutions for behavioral research. His captivating talk focused on his career path after university including his navigation of the many opportunities and pitfalls accompanying life after completing a PhD. He finished his talk with an account of life in the private sector and how to make yourself as employable as possible. Rounding off this year's forum Dr Richard Handley from the Environment Agency gave an insight into the inner workings of the public sector and careers open to PhD graduates.

On behalf of everyone I'd again like to thank all those who came this year, especially those who presented and the external speakers. I'd also like to extend my thanks to Dr Archie Murchie and Prof Rod Blackshaw for judging the all the presentation and the RES for providing the prizes. In order to showcase the quality of this years symposium below are extended abstracts from the winners and runners up of both the poster and

### Poster: Runner Up

#### What will stop the invader? Dispersal barriers of the harlequin ladybird (*Harmonia axyridis*)

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Species invasions have wide ranging ecological and economic impacts, and are one of the greatest threats to biodiversity, agriculture and human health. Despite this, we do not understand why only certain species become successful invaders, what determines their success, and what impacts they have on other species. A major aim of invasion biology is to understand invasion success, and dispersal ability is a key life history trait that influences this. Understanding the dispersal ability of a species and what constitutes a barrier to dispersal is critical to predict the spread and potential impacts of an invasive species. Barriers to dispersal can be natural physical features, such as mountain ranges or bodies of water, or the result of anthropogenic change, such as road construction, deforestation or other forms of habitat fragmentation. Traditional methods for estimating dispersal can be difficult. For example, with mark-release-recapture (MRR) the chances of recapturing individuals can be low, extensive time in the field is often required, and it is particularly difficult to do over long distances. MRR also does not help us link dispersal to gene flow between populations, so molecular techniques

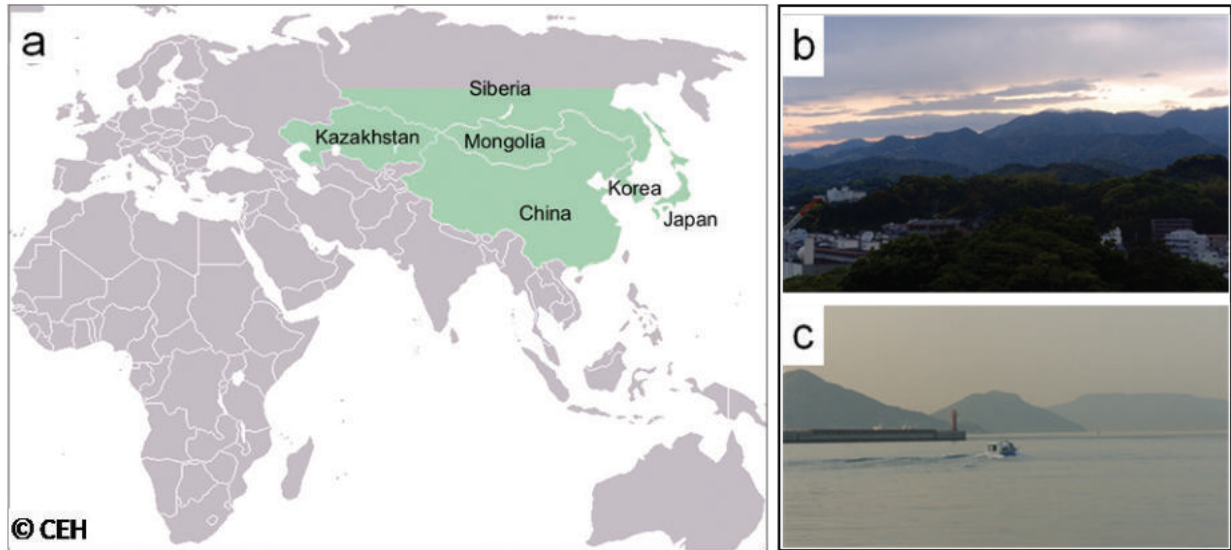


Figure 1. (a) The native range of *Harmonia axyridis*. (b) Mountain chains or (c) the sea may act as barriers to dispersal.

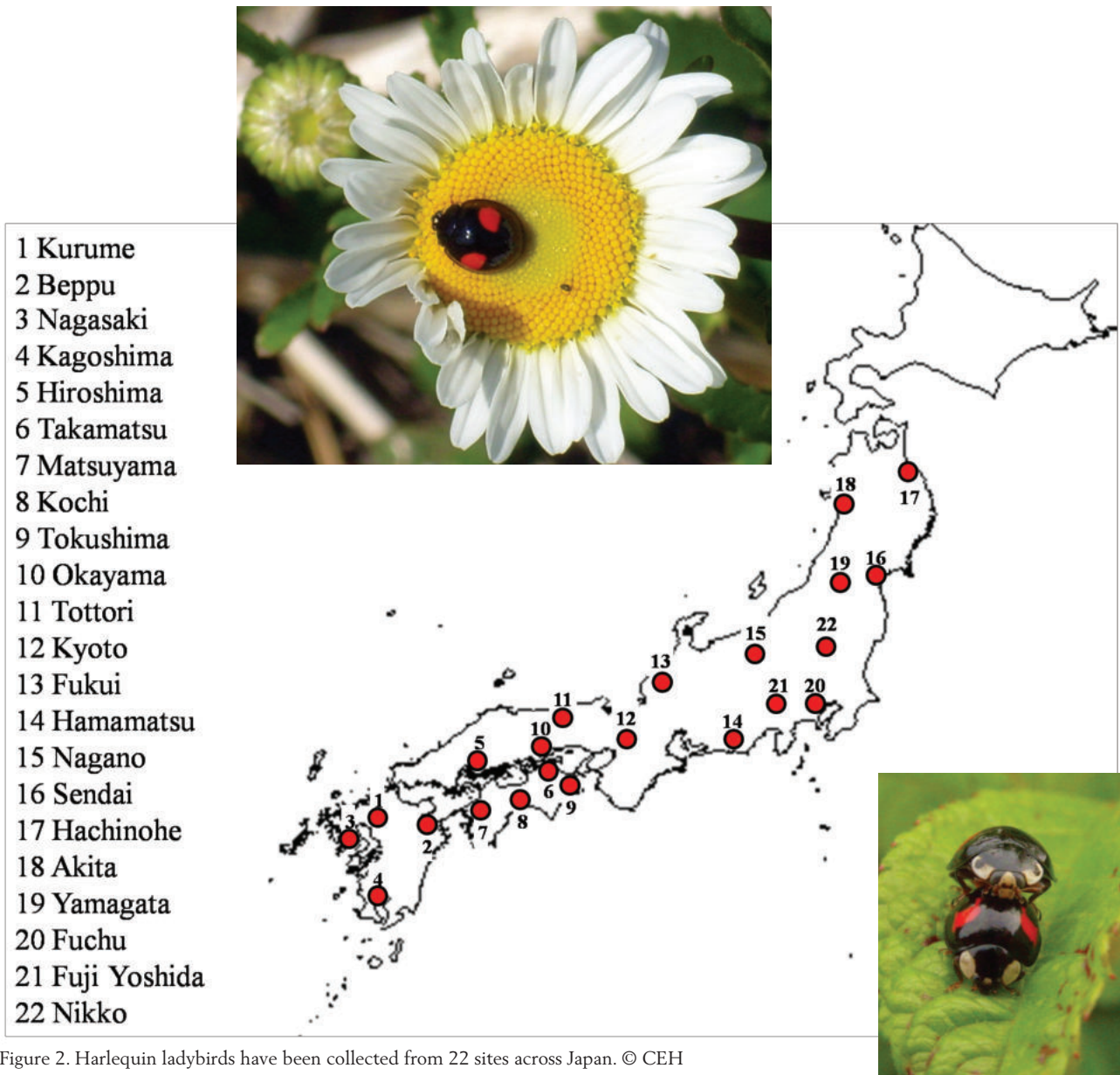


Figure 2. Harlequin ladybirds have been collected from 22 sites across Japan. © CEH

can be an attractive complementary approach. The recently developed field of landscape genetics<sup>1</sup> combines population genetics and landscape ecology, and allows us to identify migrant individuals and detect genetic discontinuities that arise from barriers to dispersal.

The harlequin ladybird, *Harmonia axyridis*, is rapidly becoming a model organism for studying biological invasions<sup>2</sup>, but very little is known about its dispersal ability. *H. axyridis* is native to Asia (figure 1), but is highly invasive in Europe, North America, and parts of South America and South Africa<sup>3</sup>. It has been used as a biological control agent of agricultural pests in North America and mainland Europe, but the species is now established in countries where there is no record of a deliberate introduction, and it is predicted to continue to spread<sup>2,4</sup>. Data from the UK-based Harlequin Ladybird Survey ([www.harlequin-survey.org](http://www.harlequin-survey.org)) indicates a spread of 58 km year<sup>-1</sup> northwards and 144.5km year<sup>-1</sup> westwards<sup>4</sup>. To gain a full understanding of the natural dispersal ability of the harlequin ladybird we must also investigate dispersal in native populations, where any restrictions to gene flow due to dispersal barriers should be easier to detect.

MRR studies suggest ladybirds frequently move over small distances<sup>5,6</sup>, however, less is known about long distance dispersal and nothing is known about dispersal barriers. In this study we aim to investigate dispersal in native Japanese *H. axyridis* populations, focusing on the role of natural physical features, geographic distance and climate. Given the spread rate of *H. axyridis* in its invasive range, we hypothesise there will be considerable dispersal in the native range with only major physical features acting as barriers. To test this, we collected over 1000 individuals from 22 sites across Japan, sampling either side of potential dispersal barriers (figure 2). These individuals are currently being genotyped at 18 microsatellite loci, and genetic data will be analysed in a geographical framework to incorporate landscape and environmental features. This will allow us to identify genetic discontinuities and estimate the amount of dispersal between populations. The results of this study will offer a unique insight into the dispersal ability of an invasive species in its native range. Our data will be combined with ecological data being generated by our collaborators, and incorporated into computer models to

help predict the spread and impact of the species in its invasive range.

#### Acknowledgements

We would like to thank everyone who assisted us during fieldwork in Japan, particularly Peter Brown, Hana Akiyama, Dr Satoshi Koyama, Dr Toshiyuki Satoh and Prof Yoshiaki Obara, and students at the Tokyo University of Agriculture and Technology, Japan. Also, the staff and students at the NERC Biomolecular Analysis Facility at the University of Sheffield for assistance with molecular work, and all members of the UK Ladybird Group for their advice and guidance throughout the project. We would also like to thank NERC, the Daiwa Foundation, The Genetics Society and the Royal Entomological Society for the funding that has made this study possible.

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## Transgenesis of the diamondback moth using the *piggyBac* transposable element

Sara Martins<sup>1,2</sup>, Neil Naish<sup>1</sup>, Neil Morrison<sup>1</sup>, Luke Alphey<sup>1,2</sup>

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The diamondback moth, *Plutella xylostella* L. (Lepidoptera:Plutellidae), is a widely distributed and damaging pest of wild and cultivated cruciferous plants, such as cabbage, broccoli and cauliflower. It is difficult to control, mainly due to widespread resistance to insecticides, so the development of new control measures is needed. Genetics-based control may provide new alternatives, for example the release of insects carrying a dominant lethal (RIDL<sup>®</sup>); in effect, genetic sterilisation to achieve the same result as the sterile insect technique (in which radiation-sterilised insects are mass-released to suppress the wild population). Genetic transformation (or transgenesis) – the insertion of exogenous DNA into the insect genome, is a key underpinning technology for any such approach.

Insect transgenesis has been successfully achieved by using transposable elements. These genetic elements, also called transposons, are sequences of DNA that move from place to place within the genome of a single cell and allow material to be inserted or relocated. One of the most commonly used transposons in insect transgenesis is *piggyBac*.

The transposable element *piggyBac* was originally isolated from baculovirus reared on cultured cells of the cabbage looper moth, *Trichoplusia ni* Hübner (Lepidoptera:Noctuidae). The *piggyBac* transposon is flanked by short inverted repeats that initiate non-replicative insertion into the DNA, mediated by an enzyme called transposase. Wild type ‘autonomous’ *piggyBac* elements encode their own transposase, but for insect genetic engineering defective ‘non-autonomous’ elements are used from which the transposase gene has been deleted and which therefore cannot catalyse their own transposition. The transposase binds to the *piggyBac* ends and catalyses the insertion of the transgene into a target sequence (TTAA) in the genome. Transposon-

bearing plasmids can be injected into embryos and transiently exposed to transposase. If, as a consequence, the transgene is inserted into the genome of the germ-cells, it can be passed to subsequent generations, leading to the production of a new, stable, transgenic line. The *piggyBac* transposon has been shown to mediate germline transformation of the silkworm (*Bombyx mori*), the pink bollworm (*Pectinophora gossypiella*), the red flour beetle (*Tribolium castaneum*), the sawfly (*Athalia rosae*), and several dipteran species.

In order to determine if the diamondback moth could be transformed, pre-blastoderm embryos were micro-injected with one or the other of two different DNA constructs (Table 1) containing different promoters and fluorescent marker genes: one construct (OX3441) has the *Hr5ie1* promoter driving the expression of a red fluorescent protein (DsRed) and the

other (OX4389) has the *Opie2* promoter driving the expression of a green fluorescent protein (ZsGreen). Both DNA constructs were flanked by *piggyBac* sequence and were co-injected with a source of transposase.

Transgenic individuals were found among the progeny of injected individuals, and showed expression of the fluorescent protein, which was easily detected under a fluorescent stereomicroscope (Figure 1).

These results represent the first germline transformation of diamondback moth. We are now attempting to transform the diamondback moth by  $\phi$ C31-mediated site-specific integration, a system allowing repeated integration of transgenes into a known genomic location. This would allow for direct comparison of transgenes in the same genomic location, thereby minimising the variations in expression caused by position effects that occur with *piggyBac*.

Table 1. Transformation summary of OX3441 and OX4389 in diamondback moth

	OX3441	OX4389
Number of embryos injected	1925	1344
Number of injection survivors	1462	603
Number of transgenic lines	7	1
Transformation efficiency (%)	0.48	0.17

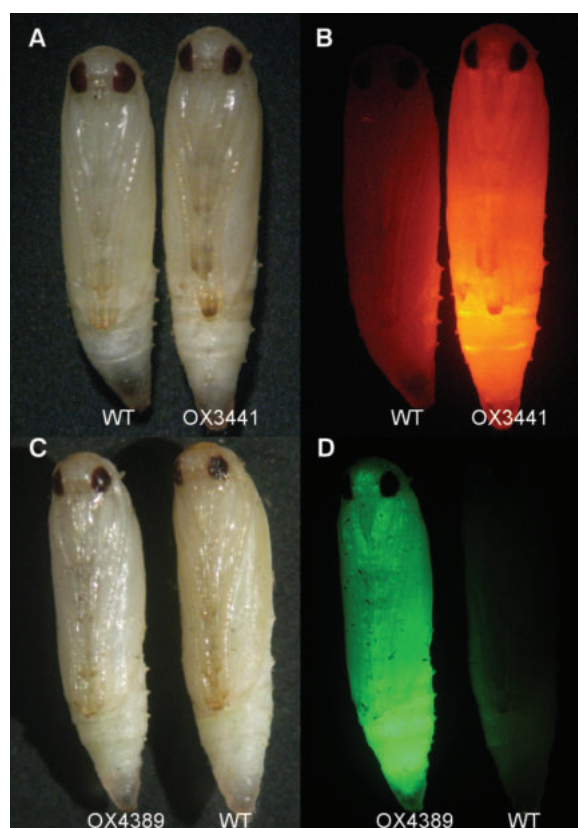


Figure 1. Expression of the red fluorescent protein DsRed in wild-type (WT) and OX3441 pupae under (A) white light and (B) DsRed-excitation wavelength light and expression of the green fluorescent protein ZsGreen in wild-type and OX4389 pupae under (C) white light and (D) ZsGreen-excitation wavelength light.

## Presentations: Runner Up

### The effect of slugs on seedling recruitment and community composition in upland hay meadow plant communities

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Species-rich upland hay meadows are of high biodiversity importance and are internationally rare. They are categorised by the National Vegetation Classification (NVC) as the neutral grassland type MG3 (*Anthoxanthum odoratum*-*Geranium sylvaticum* grassland) and are predominantly found in upland valleys in northern England where traditional hay-making practices still persist. Agricultural improvement since the 1940s has greatly reduced the area of MG3 meadows (<1000ha in England and <100ha in Scotland) resulting in vast areas of species-poor improved or semi-improved meadows. There is increasing interest in restoring botanically diverse meadows, but little is known about the effect of invertebrates on community composition.

So why slugs? In this project a number of invertebrate-plant interactions are being investigated, including pollination and herbivory. Although there are insect herbivores present in the meadows, the slugs have some unique features, such as large population size and breadth of diet, which means they are likely to have more impact on plant community structure than any insect herbivores. Slugs are most commonly thought of as pests of arable and horticultural crops and little attention has been given to their role in semi-natural grasslands.

In March 2008, a three year mesocosm experiment was set-up at Close House Biology Field Station, Newcastle upon Tyne (NZ128659), to investigate three key questions: (i) How does slug grazing affect seedling recruitment and community composition? (ii) Which plant species are selectively grazed by slugs? (iii) Does the effect of slug grazing change over time? Plastic mesocosms (1 m x 1 m x 0.39 m) were sown with either a species mix typical of a semi-improved or unimproved upland hay

meadow plant community, with or without the addition of slugs. Soil was sourced from a local mid-secondary successional grassland in order to replicate low-medium fertility field conditions. Mesocosms to which slugs were added received 50 slugs per m<sup>2</sup> (of the grey field slug, *Deroceras reticulatum* Müller) in April 2008 and again in October 2009 (to represent a high population density as found in field investigations). Mesocosms in which no slugs were added contained a low residual slug population; regular monitoring and removal maintained this low background population. To control slug migration, copper-impregnated matting (Spinout) was used as ground cover and attached to the perimeter of all mesocosms (Fig. 1). An appropriate cutting regime was used to simulate vertebrate grazing in autumn and spring, and the annual late-July hay-cut found in the meadows. Plant species richness and abundance cover (%) were recorded in mid-summer 2008 and 2009 and analysed using the multivariate technique, Canonical Correspondence Analysis (CCA).

In 2008, slugs had no significant effect, but in 2009 were a significant driving factor in shaping community

composition. A particularly interesting finding was the association of *Rhinanthus minor* L. (Hay rattle) (Orobanchaceae) with a low slug density environment. *R. minor* was first sown in autumn 2008, into mesocosms with an unimproved community only, and germinated in spring 2009 following the mandatory vernalization period.

The results indicate the selective grazing of *R. minor* seedlings by slugs; this is of particular interest for several reasons. *R. minor* is a hemi-parasitic annual, making its contribution to the sward on a yearly seedling recruitment cycle. Plants form parasitic root connections (haustoria) with host plants, particularly grasses and legumes, enabling a wider diversity of less competitive wildflower species to develop. As such, *R. minor* is a keystone species and is used as a management tool in the restoration of species-poor grasslands. A critical early step in the restoration process is to sow *R. minor* into the sward with the specific goal of reducing the grass dominance. This research is the first to show how the selective removal of *R. minor* by slugs may be relevant to the restoration management of species-rich meadows.



Figure 1. Mesocosms in June 2009.

## First Prize

### Face Flies and Faecal Fumes – Oviposition of the trachoma vector *Musca sorbens*

Julie Bristow

Rothamsted Research  
(julie.bristow@bbsrc.ac.uk)

Trachoma is a painful, debilitating disease estimated to be responsible for almost 4% of blindness cases worldwide. The bacteria responsible are transmitted by the Bazaar Fly *Musca sorbens*, native to Africa and Asia. This fly feeds on human nasal and ocular secretions and lays its eggs on faeces lying exposed on the ground, in which its larvae develop. Control of flies has been shown to reduce the incidence of trachoma, but at present little is known about the chemical ecology of this species, and species-specific attractants to bait monitoring or control traps do not yet exist.

*Musca sorbens* have been found to emerge from a greater proportion of sampled human faeces than from the faeces of any other animal tested. This suggests that human faeces are an optimal breeding medium for *M. sorbens* and hence, in environments lacking basic sanitation, human faeces may be a major source of these flies.

This study aims to identify compounds used by *M. sorbens* to locate a suitable oviposition medium. In trapping experiments carried out in The Gambia in Wali Kunda (a rural fishing village) and Farafenni (a bustling market town s), significantly more female *M. sorbens* were caught from traps baited with human faeces than from those baited with the faeces of any other animal (calf, cow, dog, donkey, horse, sheep), suggesting that human faeces are its preferred oviposition medium. This raises the possibility that compounds produced by human faeces could be oviposition attractants for *M. sorbens*.

These potential attractants were collected using air entrainment, a technique in which charcoal-filtered air is blown over a sample and the odours collected on a polymer matrix from which they can be extracted to produce liquid samples. Analysis of these samples by gas chromatography (GC) and coupled GC-mass spectrometry revealed quantitative and qualitative differences in the volatile chemicals emitted by human

faeces and those produced by the faeces of domestic animals used in the study, which also litter the environment in areas where trachoma is prevalent.

Using coupled GC-electro-antennography a number of compounds from human faeces have been found to stimulate receptors on the antennae of *M. sorbens* females. It is likely that these are semiochemicals associated with the location of a suitable oviposition site. Further behavioural work will be carried out in the field and using laboratory bioassays to test this hypothesis.

Control of *M. sorbens* by the provision of latrines, reducing the availability of human faeces in the environment, would be desirable as a solution to many other hygiene-related problems as well as trachoma. There is however a need to accurately monitor fly numbers to determine the success of control interventions. Efficient trapping mechanisms based on semiochemicals such as those sought in this study would be useful for such surveillance and may even be useful a control tool.



Sheep forage in a Farafenni street littered with refuse and excreta, an ideal breeding ground for *M. sorbens*



A faeces-baited fly trap showing a typical afternoon's catch.



## Phoresy: Hitch hiking in tiers

**Duncan Alen & Felicity Crotty**

Sustainable Soils and Grassland Systems Department,  
Rothamsted Research North Wyke,  
Okehampton, Devon, EX20 2SB

It was another day of data entry at North Wyke, as I sat at my desk I noticed out of the corner of my eye an odd looking fly, quickly I get a vial and grab the listing dipteran. Rotating the tube I notice that I have hit on an arthropod jackpot! Not one but no less than three. The fly was host to some hitchhikers three Pseudoscorpions (Chernetidae) who were also playing host to some Acari hitchers (Astigmata, hypopus), needless to say I rushed to the lab and took the following photos.

This behaviour is known as phoresy, in which the hitcher in question uses other insects or arachnids as a handy bus service. Many arthropods are known to exhibit this behaviour in fact it is quite well documented. Pseudoscorpions have been seen to form phoretic associations with many arthropod hosts; this includes 44 families of insect and three families of arachnid (Poinar Jr., 1998). This association has been happening for millions of years with records of

prehistoric hitchhikers going back as far as 40 million years (Ross 1997). It has been seen in lice which are found in bird nests who use the louse fly (Hippoboscidae) to travel between nests (Harbison et al 2009). It has also been observed in the tropics with Longhorn beetles (Cerambycidae) acting as shuttle buses for pseudoscorpions from tree to tree.

### References

- Christopher W. Harbison, Matthew V. Jacobsen, Dale H. Clayton (2009) A hitchhiker's guide to parasite transmission: The phoretic behaviour of feather lice, *International Journal for Parasitology* 39 (2009) 569-575.
- George. Poinar, Jr., Bozidar P. M. Curcic and James C. Cokendolpher (1998) Arthropod Phoresy Involving Pseudoscorpions in the Past and Present, *Acta arachnol.* 47 (2): 79-96,
- Ross, A. J., (1997). Insects in amber. *Geology Today*, 13: 24-28.





## **SCHEDULE OF NEW FELLOWS AND MEMBERS**

as at 18th February 2010

### New Fellows (1st Announcement)

Dr Jing Jiang Zhou  
Dr M Shunmugavelu  
Professor Byung-Jin Kim  
Dr Satya Ram Singh  
Professor Zeyaur Rahman Khan  
Dr Henry Y Fadamiro

### Upgrade to Fellowship (1st Announcement)

Dr Peter David Maxwell Costen  
Mr Clive Richard Turner

### New Fellows (2nd Announcement and Election)

None

### Upgrade to Fellowship (2nd Announcement and Election)

None

### New Members Admitted

Mr Azmat Amin

### New Student Members Admitted

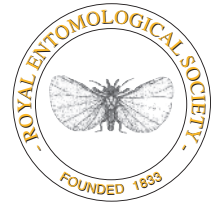
Mr James Hourston  
Mr Gary Denis Clewley  
Miss Laura Gordon  
Mr James Cook  
Mr Mark Ramsden  
Mr Ram Vasudev  
Miss Megan Coombs  
Mr Steven Robert Parratt

### Re-Instatements to Fellowship

None

### Deaths

Professor C Wilkinson      1956 Devon  
Dr J C Hartley              1957 Nottingham



## **SCHEDULE OF NEW FELLOWS AND MEMBERS**

as at 3rd March 2010

### New Fellows (1st Announcement)

None

### Upgrade to Fellowship (1st Announcement)

None

### New Fellows (2nd Announcement and Election)

Dr Torsten Michael Van Der Heyden

Dr Jing Jiang Zhou

Dr M Shunmugavelu

Professor Byung-Jin Kim

Dr Satya Ram Singh

Professor Zeyaur Rahman Khan

Dr Henry Y Fadamiro

### Upgrade to Fellowship (2nd Announcement and Election)

Dr Peter David Maxwell Costen

Mr Clive Richard Turner

### New Members Admitted

Dr Suresh Prins Benjamin

Dr Darren Peck

Mr Ian Geoffrey Tomkins

### New Student Members Admitted

Miss Bobbie Johnson

Miss Rúbia Aparecida Araújo

Mr Adam Dobson

Miss Louise Lynne Eaves

Mr James Hutchison

Mr Daniel Jeffries

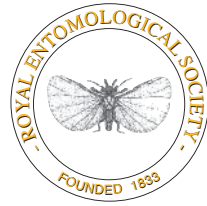
Miss Sophie Bennett

### Re-Instatements to Fellowship

None

### Deaths

None



## **SCHEDULE OF NEW FELLOWS AND MEMBERS**

as at 5th May 2010

### New Fellows (1st Announcement)

None

### Upgrade To Fellowship (1st Announcement)

Professor Hideharu Numata

### New Fellows (2nd Announcement and Election)

None

### Upgrade to Fellowship (2nd Announcement and Election)

None

### New Members Admitted

Richard Geoffrey Loxton (as at 3-3-10)  
Dr Elva Robinson (as at 25-3-10)  
Dr Hilary Margaret Swain (as at 25-3-10)  
Mr Sergey Okulov (as at 25-3-10)  
Mr Raja M Zuha Raja Kamal (as at 25-3-10)  
Mr Alistair Patrick Byford-Bates  
Dr Andrew Proudfoot  
Ms Melanie Houston  
Mr Andrew Martin Banthorpe  
Dr Dawn Sanders

### New Student Members Admitted

Miss Grace Twiston-Davies (as at 25-3-10)  
Mr James William Broom (as at 25-3-10)  
Miss Heather Campbell (as at 25-3-10)  
Miss Lucy Fray (as at 25-3-10)  
Mr Jonathan Scully (as at 25-3-10)  
Mr Jack Hearn (as at 25-3-10)  
Miss Bethany Greenfield (as at 25-3-10)  
Mr Sacha Daniel White  
Mr Brendan Canning  
Mr John Staunton  
Mr David John Hughes  
Mr Philip Michael Bowles  
Mr Christopher Barton

### Re-Instatements to Fellowship

None

### Deaths

None



## **SCHEDULE OF NEW FELLOWS AND MEMBERS**

as at 2nd June 2010

### New Fellows (1st Announcement)

Dr Naveen Samuel Singh

### Upgrade to Fellowship (1st Announcement)

None

### New Fellows (2nd Announcement and Election)

None

### Upgrade to Fellowship (2nd Announcement and Election)

Professor Hideharu Numata

### New Members Admitted

Dr Peter Kofi Kwapong  
Mr David Egerton Cary

### New Student Members Admitted

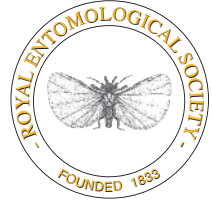
Mr Jamie Buchanan

### Re-Instatements to Fellowship

None

### Deaths

None



## **SCHEDULE OF NEW FELLOWS AND MEMBERS**

as at 19th July 2010

### New Fellows (1st Announcement)

Dr Filipe Dantas-Torres  
Dr John Leslie Davidson Williams

### Upgrade to Fellowship (1st Announcement)

None

### New Fellows (2nd Announcement and Election)

Dr Naveen Samuel Singh

### Upgrade to Fellowship (2nd Announcement and Election)

Mr Timothy Bernhard (First Reading 2.6.10)

### New Members Admitted

Dr Jake Lanion Snaddon  
Mr Wanyoike Wamiti

### New Student Members Admitted

Ms Catherine Jones  
Mrs Jiranan Piyaphongkul  
Miss Katherine Davies  
Ms Catriona Duffy

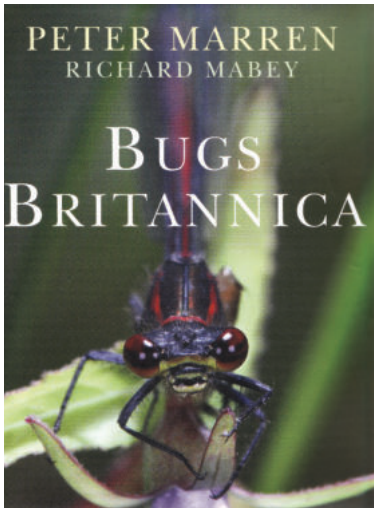
### Re-Instatements to Fellowship

None

### Deaths

Mr D S K Mcnamara 1987 Newham-On-Severn  
Mrs B M Newman 2005 Reading

# Book Reviews



## *Bugs Britannica*

Peter Marren & Richard Mabey  
Chato & Windas, London

ISBN 9780701181802 £35.00

*Bugs Britannica* follows in the footsteps of both *Flora* and *Birds Britannica* in presenting an exploration of the relationship the British people have with the natural world. In this volume the invertebrates come under the microscope, but not only insects and spiders but sponges, jellyfish, various worms, molluscs and echinoderms. The book is divided into taxonomic sections moving from simpler life forms to the more complex. It delves into our relationship with each group, examining our attitudes, their role in myth and folklore, along with a few anecdotes from the people who have encountered them. Here is an encyclopaedia of biological and cultural miscellanea, which teems with fascinating facts, both obscure and well known literary references, plus insights into our past attitudes. *Bugs Britannica* is a brilliantly holistic account of the love-hate relationship that Englishmen have and have had with the smaller animals that share our landscapes. It is richly illustrated with photographs, drawings and historical images. Here is a volume to be

dipped into and savoured on quiet evenings, a box of delights for curious entomologists and natural historians alike. For those who are familiar with the previous volumes it will be an essential third volume; for those who are not, this is an excellent volume to start with.



## *Insect Biodiversity: Science and Society*

Edited by Robert G. Foottit & Peter H. Adler  
Wiley-Blackwell

ISBN 9781-1405151429 £75.00

Presenting an overview of global insect biodiversity is a Herculean challenge, to which the assembled authors and editors have enthusiastically risen. The book is a synthesis of the diverse approaches that are required to address this topic in the twenty-first century, and presents a range of perspectives, from the regional to the taxonomic; the tools used to analyse diversity, and the important issues arising from it. Each chapter is succinct and authoritative, presenting a review of the subject area and a reflection on its future.

The book is divided into three parts: in part one there are chapters dealing with biogeographic faunas which examine the diversity of their constituent geographical areas and/or major habitats. These include the faunas of the Nearctic, Afrotropical, Australasian and Palaearctic regions.

In part two the chapters deal with taxonomic or habitat-based groupings and examine the diversity within families. The groups covered include aquatic insects, Diptera, Heteroptera, Coleoptera, Hymenoptera and Lepidoptera. These chapters also highlight a number of problems, such as the need to raise public and political awareness of insect diversity and the vital roles that insects play in ecosystem function. Insect collections are not always housed in their country of origin, necessitating costly and time-consuming visits to examine them. New technologies that offer solutions are examined, including global databases and remote access to specimens via the internet.

In section three the chapters deal with tools and approaches: they explore the nature and purpose of taxonomy before examining its future. The role of traditional morphological studies are discussed and championed, along with more recent molecular techniques such as DNA bar coding. It then deals with the roles that insect diversity plays in our understanding of agricultural pests and their control, vectors of disease, and insect conservation. This section then culminates in a fascinating history of our attempts to quantify insect diversity.

There is much to do, and as Quentin Wheeler states in his chapter, “we do not yet know enough about insect diversity to characterize precisely the magnitude of our ignorance”. Despite the challenges, this volume provides a comprehensive overview of our current knowledge. Tim New writes in his forward that he hopes that “some of the chapters will be key references as we progressively refine and enlarge our understanding”. I feel that this book defines the baseline in this field at the beginning of the twenty-first century, and is destined to become an indispensable first port of call for any one initiating work in this field.

## ***Big Bugs. Life Size***

George Beccaloni

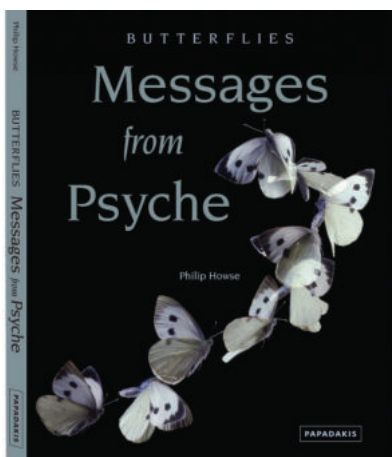
Published by the Natural History Museum

ISBN 978-0-565-09213-9 £9.99



There is a growing concern regarding the decline in the number of entomologists and a developing interest in inspiring the next generation. *Big Bugs* is a wonderful addition to our armoury in this battle for the hearts and minds of future entomologists. This is a book with instant impact: it contains a set of excellent photographs that present some of our largest insects life size. It is a wonderful introduction to the diversity of forms in the invertebrate world and contains a wealth of information for such a slim volume. It is guaranteed to excite young minds and pique the curiosity of older ones. This is a book that will inspire and enthuse the next generation, but it will also delight and inform even battle-scarred entomologists.

This book is linked to the *Big Bugs* exhibition at Tring Natural History Museum, Hertfordshire which runs until the 21st of November.



## ***Butterflies Messages from Psyche***

Philip Howse

Published by Papadakis

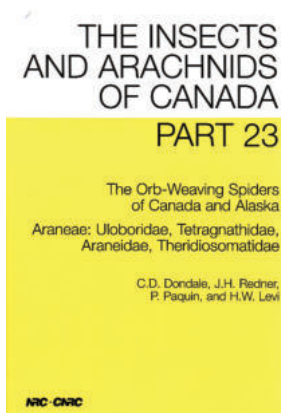
ISBN 978-1901092-80-6 £25.00

'Messages from Psyche' is fascinating, enthralling and I am sure controversial in some quarters. It is an eclectic assemblage of ideas relating to our perception of insects and the roles played by patterns on the wings of Lepidoptera in communication, camouflage and predator distraction.

It is a wonderfully meandering personal reflection on the biology of visual deception in the insect world, exploring the history of our understanding of it and placing this in a cultural context. We are taken on an odyssey of epic proportions

from Bates, Wallace and Darwin to Dali, Lewis Carroll and TS Elliot. The text is littered with literary references and metaphors, from snarks and boojams to Gombrich and Keats.

'Messages' is full of intriguing ideas and thought-provoking concepts and is illustrated with a wealth of arresting coloured images. For anyone with an interest in insect communication or the role of entomology in our wider cultural landscape, Philip Howse's book is not to be missed.



## ***The Insects of Canada part 23. The Orb weaving spiders of Canada and Alaska***

C.D Dondale, J.H.Redner, P.Paquin and H.W Levi.

Published by NRC Research Press

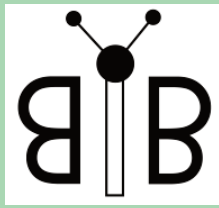
ISBN 0-660-18898-8

This is an excellent addition to the long line of identification manuals for the invertebrate fauna of this region. It is illustrated with line drawings of each genus of spider and drawings of the genitalia of each species. It contains keys to the species in both French and English, plus maps showing the distribution of each species across North America. For each species there are descriptions of both sexes, and notes on distinguishing features and biology. This is an essential addition to the library of anyone who needs to identify spiders in this region.

Previous editions in this series have recently been made available online as free PDFs. They are available at <http://www.escsec.ca/aafcmono.html>

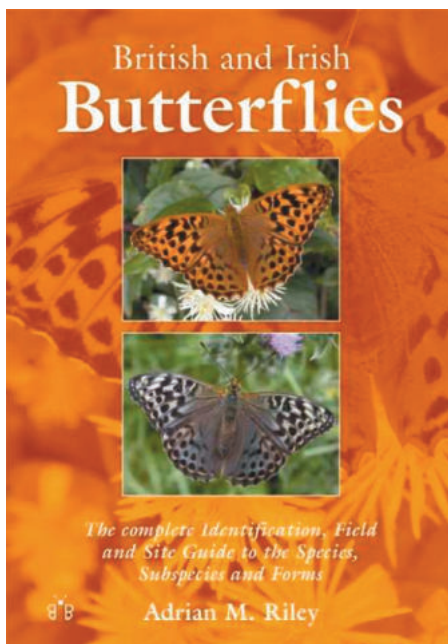
This site also contains a range of entomological books.

*All reviews by Peter Smithers*



## Press Release

# New iPhone app is out!!



### The British and Irish Butterflies by Adrian Riley

#### Key Features

- Description of 108 taxa, including 59 species, as well as subspecies and forms
- Detailed information on when and where to find them, using OS references.
- Lists for each butterfly general distribution, flight period, larval food plants, habitat requirement and identification characters, variation and similar species
- Helpful fieldtips to locate the butterflies
- Donation to Butterfly Conservation with each app sold to support their splendid work.

Ready for downloading on iTunes store: **only £4.99**

Link on iTunes Store: <http://itunes.apple.com/gb/app/british-irish-butterflies/id376331398?mt=8#>

#### Description

This app entitled "British and Irish Butterflies" is an abridgment of the book of the same name by Adrian Riley. It comprises all the text, photographs and site information of the book, but lacks the scientific references, which can be consulted in the original published work (ISBN 978-0-9553928-0-1), readily available discounted from the publisher's website ([bramblebybooks.co.uk](http://bramblebybooks.co.uk)) or at [Amazon.co.uk](http://Amazon.co.uk).

#### Author information

Adrian Riley was born in Birmingham but grew up in Shropshire. He spent much of his working life at Rothamsted, the agricultural research station in Harpenden, Hertfordshire, where he pursued a professional career in entomology. On retiring early, he turned his energies to natural history, more especially the study of butterflies and birding.

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# Diary

**Assistant Editor:** Craig Macadam (e-mail: [craig.macadam@bradan-aquasurveys.co.uk](mailto:craig.macadam@bradan-aquasurveys.co.uk))

## Abbreviations

AAB	Association of Applied Biologists
AES	Amateur Entomologists' Society
BAS	British Arachnological Society
BC	Butterfly Conservation
BENHS	British Entomological and Natural History Society
BENHS (WS)	BENHS workshops held at Dinton Pastures Country Park, Davis Street, Hurst, Reading RG10 0GH. Grid reference SU 784 718. I: Ian McLean, 109 Miller Way, Brampton, Huntingdon, Cambridgeshire PE18 8TZ.
BES	British Ecological Society
BISG	Bloomsbury Insect Science Group meetings held at Birkbeck College, Department of Biology, Malet Street, London, Room 232.
BMIG	British Myriapod and Isopod Group. I: <a href="http://www.bmig.org.uk">www.bmig.org.uk</a>
DaNES	Derbyshire and Nottinghamshire Entomological Society
ECSS	Ecology and Conservation Studies Society. Meetings start at 6:30pm and are held in Room B29, Senate House, Malet Street. London WC1E.
EEC	Edinburgh Entomological Club
ESA	Entomological Society of America
FBA	Freshwater Biological Association I: <a href="http://www.fba.org.uk">www.fba.org.uk</a>
FSC	Field Studies Council. I: <a href="http://www.field-studies-council.org">www.field-studies-council.org</a>
KFC	Kent Field Club
KMBRC	Kent and Medway Biological Records Centre
LCES	Lancashire and Cheshire Entomological Society
LNHS	London Natural History Society
LSL	The Linnean Society of London, Burlington House, Piccadilly, London W1V 0LQ.
NFBR	National Federation for Biological Recording
NHM	The Natural History Museum, Cromwell Road, London SW7.
RES	Royal Entomological Society
RS (CHT)	The Royal Society, 6 Carlton House Terrace, London SW1Y 5AG.
SHNH	Society for the History of Natural History (Hon. Sec.) c/o NHM.
YNU	Yorkshire Naturalists' Union. I: <a href="http://www.ynu.org.uk">http://www.ynu.org.uk</a>
ZSL	The Zoological Society of London, Regent's Park, London NW1 4RY.
I:	Information from:

**Contributions please!** Your support is needed to make this diary effective so please send any relevant items to the diary's compiler, **Craig Macadam**, E-mail: [craig.macadam@bradan-aquasurveys.co.uk](mailto:craig.macadam@bradan-aquasurveys.co.uk). No charge is made for entries. To ensure that adequate notice of meetings, etc. is given, please **allow at least 6 months' advance notice**.

## Meetings of the Society

Recently, Special Interest Group (SIG) meetings have been held at Rothamsted, Harpenden and usually begin with registration and refreshments at 10am for a 10.30am start. Details of the day's programme can be downloaded from the RES website ([www.royensoc.co.uk](http://www.royensoc.co.uk)) and include a registration form, which has to be completed in advance so that refreshments can be organised. All meetings finish by 5pm.

Some SIG or monthly meetings may begin after lunch and be held at a different location, so it is best to consult the diary or the RES website for full details. Regional meetings, by definition, will be held locally.

## 2010

### Sept. 22 Aphid Special Interest Group

**Venue: Syngenta at Jealott's Hill International Research Centre, Berkshire**

Offers of talks and posters are welcome in all areas of aphidology, from molecular to population studies.

Convenor: Dr Rob Lind (rob.lind@syngenta.com)

### Oct. 2 Insects and the changing scene: commemorating the life and work of Peter Skidmore PhD FRES

**Venue: Doncaster Museum**

This symposium celebrates the life and work of Dr Peter Skidmore, a notable entomologist, conservationist and illustrator. Peter was Keeper of Natural Sciences at Doncaster Museum for almost 30 years.

Convenors: Mr Martin Limbert (martin.limbert@doncaster.gov.uk)

Mrs Valerie Holt (v.holt1@ntlworld.com)

### Oct. 27 Climate Change Special Interest Group

**Venue: The Food and Environment Research Agency (FERA), York**

Confirmed Speakers:

Silvia Dorn, ETH, Zurich "How rising temperature affects behaviour and performance of fruit moths and their sustainable management in perennial agroecosystems"

Philip Mellor, IAH, "Climate and the transmission of BTV by biting midges"

Convenors: Dr Howard Bell (howard.bell@fera.gsi.gov.uk)

Dr Richard Harrington (richard.harrington@bbsrc.ac.uk)

### Nov. 3 Orthopterists' Special Interest Group

**Venue: Natural History Museum, London**

The meeting will be convened as a special tribute to the research on Orthoptera carried out by Dr J C Hartley.

Convenors: Dr David Robinson (D.J.Robinson@open.ac.uk)

Mrs Judith Marshall (j.marshall@nhm.ac.uk)

### Nov. 19 South-West Regional Meeting joint with Peninsular Invertebrate Forum – "Applied Entomology"

**Venue: University of Plymouth**

Convenor: Peter Smithers (psmithers@plymouth.ac.uk)

### Nov. 26 Insect Parasitoid Special Interest Group

**Venue: Biology Department, University of York**

Convenor: Dr Peter Mayhew (pjm19@york.ac.uk)

### Dec. Aquatic Insects Special Interest Group

(tbc)

**Date: To be confirmed**

**Venue: Glasgow**

Convenor: Mr Craig Macadam (craig.macadam@buglife.org.uk)

## 2011

### Feb. 2-3 Postgraduate Forum

**Venue: Royal Hotel, Hull**

Convenor: Ms Cathleen Thomas

### March 2 Verrall Lecture

**Venue: Natural History Museum**

By Professor Jane Memmott, Bristol University

"The conservation and utilization of entomological interactions"

### April Joint meeting with the Botanical Society of the British Isles on 'Pollination'

(tbc)

**Venue: Rothamsted Research, Harpenden, Herts.**

Convenors: Dr Ian Denholm and Prof. Jane Memmott (RES Pollination SIG)

### May 12 Conservation Special Interest Group

**Venue: Rothamsted Research, Harpenden, Herts.**

Convenor: Dr Alan Stewart

### June 1 RES Annual General Meeting

- Jul 3 Insect Festival**  
**Venue: York Museum Gardens, York**  
 Convenor: Mrs Julie North
- Sept 7-9 Ento'11 Symposium on 'Chemical Ecology' "Reception, Detection and Deception" and National Meeting**  
**Venue: University of Greenwich, Medway Campus, Chatham Maritime, Kent**  
 Symposium Convenors: Prof. David Hall, Prof. Alan Cork, Prof. Bill Hansson & Prof. John Pickett
- Nov 10 Insect Behaviour Special Interest Group**  
**Venue: Rothamsted Research, Harpenden, Herts.**  
 Convenors: Drs Jason Chapman & James Bell

## Diary of other Meetings

### 2010

#### October

- 2 AES Annual Exhibition and Trade Fair**  
 Venue: Kempton Park Racecourse, Sunbury-on-Thames  
 I: [www.amentsoc.org](http://www.amentsoc.org)
- 2 BENHS Workshop: An introduction to woodlice, millipedes and centipedes – Steve Gregory**  
 Venue: Dinton Pastures, Reading  
 I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 9 Quekett Microscopical Club Annual Exhibition**  
 Venue: Natural History Museum, South Kensington, London  
 I: [meetings@quekett.org](mailto:meetings@quekett.org)
- 9 Identifying Aquatic Bugs (Hemiptera)**  
 Venue: Freshwater Biological Association, Ferry Landing, Far Sawrey  
 I: [www.fba.org.uk](http://www.fba.org.uk)
- 10 BENHS Open Day**  
 Venue: Dinton Pastures, Reading. I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 12-15 4th International Simuliidae Symposium**  
 Venue: Hotel Sun Zeynep, Belek, Antalya, Turkey  
 I: [www.simuliid10.hacettepe.edu.tr](http://www.simuliid10.hacettepe.edu.tr) or [www.blackfly.org.uk](http://www.blackfly.org.uk)
- 16 BENHS Workshop: Insect curation – Martin Harvey and Ian Maclean**  
 Venue: Natural History Museum, South Kensington, London  
 I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 20 Edinburgh Entomological Club**  
**The diversity of insects in Bromeliads on Caribbean islands – does island-size matter? – Barbara Richardson**  
 Venue: Crew Building, King's Building, University of Edinburgh  
 I: [www.edinentclub.org.uk](http://www.edinentclub.org.uk)
- 24 BENHS Open Day**  
 Venue: Dinton Pastures, Reading. I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 25 Northern Coleopterists' Meeting**  
 Venue: The Manchester Museum, Oxford Road, Manchester  
 Time: 10am to 4:30pm  
 This meeting is open to anybody interested in beetles and it is aimed at both novice and more experienced Coleopterists, in order to meet and discuss ideas and records. There will be a series of presentations (e.g., by Darren Mann on UK Scarabaeoidea, by Mike Denton on his local patch, Blackmoorfoot Reservoir, etc.), as well as a chance to view and explore the Manchester Museum's extensive collections of beetles. Everyone is welcome!  
 I: Tom Hubbal ([vc63dragonfly@blueyonder.co.uk](mailto:vc63dragonfly@blueyonder.co.uk) or 01535 678334) or Dmitri Logunov ([dmitri.v.logunov@manchester.ac.uk](mailto:dmitri.v.logunov@manchester.ac.uk) or 0161 275 2666).

## November

- 6 DaNES Annual Insect Show**  
Venue: Broomfield Hall, Morley  
Time: 10:30 to 16:00  
I: [www.danes-insects.org.uk/events.htm](http://www.danes-insects.org.uk/events.htm)
- 13 BENHS Annual Exhibition and Dinner**  
Venue: Imperial College, South Kensington  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 14 BENHS Open Day**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 17 Edinburgh Entomological Club**  
**Darwin: insects and orchids – Roy Sexton**  
Venue: Crew Building, King's Building, University of Edinburgh  
I: [www.edinentclub.org.uk](http://www.edinentclub.org.uk)
- 24 Life on lots of legs: a prehistory of creepy-crawlies**  
Venue: National Museum of Wales, Cardiff  
Time: 13:05 to 13:35  
I: [heidi.evans@museumwales.ac.uk](mailto:heidi.evans@museumwales.ac.uk)  
Booking essential
- 27 Dipterists' Forum Annual Conference and AGM**  
Venue: To be confirmed  
I: [www.dipteristsforum.org.uk](http://www.dipteristsforum.org.uk)
- 27-28 Dipterists Forum Annual Meeting and AGM**  
Venue: Oxford University Museum of Natural History, Parks Road, Oxford OX1 3PW  
I: [www.dipteristsforum.org.uk](http://www.dipteristsforum.org.uk)
- 28 BENHS Open Day**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)

## December

- 12 BENHS Open Day**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 15 Edinburgh Entomological Club**  
**Sexual selection for elaborate ornamentation in courtship feeding dance flies (Diptera: Empididae) – Luc Bussière (University of Stirling)**  
Venue: Crew Building, King's Building, University of Edinburgh  
I: [www.edinentclub.org.uk](http://www.edinentclub.org.uk)

## 2011

### January

- 9 BENHS Open Day**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 19 Edinburgh Entomological Club**  
**An assessment of Scotland's montane invertebrate fauna – Graham Rotheray (National Museums of Scotland)**  
Venue: Crew Building, King's Building, University of Edinburgh  
I: [www.edinentclub.org.uk](http://www.edinentclub.org.uk)
- 23 BENHS Open Day**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)

## February

- 5 Coleopterists' Day**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 11 AES and Bug Club: Young entomologists' day**  
Venue: Oxford University Museum of Natural History  
Time: 11:00 to 16:00  
I: [www.amentsoc.org](http://www.amentsoc.org)
- 12 BENHS Workshop: Banchinae identification workshop – Jim Brock, Gavin Broad, Mike Fitton and Mark Shaw**  
Venue: Natural History Museum, South Kensington, London  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 13 BENHS Open Day**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 16 Edinburgh Entomological Club**  
**Sex ratios, sexuality and parasitism in the Greenlandic seed bug (*Nysius greenlandicus*) – Matt Tinsley (University of Stirling)**  
Venue: Crew Building, King's Building, University of Edinburgh  
I: [www.edinentclub.org.uk](http://www.edinentclub.org.uk)
- 19 BENHS meeting with the Kent and Midway BRC**  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 26 BENHS Workshop: Staphylinidae identification workshop – Roger Booth, Peter Hodge and Colin Welch**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 27 BENHS Open Day**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)

## March

- 3 Annual meeting of the Verrall Association of Entomologists (Verrall Supper)**  
Venue: Senior Common Room, Sherfield Building, Imperial College, London.  
Time: 18:00 to 23:30  
Private event organised by the Entomological Club; by invitation only.  
I: [h.f.vanemden@reading.ac.uk](mailto:h.f.vanemden@reading.ac.uk)
- 5 BENHS Workshop: Tachinidae identification workshop – Matt Smith and Chris Raper**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 12 BENHS Annual General Meeting and Presidential Address**  
Venue: Oxford University Museum of Natural History, Parks Road, Oxford OX1 3PW  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 13 BENHS Open Day**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 16 Edinburgh Entomological Club**  
**Scottish spiders – Chris Cathrine (Buglife)**  
Venue: Crew Building, King's Building, University of Edinburgh. I: [www.edinentclub.org.uk](http://www.edinentclub.org.uk)
- 19 BENHS Workshop: Ground beetle (Carabidae) identification workshop – Mark Telfer and John Walters**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)
- 26 BENHS Workshop: Sawfly identification workshop – Guy Knight and Andrew Halstead**  
Venue: Dinton Pastures, Reading  
I: [www.benhs.org.uk](http://www.benhs.org.uk)

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# Publications of the Royal Entomological Society



**Agricultural and Forest Entomology** provides a multi-disciplinary and international forum in which researchers can present their work on all aspects of agricultural and forest entomology to other researchers, policy makers and professionals.

2011 print or online prices: UK £590, Euroland € 751, USA \$1,091, Rest of World \$1,272

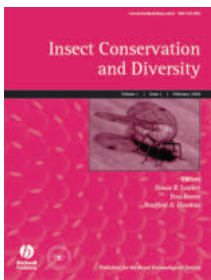
2011 print and online prices: UK £679, Euroland € 864, USA \$1,255, Rest of World \$1,463



**Ecological Entomology** publishes top-quality original research on the ecology of terrestrial and aquatic insects and related invertebrate taxa. Our aim is to publish papers that will be of considerable interest to the wide community of ecologists.

2011 print or online prices: (with Insect Conservation and Diversity) UK £973, Euroland € 1,236, USA \$1,800, Rest of World \$2,099

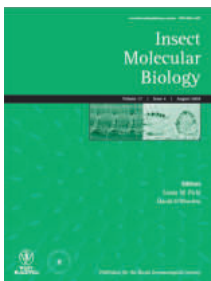
2011 print and online prices: UK £1,119, Euroland € 1,422, USA \$2,070, Rest of World \$2,414



**Insect Conservation and Diversity** explicitly associates the two concepts of insect diversity and insect conservation for the benefit of invertebrate conservation. The journal places an emphasis on wild arthropods and specific relations between arthropod conservation and diversity.

2011 print or online prices: UK £590, Euroland € 751, USA \$1,091, Rest of World \$1,272

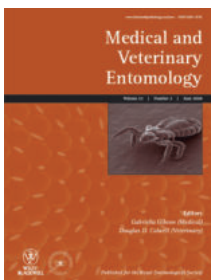
2011 print and online prices: UK £679, Euroland € 864, USA \$1,255, Rest of World \$1,463



**Insect Molecular Biology** has been dedicated to providing researchers with the opportunity to publish high quality original research on topics broadly related to insect molecular biology since 1992. *IMB* is particularly interested in publishing research in insect genomics/genes and proteomics/proteins.

2011 print or online prices: UK £984, Euroland € 1,249, USA \$1,818, Rest of World \$2,120

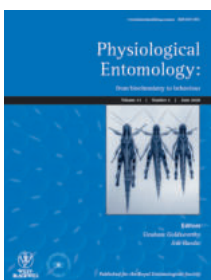
2011 print and online prices: UK £1,131, Euroland € 1,437, USA \$2,091, Rest of World \$2,438



**Medical and Veterinary Entomology** is the leading periodical in its field. The Journal covers all aspects of the biology and control of insects, ticks, mites and other arthropods of medical and veterinary importance.

2011 print or online prices: UK £566, Euroland € 721, USA \$1,048, Rest of World \$1,223

2011 print and online prices: UK £651, Euroland € 830, USA \$1,206, Rest of World \$1,407



**Physiological Entomology** is designed primarily to serve the interests of experimentalists who work on the behaviour of insects and other arthropods. It thus has a bias towards physiological and experimental approaches, but retains the Royal Entomological Society's traditional interest in the general physiology of arthropods.

2011 print or online prices: UK £522, Euroland € 664, USA \$965, Rest of World \$1,126

2011 print and online prices: UK £600, Euroland € 764, USA \$1,110, Rest of World \$1,295



**Systematic Entomology** encourages the submission of taxonomic papers that contain information of interest to a wider audience, e.g. papers bearing on the theoretical, genetic, agricultural, medical and biodiversity issues. Emphasis is also placed on the selection of comprehensive, revisionary or integrated systematics studies of broader biological or zoogeographical relevance.

2011 print or online prices: UK £940, Euroland € 1,195, USA \$1,739, Rest of World \$2,029

2011 print and online prices: UK £1,081, Euroland € 1,375, USA \$2,000, Rest of World \$2,334

Subscriptions and correspondence concerning back number, off-prints and advertising for the seven principal journals of the Society should be sent to the publishers, Wiley-Blackwell Publishing Ltd, 9600 Garsington Road, Oxford OX4 2DQ. (customerservices@blackwellpublishing.com)

**Antenna** (Bulletin of the Society). Free to Members/Fellows. Published quarterly at an annual subscription rate of £40 (Europe), £42 (outside Europe), \$70 (United States). This journal contains entomological news, comments, reports, reviews and notice of forthcoming meetings and other events. While emphasising the Society's affairs, *Antenna* aims at providing entomologists in general with a forum for their views and news of what is going on in entomology. Subscriptions and advertising enquiries should be sent to the Business Manager at The Mansion House, Chiswell Green Lane, Chiswell Green, St. Albans, Hertfordshire AL2 3NS and any other enquiries to the Editor.

**Handbooks for the Identification of British Insects.** This series now covers many families of various Orders. Each Handbook includes illustrated keys, together with concise morphological, bionomic and distributional information. A full list of Handbooks with order form is available. See website [www.royensoc.co.uk](http://www.royensoc.co.uk)

**Symposia.** Nos. 1-3 were published by the Society; Nos. 4-10 by Blackwell Scientific Publications; Nos. 11-17 by Academic Press and No. 18 by Chapman & Hall, No. 19 by Kluwer, No. 20, 21, 22 and 23 by CABI.

# RECOGNISING ACHIEVEMENT

## Royal Entomological Society - Society Awards -

### THE ROYAL ENTOMOLOGICAL SOCIETY STUDENT AWARDS

**Award Criteria:** Any article about an Entomological topic that would be of interest to the general public. The article to be easy to read, in a popular style and no longer than 800 words.

**Prize:** Winner £300, runner up £200, third place £100, all three articles published in *Antenna*.

### RES JOURNAL AWARDS SCHEME

**Award Criteria:** The best paper published in each Society Journal over a two year period. Each of the Society Journals participate biennially.

**Prize:** £500 and Certificate for each participating Journal.

### THE LJ GOODMAN AWARD FOR INSECT BIOLOGY

**Award Criteria:** For advancing the education of the public in the knowledge, understanding and appreciation of all aspects of Insect Physiology, thereby promoting the control and conservation of insect species.

**Prize:** £1,000, also additional awards may be given.

### THE MARSH AWARD FOR INSECT CONSERVATION

**Award Criteria:** For an outstanding contribution to Insect Conservation; on the basis of 'Lifetime Achievement', or 'Considerable and Exemplary Contribution' to a significant project or undertakings. In exceptional circumstances two prizes may be awarded to reflect each criterion.

**Prize:** £1000 and Certificate.

### POSTGRADUATE AWARD: THE ALFRED RUSSEL WALLACE AWARD

**Award Criteria:** For post-graduates who have been awarded a PhD, whose work is considered by their Head of Department to be outstanding. The research involved should be a major contribution to the Science of Entomology.

**Prize:** £750 plus Certificate, plus one year's free Membership. The winner will also be invited to present their work at a Society Meeting.

### JO WESTWOOD MEDAL - AWARD FOR INSECT TAXONOMY

**Award Criteria:** The best comprehensive taxonomic work on a group of Insects, or related Arthropods (including terrestrial and freshwater Hexapods, Myriapods, Arachnids and their relatives). Typically, this will be a taxonomic revision or monograph.

**Prize:** A specially struck silver gilt medal inscribed with the winners name. Also costs incurred in attending the International Congress of Entomology, European Congress of Entomology, or other major meeting (specified by the Adjudicators) to present his/her work.

### THE WIGGLESWORTH MEMORIAL LECTURE AND AWARD

**Award criteria:** The outstanding services to the science of Entomology. The award will be made to a researcher who has contributed outstanding work to the science and who best reflects Sir Vincent Wigglesworth's standards of personal involvement in every aspect of his/her research.

**Prize:** A specially struck gilt medal inscribed with the winners name. Also the costs of attending the International Congress of Entomology to give the Wigglesworth Lecture.

### BOOK PURCHASE SCHEME FOR FELLOWS AND MEMBERS IN DEVELOPING COUNTRIES

**Award Criteria:** To provide assistance in purchasing specialist Taxonomic books, that will assist in the identification of Insect groups being studied in developing countries and their regions. Applicants will be required to demonstrate need and specify particular texts.

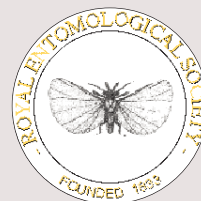
**Prize:** Any one applicant may be awarded up to £200 in a three year period. The Society will purchase the texts awarded and send them to the applicant. The applicants may, themselves, provide any additional funds in excess of the amount awarded.

### OUTREACH AND CONFERENCE PARTICIPATION FUNDS

**Award Criteria:** ORF: Grants to support activities which further the Society's aims. This may range from, help to purchase equipment, to help in funding expeditions/meetings. CPF: Grants to assist applicants who are participating in a meeting or conference in some way, e.g. presenting a paper/poster.

**Prize:** ORF: Monetary grant. CPF: Monetary grant.

*For more details on these Society Awards  
please see [www.royensoc.co.uk](http://www.royensoc.co.uk)*



Royal Entomological Society  
[www.royensoc.co.uk](http://www.royensoc.co.uk)

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E-mail: [info@royensoc.co.uk](mailto:info@royensoc.co.uk)