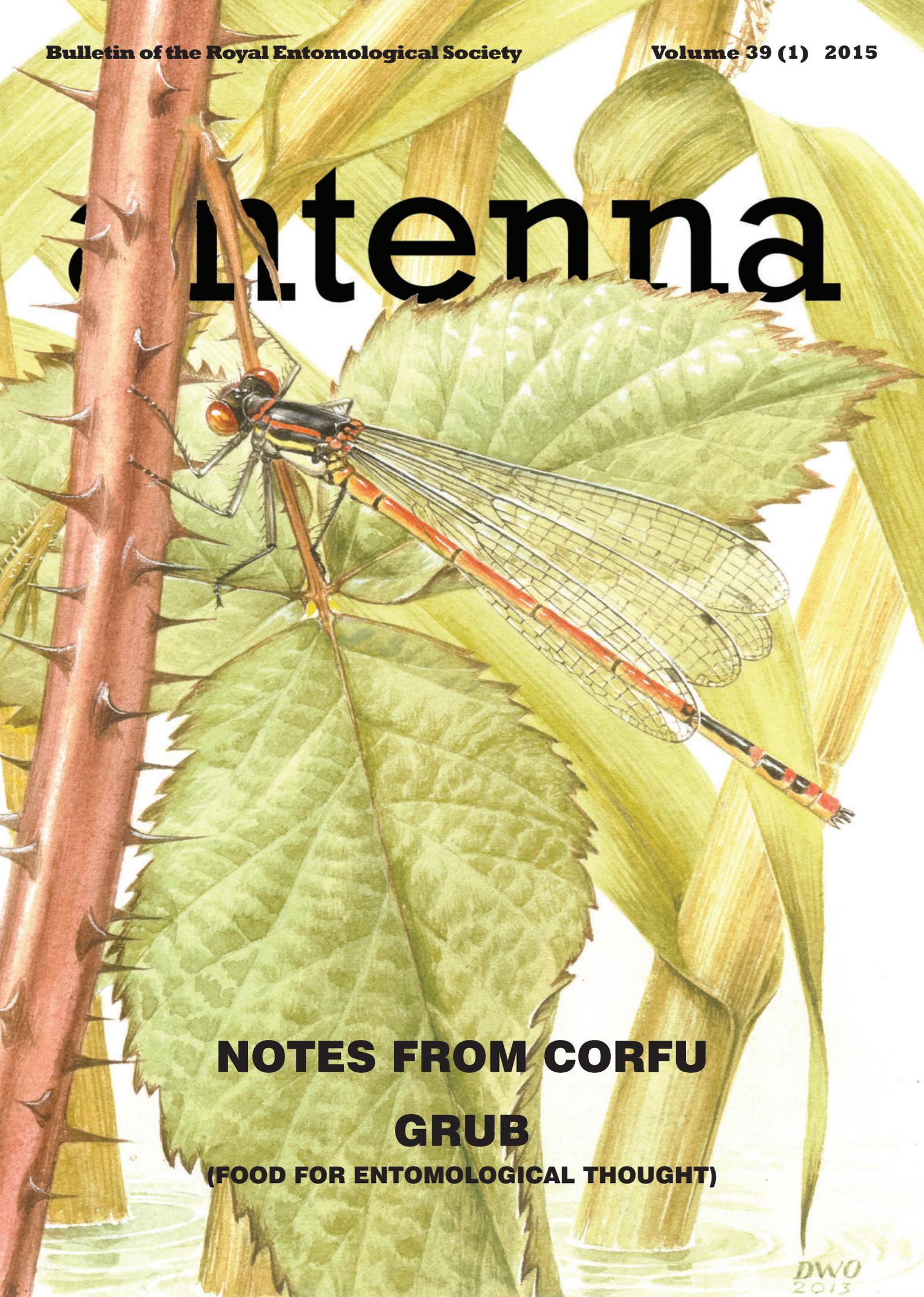


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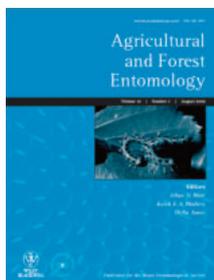


NOTES FROM CORFU

GRUB

(FOOD FOR ENTOMOLOGICAL THOUGHT)

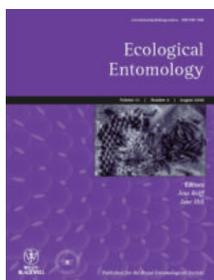
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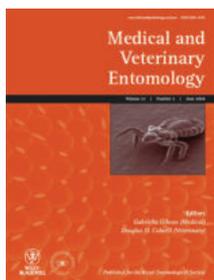
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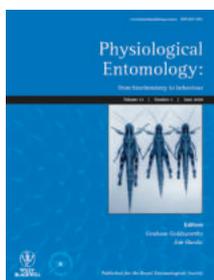
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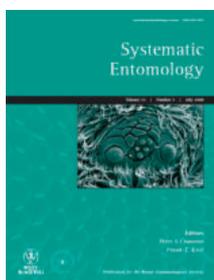
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COVER PICTURE

The Greek Red Damselfly *Pyrrhosoma elisabethae*.
(Watercolour painting by Denys Ovenden)

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EDITORIAL



Welcome to the first edition of 2015. In order to banish those winter blues we offer you tales from the sun drenched Mediterranean, to brighten the start of the year.

For those who may have over-indulged during the festive season there is news of some healthy alternative protein sources that may be available in the UK in the near future. Once again and by pure coincidence the eating of insects features heavily in this first issue of the year. In my first editorial of 2014 I promised updates on the development of the role of insects in western diets and events have moved more rapidly than anticipated. The Society has now formed a Special Interest Group to explore and develop ideas in this field. This followed a meeting of interested parties that took place in London last autumn. A report of this meeting outlines progress in this area within the

UK and sketches some of the enterprises that are evolving. We also have a short interview with an insect farmer, an account of how weaver ants are collected in Thailand and an interview with an entomological chef.

Dick Vane-Wright's reports on the International Conference on the Biology of Butterflies held in Turku, Greece last year and reflects on the future of butterfly research. Peter Sutton offers an update of the entomological fauna of Corfu and reports the continuing success of the Durrell School's annual course. Sadly he also reports the environmental degradation that has occurred in the wake of Greece's economic crisis; a stark reminder of the connectivity of the global world in which we now live. For those who have yet to make New Year's resolutions, Simon Leather offers several good reasons why entomologists should join the 21st century and become members of the Twitterati.

The accounts of why the three RES scholars on the masters course at Harper Adams are studying Entomology clearly demonstrates that an interest in insects kindled at an early age can lead to a passion that can define one's career, whilst the report of the Harper Adams students visit to the Society's HQ in St Albans reveals that these students' have a voracious curiosity and appetite for Entomology, and on this occasion Yorkshire puddings as well. It is wonderful to see the unbridled enthusiasm of these young entomologists and reassuring to know that the future of Entomology is in good hands.

We also offer a generous number of book reviews that brim with recommendations to keep you busy during those long winter evenings. Plus, of course, all the usual society news to keep you up to date.

With Best wishes from the *Antenna* Team.

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

Recent developments regarding the entomological fauna of Corfu (Kérkira)

Figure 1 (Front cover). The Greek Red Damselfly *Pyrrhosoma elisabethae* (Watercolour painting by Denys Ovenden)

Introduction

A little over two years ago, an article describing aspects of the rich entomological fauna of Corfu (Sutton, 2012a) provided details of a number of new species that had been recorded for the island. This second article describes some of the exciting new discoveries that have been made during the intervening period, and highlights the considerable efforts of a number of workers who are attempting to provide an increasingly detailed account of the status of species from an island which continues to produce surprises. However, it should also be noted that while there have been significant steps forward regarding the development of a knowledge base for conservation purposes, Corfu continues to suffer from the pressures of tourism, development, changing agricultural practice, loss of water resources and latterly, the destructive influence of an economic downturn that has had a significant impact on the environment. A case in point is provided by the declining fortunes of the critically endangered Greek Red Damselfly *Pyrrhosoma elisabethae* Schmidt (Fig 1: front cover) on Corfu. This globally threatened species, which is now confined to a handful of sites in the Balkan Peninsula, appears to have been quickly lost from sites that have become polluted, and may be lost from the island altogether in the absence of a strategic and concerted effort to protect its remaining site(s) from further pollution incidents.

The original article, *Durrellian Odyssey – An entomological journey to the island of Corfu*, also demonstrates the positive influence that one person

can have on the development of so many other naturalists. In addition to being inspired by Gerald Durrell myself, I have yet to encounter another naturalist who has not cited his books as the reason for studying the remarkably diverse flora and fauna of Corfu¹. This theme is continued through the Gerald Durrell Week, an annual event on Corfu that introduces people to the natural history of the island. It was therefore a pleasure and a privilege to be invited to join Dr Lee Durrell, Dr David Bellamy and the Durrell School faculty to be their entomological consultant/‘Bug Guy’ for the week in May 2014, during which a number of significant discoveries were made, as described below.

This article focuses mainly on the addition of new records for the odonatan and orthopteroid insects, but there have been interesting developments elsewhere on the invertebrate front. Of particular interest has been the separation, and elevation to species status, of a number of *Euscorpium* species of scorpion across the eastern Mediterranean region, including the newly recognised *Euscorpium corcyraeus* Tropea & Rossi (2012) from Corfu. At least eight *Euscorpium* species have now been confirmed from Greece (Tropea *et al.*, 2013) using complex morphological measurements, which have been subsequently validated by molecular DNA and phylogenetic studies (Parmakelis *et al.*, in press).

The reappearance of one of the world’s largest bugs on Corfu after a period of 75 years made a particularly nice story (Ashcroft, in prep), not least



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¹ Which can largely be explained by its pivotal position in the Mediterranean as described by Arndt *et al.*, (2011): “Greece is an intersection point for several distribution patterns. There are Palaearctic and Palaeotropical faunal elements with the following distribution patterns: Eurasian, European-American, European, Iranian-Turanian, Aegaeidean, Palaemediterranean and Pontomediterranean, and Balkan endemics.”



Figure 2. The giant water bug, *Lethocerus patruelis* found in a Corfu swimming pool (Photograph: David Ashcroft)

because of the extraordinary coincidence regarding the links between the former and latter recorders. The 7 cm specimen of the giant water bug *Lethocerus patruelis* (Stål, 1854) was recorded by David Ashcroft, a director of the Durrell School of Corfu, when it was retrieved from a swimming pool at a villa near New Perithea, placed in a pint glass and photographed (Figure 2). This enormous species is a member of the Belostomatidae family (colloquially known as electric light bugs, alligator ticks and toe-biters) which are known to be fierce aquatic ambush predators with an extremely painful bite. An internet search for these insects quickly reveals photographs of them dispatching and feeding on anything that strays into their strike zone, including juvenile turtles and snakes. The three previous records for the island (where the species is reported under its synonym *Belostoma niloticum*) are documented by Dr Theodore Stephanides in his survey of the freshwater biology of Corfu (1939) as follows:

Extremely rare. The author has only seen one living specimen found by a friend, Mr. Laurence Durrell, in a wayside ditch near the village of Kalamí on the N.E. coast of Corfu (Oct. 1936). Length 81 mm. Two more specimens found by Mr. Gerald Durrell, these were floating dead in the sea near Kontokali; Dec. 1937.

This species is apparently in the process of a climate-induced range expansion (e.g. Grozeva *et al.*, 2013) in the Balkan region, and there is a possibility that it may become established in suitable freshwater habitat on Corfu in due course.

The study of some of the larger water beetles of Corfu (Sutton, 2012b) was kindly assisted by a number of European coleopterists including Professor Robert Angus, who subsequently collaborated with Dr Hans Fery and Dr Zoltan Csabai to produce a published list of 84 species for the island (Angus, 2013). This prompted a further exchange with Zoltan Csabai and Elio Gentili regarding the status of *Laccobius* on Corfu, resulting in a second publication that now records the occurrence of six *Laccobius* species for the island. (Angus, 2014).

More dragonflies and damselflies

In 2009, following the discovery of a new species of dragonfly for the island, the Black Pennant *Selysiothemis nigra* (Vander Linden, 1825), it was reported that Corfu held a total of 40 species (Sutton, 2009a) and the following comparison was made:

Corfu has, by far, the richest odonatan fauna of all the Ionian islands. Only the Dainty Bluet *Coenagrion*

scitulum is missing from the Corfu list. In comparison, Kefalloniá and Lefkáda have 20 species of Odonata, and Zákynthos has 14 species.

This situation has now changed, and three new species have been added to the Corfu list: Dainty Bluet *Coenagrion scitulum* (Rambur, 1842), Blue-eye² (formerly known as the Goblet-marked Damselfly) *Erythromma lindenii* (Selys, 1840), and the Bladetail *Lindenia tetraphylla* (Vander Linden, 1825).

The former two species, *C. scitulum* and *E. lindenii*, were discovered by Brochard and van der Ploeg during a survey of Corfu for the exuviae of endemic Odonata species in Greece, in May 2012 (Brochard and van der Ploeg, 2013a). *Coenagrion scitulum* (Figure 3) was found at two separate locations: one at a reservoir in the extreme south of the island near Kavos, and the other in the vicinity of some small lakes near Poulades in the Ropa Valley (Figure 4). *E. lindenii* (Figure 5) was discovered at the same reservoir (Figure 6) as *C. scitulum*, near Kavos. The presence of the Black Pennant *Selysiothemis nigra*, which had been found previously in 2007 (Sutton, *loc. cit.*) was confirmed by the observation of four larvae and a substantial number (163) of exuviae, but no imagines from this emergence were observed. The paper goes on to describe some of the less frequently seen Odonata of Corfu, providing records for the Turkish Clubtail *Gomphus schneiderii* Selys, 1850, the Small Pincertail *Onychogomphus forcipatus* (Linnaeus, 1758), and the Balkan Emerald *Somatochlora meridionalis* Nielsen, 1835. Of particular importance was the record for the Greek Red Damselfly *Pyrrhosoma elisabethae*, and the authors state that in spite of their best efforts, this species could only be found at a single site two kilometres south-east of Sidari (Brochard and van der Ploeg, 2013b), with “other locations on Corfu formerly known to hold *P. elisabethae* now so heavily polluted by sewage that it seems improbable that they still hold populations of this species.” In the same year *P. elisabethae* had been observed at two different localities on the island, one of which was a well-vegetated spring-fed stream near Dassia (Figure 7) to the north of Corfu town (Sutton, 2012a) and at a second site near Vatos, where the source of the three imagines observed was assumed

² The common names for these species have been taken from Dijkstra & Lewington (2006)



Figure 3. The Dainty Bluet *Coenagrion scitulum* (Photograph: Christophe Brochard)



Figure 4. Typical biotope for the Dainty Bluet *C. scitulum* (Photograph: Christophe Brochard)

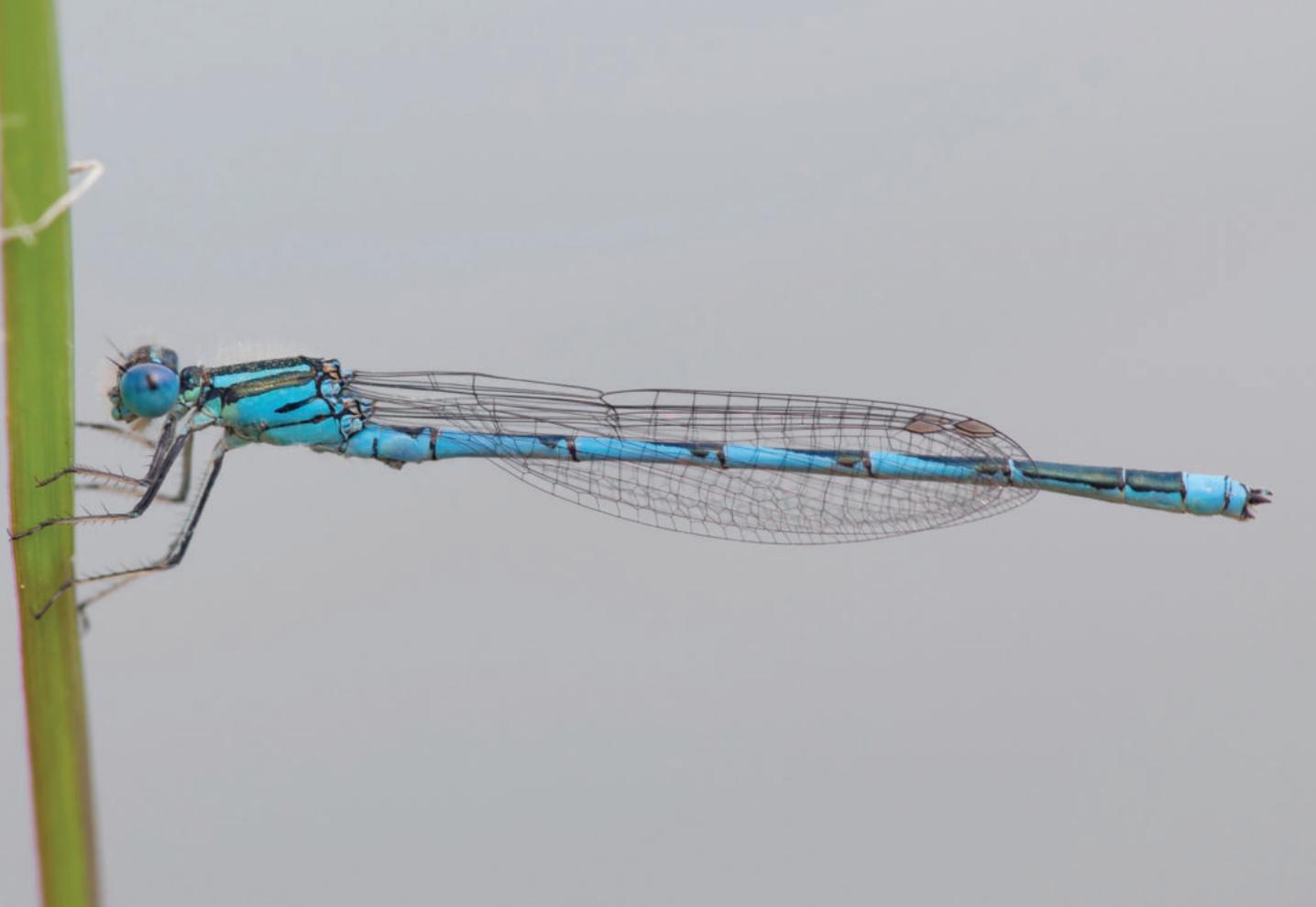


Figure 5. The Blue-eye *Erythromma lindenii* (Photograph: Christophe Brochard)



Figure 6. Typical biotope for the Blue-eye *Erythromma lindenii*, a reservoir near Kavos (Photograph: Christophe Brochard)

to be the Ropa River and its small tributaries. Sadly, a return visit in October 2013, and a subsequent visit in May 2014, found that the Dassia site had also become heavily polluted with all manner of waste materials including motor vehicle oil containers (Figures 8-10), and the species could not be re-found. For this to have happened, so soon after its discovery at this site was gravely disappointing, but reflects the fact that Greece has yet to recover from a financial situation that has led to the pollution of the countryside with rubbish that the local infrastructure cannot apparently afford to collect. If ever there was a species in desperate need of a champion, it is the Greek Red Damselfly, which is in danger of disappearing without trace before those charged with the stewardship of Corfu's natural riches can come up with an effective strategy to save it from extinction.

Brochard and van der Ploeg recorded 30 of the 43 species now known to occur on Corfu, but interestingly, did not report the presence of the Yellow-spotted Emerald *Somatochlora flavomaculata* (vander Linden, 1825). This species was added to the list by Hämäläinen (1983) when it was described as a species new to Greece, and appears to have been recorded on only three occasions with Hämäläinen's record from Perama in 1981, Wolfgang Lopau's record for Vatos in 1994 (Lopau, 1999), and Butler's record for Lake Korission in 1998 (Butler, 1999). In May 2012, I had the good fortune to share an encounter of an emergence of this species with Bosse and Marie Stille, confirming that it is still present in the vicinity of Vatos (Figure 11).

The third species new to the island, the Bladetail (Figure 12), was reported for the first time when five adult males were found at the Kavos reservoir (Figure 6) on 28-vi-2014 (Stille, Stille and Schröter, 2014). The authors consider the ecological conditions of the reservoir to be sufficiently favourable to suggest that this species may, in accordance with observations elsewhere in the Mediterranean, be indigenous to the island.

New orthopteroid insects

In 2009, a review of the orthopteroid insects of Corfu revealed a total of 65 species of Orthoptera³, with seven allied species from the Mantodea (two

species), Blattaria (two species), Dermaptera (two species) and Isoptera (one species) (Sutton, 2009b). A subsequent paper (Sutton, 2012c) reported a new species of grasshopper, *Tropidopola graeca graeca* Uvarov, 1926 for the island. Other species newly recorded for the island include the attractively marked grasshopper *Eyrepocnemis plorans* (Charpentier, 1825) (Figure 13) which was found by the author in saltmarsh grassland at the edge of Lake Halikiopoulos next to Corfu Airport in October 2013, the Oriental Cockroach *Blatta orientalis* Linnaeus, 1758, from Corfu Town, and a new species of termite, the Yellow Necked Dry-wood Termite *Kaloterms flavicollis* (Fabricius, 1793), also from Corfu Town. An older reference (Ebner, 1912) provided evidence that the stick insect *Bacillus rossius* (Rossius, 1790) had previously been recorded from Corfu and a more recent source (Brock, 1991) provides a record of this species from Kavos, and details of an additional species, *Clonopsis gallica* (Charpentier, 1825) from Roda in 1983. However, the situation regarding the stick insects of Corfu merits further investigation to determine whether the subspecies of *Bacillus rossius* is *redtenbacheri* Nascetti & Bullini, 1983, and indeed, if *Bacillus atticus* Brunner von Wattenwyl comes into the equation, since it is present nearby in mainland Greece, and it has been suggested that one photograph of a Corfu specimen of *B. rossius* has more tubercles than expected, a sign that it might be *atticus*. Similarly, the mantids also require close scrutiny since *Ameles decolor* and *Ameles heldreichi*, which occur sympatrically in the region, are difficult to separate without close examination of morphological differences. What can be said, for the time being, is that the presence of two other species, *Ameles spallanzania* (Rossi, 1792) (Figure 14) and *Geomantis larvoides* Pantel, 1896 has recently been confirmed by Bosse and Marie Stille. During the course of 2013, three separate accounts of the discovery of the cone-headed praying mantis *Empusa fasciata* Brullé, 1836 on Corfu were received. However, while a review of available literature failed to provide evidence that this species occurred on the island, a photograph of a juvenile specimen appeared on a website about the wildlife of Corfu (Doyle, 2005), where this species is described as being found in grassy shrub land throughout

the summer and well into October. This brings the number of mantid species on the island to at least five. Finally, male (Figure 15) and female (Figure 16) specimens of the unusual and impressive banded form of the Greek Magician *Saga hellenica* (Kaltenbach, 1965) were found by Howard Inns in June 2014.

Gerald Durrell Week: 3rd-10th May 2014

The Durrell School faculty consisted of the following members, whose job it was to introduce the participants to the Corfu that Gerald Durrell knew: Lee Durrell, Colin Stevenson, David and Rosemary Bellamy, David Shimwell, David and Alexina Ashcroft, Bosse and Marie Stille, and myself. The week was characterised by the strong desire of all concerned to immerse themselves in the magic of the island, and things began well when David Shimwell and I, while preparing a walk for the Durrell School in the woodlands above the town of New Peritheia, discovered the tunnels of trapdoor spiders as we searched for the corkscrew tendrils of the cyclamen tubers that David referred to as 'sowbread'. The perfectly camouflaged lids of these tunnels (Figure 17), when carefully lifted from their "neatly bevelled edge", revealed the finely crafted silken tubes (Figure 18) that left the young Gerald Durrell wondering what on Earth could have been responsible for "this magnificent piece of workmanship" (Durrell, 1956).

In the days that followed, visits to a variety of different habitats, from mountain woodlands to coastal lagoons, resulted in more notable discoveries, including an important new site for the Greek Red Damselfly *Pyrrhosoma elisabethae* at Xanthates. A day in the mountains overlooking the spectacular wetlands of Albania produced a memorable display of butterflies as we walked through the orchid lined paths, including a sighting of the Grecian Copper *Lycaena ottomana* (Lefèbvre, 1830) (Figure 19). In 2012, a revision of the checklist of the Rhopalocera of Corfu (Sutton, 2012d) showed that this species had not been recorded on Corfu by a number of lepidopterists from western Europe, but that its presence on Corfu had recently been confirmed by Kudrna *et al.* (2011), Tshikolovets (2011) and Pamperis (2009).

³(The number of species was erroneously given as 64)



Figure 7. The well-vegetated spring-fed stream near Dassia prior to the pollution event that appears to have caused the disappearance of the Greek Red Damselfly *P. elisabethae*; Figure 8 (top left). The stream near Dassia after the pollution event; Figure 9 (bottom left). Oil containers retrieved from the stream; Figure 10 (bottom right). Rubbish piled up next to the spring-fed stream near Dassia.



Figure 11 (top left). The Yellow-spotted Emerald *Somatochlora flavomaculata* near Vatos

Figure 12 (middle left). The Bladetail *Lindenia tetraphylla* found at the Kavos reservoir (Photograph: Marie Stille)

Figure 13 (top right). The grasshopper *Eyprepocnemis plorans* from Lake Halikiopoulos, newly recorded for Corfu

Figure 14 (bottom left). The mantis *Ameles spallanzania* (Photograph: Marie Stille)



Figure 15. A male of the unusual banded form of the Greek Magician *Saga hellenica* (Photograph by Howard Inns); Figure 16. Female banded form of the Greek Magician (Photograph by Howard Inns)



Figure 17 (left). The trapdoor spider *Cyrtocarenum* sp. tunnel hidden by moss; Figure 18 (right). Open trapdoor showing the silk 'hinge' and beautifully constructed tunnel.



Figure 19 (left). The Grecian Copper *Lycaena ottomana* from the Hellenic valonia oak forest; Figure 20 (right). Dr David Bellamy holding a giant acorn from *Quercus macrolepis*, the main component of the threatened Hellenic valonia oak forest.

Ghinis *et al.* (2013) provided information on the presence of this species in the Rechini area of the Melissoudi River valley, and in the Marsh of Kanoufadi area near Lake Antiniotissa to the north-east of the island. This species was formerly classified as Vulnerable according to IUCN Red List criteria when a decline in its distribution area (which is focussed mainly on Albania, Greece and Turkey) of between 25- 50% was reported towards the end of the 20th century (van Swaay and Warren, 2000). A recent revision of the IUCN Red List now considers this species to be Least Concern (van Swaay *et al.*, 2010), and its populations are generally regarded to be stable. The authors state that the Grecian Copper is not now believed to face major threats at a European level, primarily because “this species occurs in a number of protected areas across its range”. However, this does not appear to be the case on Corfu, where populations remain under threat from the development of coastal sites. Also, at least one of the known populations on Corfu (as with the threatened Bulgarian populations, and probably those in similar habitats in other Balkan countries) is associated with xerothermophytous oak forest, a habitat which is under considerable threat across the Mediterranean region. These fairly open forests are dominated by the semideciduous Valonia Oak *Quercus macrolepis*, (a species that apparently has the largest acorns of any oak tree in the world (Figure 20)), and a continuing decline in these characteristic Hellenic valonia oak forests is likely to have a significant impact on the typically rich vertebrate and invertebrate life associated with this habitat.

Many other insects were seen during the day trips, which were regularly punctuated by various impromptu talks from the experts (Figure 21), finding species such as the supremely showy meloid beetle, *Teratolytta dives* (Brullé, 1832) (Figure 22) and leisurely lunch breaks after taxing ourselves with the enjoyable rigours of fieldwork (Figures 24-26).

The conclusion from the previous article:

“...the magic of Durrell’s Corfu still exists, and for those who wish to explore the island, there are still some extraordinary finds to be made”,

... is as true now as when it was first

written.

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Finally, sincere thanks again to the Durrell School of Corfu, both faculty and all of the participants, and also the local Corfiots, who made the entire week such a warm and enjoyable affair. I will fondly remember the Greek night, where two delightful local Corfiots attempted to teach us Greek dancing, ending with one of the memorable highlights of the trip, with Messrs Bellamy and Shimwell, arm in arm, wheeling around on the cobbled stones of the *Villa Alexina* courtyard in





Figure 21 (top left). Dr David Shimwell explaining the many benefits of the Strawberry Tree *Arbutus unedo*, the food plant of the Two-tailed Pasha *Charaxes jasius*; Figure 22 (top right). The spectacular meloid beetle *Teratolytta dives*, a species at the western limit of its European range in Corfu; Figure 23 (middle left). Exploring a coastal lagoon; Figure 24 (middle right). Dr Lee Durrell inspiring one the next generation of naturalists; Figure 25 (bottom left). A well-earned break in the mountains overlooking Albania; Figure 26 (bottom right). The team sampling the delights of a Greek Taverna.

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Grub's Up Lunch at The Bug

When I was a child, visits to my grandmother's house were often interrupted by the arrival of a gentleman of the road. These tramps or vagrants would arrive unannounced and stand expectantly at the front door. Despite their ragged appearance, my grandmother would always receive them courteously and they would be seated in the scullery where they were offered a mug of tea, a slice of cake and their empty whisky bottle would be refilled with cold tea before they returned to the road. My grandmother told me that these gentlemen of the road had a secret set of marks that they made on, or near to, the gatepost of a hospitable house, so that fellow travellers could avail themselves of the owner's hospitality. I searched endlessly for these elusive signs but never found them.

The road leading to Dr Beynon's Bug Farm (also known as The Bug Farm) has a similar, elusive set of marks. As I drove through the wide horizons of the

Peter Smithers

Pembrokeshire countryside, a mark on a post caught my eye. To a non-entomologist it would be a black, symmetrical shape; a dark splat on a post, a sign of no real consequence. But to an entomologist it was, without doubt, a scarab beetle. A statement that shouted to all who could read the secret code: This way to The Bug Farm: Anyone with an interest in insects is welcome here.

I had met Sarah earlier that year at the launch of National Insect Week, where she had sat on an Insect Question Time panel. One of the questions from the audience had been about insects as a future food and, to my surprise, Sarah had replied that her partner was opening a restaurant in which insect dishes would be offered. I could not resist a visit to find out more and so here I was entering at the sign of the black beetle.

We drove in and parked in the farm courtyard, a ramshackle array of buildings dominated by an old grain

grub

Starters

Chilli cricket cocktail with bloody Mary salsa and lemon chapuline salt.

Bug blinis with wild garlic humus and toasted cumin mealworms.

Grub garden salad of local organic leaves, tomatoes other oddities and herbs with crunchy insect granola, Grub goats cheese and balsamic jelly.

Mains

Bug burritos; Lemon and coriander bulgar wheat, spicy beans and chilli-con crickets with chilli chapuline and tomato salsa, sour cream and sago worm guacamole.

Grub bug burgers with a sour dough and cricket flour bun, parmesan and rosemary polenta chips, tzatziki, chilli salt and tomato relish.

Sago, and bamboo worm pad Thai curry.

Pudding

Carrot, cricket and cardamom sponge cake with caramelized crickets and lemon crème fraiche.

Cricket crepes with a bamboo worm fudge ice cream.

Treacle tart with bug brittle and hedgerow compote.



silo. The farm was still and quiet; we waited in the sunshine deciding where to check first, when Andy Holcroft appeared from one of the old buildings with a warm and friendly greeting. He escorted us into the only building that had been thus far renovated. This was destined to be the classroom when the farm is up and running but, for now, it is everything: lecture room, lab, meeting room and eating area. Before we settled down, Andy showed us the kitchen, that had been freshly lime-rendered, and the building that will eventually be his restaurant, Grub. Back to the classroom where the coffee machine stirred into life. We sat drinking our espresso in the bright, white interior, sunlight streaming through the high windows of the old barn.

Sarah arrived shortly afterwards, a whirlwind of energy, in stark contrast to Andy's calm and measured manner. More coffee with a few crickets as a snack. Then Andy brought out a light lunch that he had prepared for us to give a flavour of what Grub will have on offer: Grub's signature orthopteran burger in a fresh bread roll with polenta chips. This was delicious. The tastiest burger I had ever eaten. I am definitely going back when the restaurant is up-and-running. The burger was meaty, slightly crunchy and bursting with a range of tantalising flavours (see Andy's appended recipe).

The polenta chips were also magnificent. One simple dish and I am sold on the concept.

Sarah's business venture, Dr Beynon's Bug Farm is a project in its early stages, it aims to provide a raft of sustainable services to the farming community, as Sarah will explain in her article in the next *Antenna*, but it was Grub, the onsite restaurant, that I had come to St Davids to explore with them. Grub plans to offer a range of local and sustainable food to the farm's visitors. Sarah and Andy are from opposite ends of the food spectrum. Sarah comes from a long line of farmers, so one of her passions is the production of our food, while Andy, as a chef, is passionate about its consumption.

Farming is a consumer-driven enterprise so, while Sarah will be offering advice on sustainable practices to the production end of the business, Andy will be altering the way that consumers view its presentation and consumption. As well as serving insects, Grub will be offering eager diners a range of local, conservation grade meats, sustainably-sourced seafood, local vegetables and foraged herbs and seaweeds. Andy hopes that by offering a range of delicious and affordable dishes he will create a demand for sustainably produced food.

As sustainability is a key theme that

runs through the entire project, the farming of insects and their incorporation into our diets is a vital aspect of the enterprise. Alternative systems for the production of animal protein will become an essential part of farming in the not too distant future. Grub aims to get ahead of the game and offer its diners a chance to sample a range of entomological delicacies in an effort to raise awareness and bend public opinion in favour of these new foods.

Persuading potential diners that insects are a desirable and tasty addition to Grub's menu will be a challenge. Despite being a tourism hotspot, St Davids is far from the large cosmopolitan population centres that projects like Ento can tap into (see *Antenna* 38, 1). Grub's challenge is to appeal to local diners, attendees of Bug Farm courses and activities plus visitors to The Bug Farm and the local area.

Andy plans to offer his new, innovative foods in traditional formats: The lunch we had enjoyed was a classic example. As Andy said: "What could be more accessible than burger and chips? This is a dish that everyone can relate to".

Visitors to The Bug Farm will possess various degrees of predisposition to new culinary experiences. People attending workshops or walks based at the farm can eat at Grub as a matter of



grub

Grub's signature bug burgers

(makes about 8 medium patties)

Ingredients

- 1 onion
- 1 stick of celery
- 1 medium carrot
- 1 small courgette
- 2 mushrooms
- 1 clove of garlic
- 100g breadcrumbs
- 50g freeze dried mealworms
- 50g freeze dried crickets (legs removed)
- 30g freeze dried grasshoppers (legs removed)
- 1 tsp sea salt
- 1 tsp ground black pepper
- 1 tbsp Dijon mustard
- 2 medium free range eggs, beaten
- 1 tsp fresh parsley, oregano and/or thyme (if available)

Method

1. Place all the vegetables and garlic into a food processor and pulse for about ten seconds until the contents are finely chopped but not pureed.
2. Stir fry the veg mix in a little olive oil for 5 minutes in a heavy bottomed pan stirring regularly.
3. Scrape the par-cooked veg into a large mixing bowl and return the pan to a low heat, mix in the breadcrumbs, seasoning, eggs and mustard.
4. Put the insects into the food processor but hold back 5-10% if you like to see whole insects in the burger, and pulse for no more than 5 seconds.
5. Put the insects into the vegetable mix and using your hands combine well.
6. Using your hands press the bug burger mix into even sized patties about 3cm thick and place onto a tray with a little flour. Be sure to press the burger well, so there are no folds or cracks.
7. Splash a little more oil into the hot pan and fry the burgers for 3 mins each side or until golden brown in colour, turn down the heat on the pan and cook for a further 4 mins until hot in the middle (75 degrees celsius)
8. Enjoy Grub's signature bug burgers in a bun with some fresh tzatziki or mayonnaise, lettuce and tomato and your favourite form of chips or wedges.

conservation are likely to be more open to the new dishes. Tourists that are visiting the farm are likely to have their curiosity piqued by the range of interesting and novel foods on offer at Grub.

However, Grub will tempt the more traditional, regional diners with locally sourced food and hope to introduce them to its entomological delights as side dishes and tasters. The menu will offer not just a list of dishes but also their ingredients, preparation and provenance.

Many of the grains, vegetables and livestock that feature on the menu will be produced on the farm, ensuring that diners are conversant with the source of their meal. The insects are currently sourced from Crunchy Critters, but other sources of insects for human consumption will soon be available. Andy and Sarah have plans afoot to explore farming their own human-grade edible insects, which they intend to serve in Grub.

Grub plans to open in summer 2015 with a series of feast nights alongside the public opening hours. Feast nights will feature a talk or activity around which the menu will be themed. Food products developed in the restaurant will also feed into the farm shop.

Grub is one small part of The Bug Farm project, which is an ambitious, holistic approach to sustainable food production and consumption. We wish Andy & Sarah well and look forward to some interesting meals in the coming year.



grub



Hazy days. Humbert is on the right, Dolores the left. As Christer discovered many years ago, Dolores is good at saying “yes” but not saying “no”, relying on Humbert to do the decent thing when she is not interested. (Wiklund, C. (1977). Courtship behaviour in relation to female monogamy in *Leptidea sinapis* (Lepidoptera). *Oikos* 29: 275-283.) [Courting wood whites, *Leptidea sinapis*, photographed in Surrey by Adrian Hoskins, FRES. Reproduced here with permission.]
 See <http://www.learnaboutbutterflies.com/Lifecycle%20-%20mate%20location%20courtship.htm>

Thoughts on the Biology of Butterflies – Turku 2014

Prediction is very difficult, especially about the future.
 [Often attributed, incorrectly it seems, to Niels Bohr]

Dick Vane-Wright

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Leptidea. Lep-tid-ee-ah (apologies to VN). And rather like Humbert Humbert’s muse, small, delicate, beautiful, captivating.

Since attending the 7th International Conference on the Biology of Butterflies, which took place in Turku, Finland, 11-14 August, I had the further pleasure to spend a short vacation in Parga. September 2014 saw a great deal of rain in this NW corner of Greece and, to my innocent mind at least, I was surprised to see a good number of butterflies, many very fresh.

The various species and genera set me thinking about where we have got to with an understanding of the biology of butterflies . . . beautiful creatures, sources of perennial fascination . . .

Many Leptidea were flying in olive groves and on verdant sea cliffs. The modern biology of wood whites is forever in my mind linked to the work of Professor Christer Wiklund. *Kris-ter Vik-lund*. So it was great to find that one of the main sessions on the very first day of the Turku conference, on the Evolutionary Ecology of Butterflies,

was dedicated in Christer's honour. Ten papers covered a wide range of topics, launched by a keynote from Jeremy Thomas (Oxford) on that remarkable tri-trophic system – *Maculinea* butterflies, their hymenopteran parasitoids, and *Myrmica* ants. This is another great success story of butterfly biology, stretching back to Frederick William Frohawk and other pioneers, but year on year now brought to modern sophistication through many contributions – often spearheaded by Jeremy himself. As would seem appropriate, given Christer's Stockholm base, all the papers in this session involved work on north temperate species, including various *Euphydryas*, *Pieris*, *Maniola*, *Speyeria*, *Colias* and *Araschnia* – but not *Leptidea*! Instead, we had to wait for a catch-all session two days later, on general butterfly biology, to hear Vlad Dincă (Guelph) give a paper, on behalf of 10 co-authors including Christer, “*Leptidea* wood white butterflies as an emerging model to study speciation”. The wood whites in question consist of three highly cryptic species (*L. sinapis*, *L. reali* and *L. juvernica*), with *L. sinapis* itself the metazoan with the greatest known intraspecific variation in chromosome number ($n = 28-53$). However, even this now seems to be an underestimate. Moreover, this karyotypic variation is expressed clinally, making it a superb model for speciation studies. *Lep-tid-ee-ah* will soon ‘benefit’ from genomic studies – even Nabokov would surely never have dreamt of that.

A single male *Argynnis paphia* was encountered at the supposed source of the Acheron River, gateway to Hades. Only relatively recently has the relationship of *Argynnis* to the equally but differently fabled *Heliconius* butterflies of South America been confirmed to the point where these fritillaries (with *Boloria*, *Issoria*, etc.) are now firmly placed together with *Heliconius* in the monophyletic nymphalid subfamily Heliconiinae (Wahlberg et al., 2009). Paul Brakefield (Cambridge) noted in his talk during the Ecology and Evolution session, how studies on butterfly biology have contributed a great deal to biosciences in general, with the suggestion that, amongst the butterflies, the leading model system today is probably *Heliconius*. At least eight papers were given largely or entirely based on *Heliconius* species, including two remarkable presentations in the Genomics of Adaptations session



Argynnis paphia drinking at the source of the Acheron River, NW Greece, 16.ix.2014. Part of the androconial field of the forewing upperside is clearly visible – but, despite the early work of Rudolf Barth (1944), how these male scent organs really work is still largely unknown. [Photograph: R.I. Vane-Wright; Barth, R. (1944) Die männlichen Duftorganen einiger *Argynnis*-Arten. *Zoologischer Jahrbucher (Anatomie)* 68: 331-362.]

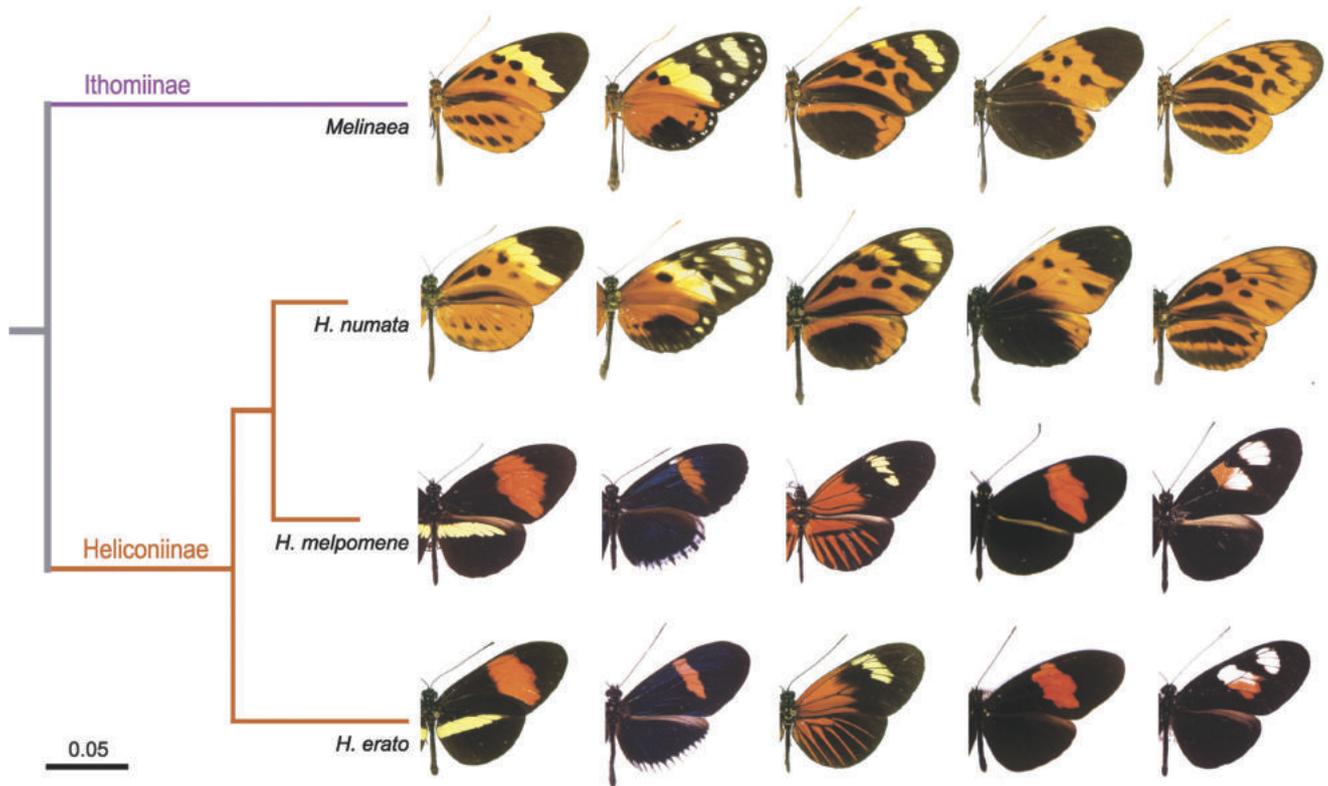
by Mathieu Joron's team (based at the Muséum National d'Histoire Naturelle, Paris), concerning pattern polymorphism in *H. numata*. These papers gave very up-to-date accounts of fundamental issues in evolutionary genetics (e.g. frequency enhanced and frequency attenuated selection, evolution of dominance) going right back to Ronald Fisher's classic work.

Around Parga, Lasiommata megera were numerous. As a child growing up in outer London, the Wall Brown was a common and lovely sight, even in suburban gardens. I have not seen one in Kent now for many years, although they still occur sparsely. Why would a grass-feeding species become so diminished? Perhaps it is like the Comma, *Polygonia c-album*, always considered a butterfly that cycled from common to infrequent and back – and there is some evidence for this in *L. megera*. However, for such organisms, not tied to very specific localities or ecosystems, untangling ‘natural’ trends and cycles from the effects of human ‘enterprise’ is a key challenge for conservation biology. Thus it was good to see two of the five papers presented in the ‘Population Biology and Conservation’ section address general habitat issues, both within the framework of climate change. Rob Wilson (Exeter) presented a co-authored summary of work on population persistence in relation to topography and microclimate, featuring another grass-feeder, *Hesperia comma*,

with the conclusion that in the north-temperate at least, with respect to offsetting climate change effects, conservation efforts should best be focused on topographically varied landscapes. In some contrast, Jenny Hodgson (Liverpool), in a presentation also featuring work on the Silver-spotted Skipper, argued for a focus on habitat quality and availability, with the need at continental level to link isolated landscapes on a much larger scale than current approaches to fostering “ecological networks”.

The debate will surely continue – as it did on day two in the Butterfly Movement session, notably in a paper from Elizabeth Crone (Tufts) and colleagues on habitat use and habitat quality in *Plebejus*, *Euphydryas* and *Satyrodes* butterflies. Yet our concerns for so many species are tempered by the conviction that action is essential now. If hasty action is misinformed, will the opportunity to make a difference be lost forever? But if we wait for better understanding, will it be too late anyway? The application of our increasing knowledge of butterfly population biology to conservation faces this seemingly perpetual difficulty – when do we have enough information to act wisely? The skill of a good professional conservationist still lies to some considerable extent in the realm of intuition.

Neptis sappho was seen on several occasions. Although one might consider



A hint of why *Heliconius* is probably “the leading model system”. Five sympatric forms of *H. numata* from northern Peru are shown on the second row, with corresponding separate species of danaine co-mimics above. Below, part of the classic *erato/melpomene* parallel mimicry system. Figure 1 from Joron et al. (2006). (Joron, M., Papa, R., Beltrán, M., Chamberlain, N., Mavárez, J., 10 others & Jiggins, C.D. (2006). A conserved supergene locus controls colour pattern diversity in *Heliconius* butterflies. *PLoS Biology* 4(10): e303. doi: 10.1371/journal.pbio.0040303. Open access.)

the ‘white admiral’ wing patterns of *Neptis* to be disruptive, I always feel that, being so striking, they may (also) offer species or species-group recognition characters – what Alfred Wallace might have included in his category of ‘normal colours’. Generally among the numerous Asian and African species of *Neptis* there are subtle differences in wing pattern between species, but within each species the sexes are visually almost indistinguishable. Wallace also recognised ‘sexual colours’ – which he thought of as originally gaudy in both sexes. Where sexual dimorphism occurs, he considered this to be a result of natural selection favouring more cryptic or mimetic female patterns, for better protection against predators.

Wallace, as is well known, disagreed with Darwin’s sexual selection hypothesis, which proposed that the more gaudy male colours of many species are driven by female preference. This debate is still very much alive in butterfly biology, and was evident in several of the 10 papers presented in the sexual selection session. Following a masterly overview by Ron Rutowski (Arizona State) of Darwinian sexual selection as applied to butterflies, a wide variety of related topics were covered – including mate preference learning, species recognition within Müllerian mimics, the possibility of sexual conflict driving pattern diversification in Müllerian

mimics, interactions between olfactory and wing-pattern diversity in a radiation of Satyrinae, and an attempt to explore the possibility of cryptic female choice in the Monarch. This last paper reminded Michael Boppré of the need to determine what really passes for ‘normal’ courtship in *Danaus plexippus* – is it just the widely reported ‘brutal’, coercive strategy now widely considered ‘normal’ for this species, or perhaps one of the other known courtship sequences that would seem to allow greater possibilities for female (and male) choice in this species – as long ago described by Tom Pliske (1975). Presentations involving questions about sexual selection were also given in other sessions, including a paper by Krushnamegh Kunte and Deepa Agashe (Bangalore) in *Ecology and Evolution* on drivers of sexual dimorphism and polymorphism in mimetic butterflies – in which they concluded that, contra views expressed in the past, neither sexual selection nor physiological tradeoffs were involved in female-limited polymorphisms.

The dazzling blue coloration of Polyommatus butterflies in the Greek autumn sunshine led to thoughts of the remarkable co-adaptations between butterflies (Lycaenidae, Riodinidae) and ants. Queen of lycaenid butterfly biology, ever since the London meeting, has been Naomi Pierce (Harvard). In her plenary lecture opening the *Ecology and Evolution* session on day 3, Naomi

cast her net wide to look at major diversification patterns across the whole of the Lycaenidae. She identified two major rapid radiations. Diversification of the Polyommata (approaching 500 known species) appears to relate to, among other factors, ant associations, wide thermal tolerances and, perhaps in particular, karyotype instability. The Eumaeini, with over 1200 species and more than 80 recognised genera, are the most speciose tribal level grouping in all the butterflies. As long ago suggested by John Eliot, in this group speciation seems associated with hyper-diversity of male secondary sexual characters – including remarkable black wing pads now demonstrated to be capable of broadband infrared absorption and emission.

Across the Lycaenidae as a whole, ant associations seem important in diversification. However, when this leads on to carnivory (succumbing in an evolutionary sense to “the temptation to cheat”, as Naomi put it), the phylogenetic patterns suggest this is usually an “evolutionary dead end”. My only unfulfilled wish from this lycaenid extravaganza was some discussion of the exclusively African Lipteninae – with well over 600 species, apparently all linked to a larval feeding shift to exploit terrestrial algae (including algae within lichens). Judging by the phylograms presented, this is an older group, so arguably the diversification rate is not above average. Even so, the



Day one (left). An apparently tense and apprehensive organizer-in-chief gets the conference under way. [Niklas Wahlberg, photographed by R.I.Vane-Wright.]; Day two (right). Antónia Monteiro delivering her plenary lecture on nymphalid border ocelli, Tuesday 12th August 2014. [Photograph by R.I.Vane-Wright.]



Day 3. A now happy and relaxed Niklas Wahlberg charms and amuses his flock at the Conference Banquet, Pikku-Pukki Island, 13.ix.2014. One of the most popular banqueting locations in Turku, the island is 30 min by boat from the centre of town, along the Aura River. [Photograph: R.I. Vane-Wright.]



Ethope himachala has one of the most even and complete sets of border ocelli in all the Nymphalidae. But why the blue eyes? Butterflies pose so many interesting questions! [Photographed near Sessa, Arunachal Pradesh, NE India, v.2013, by Ray Cannon; reproduced here with permission. <http://rcannon992.com/2014/11/23/old-blue-eyes/>]

existence of this group is without parallel in the rest of the butterflies.

Five species of *Maniola* occur in Greece, but only the most familiar, the Meadow Brown, is found on the mainland – and was common around Parga. *Maniola jurtina* holds a special place in the history of biology, being a key study organism for E.B. Ford and his collaborators in establishing the field of ecological genetics. With his remarkable ability to breed successive generations of this species, Paul Brakefield engaged in the meadow brown world after leaving Oxford to become a University of Liverpool PhD student in the late 1970s, creating new insights into the genetics and ecology of seasonal changes affecting the border ocelli of *M. jurtina*. Encountering the remarkable Torben Larsen at the London meeting, Paul started to explore the greater phenotypic seasonal plasticity exhibited by tropical Satyrinae – notably *Melanitis*, and then *Bicyclus*.

Paul's ability to culture *B. anynana* has led to this species become something akin to the 'Drosophila' of butterfly biology – most notably perhaps with respect to 'evo-devo'. In a tour de force, Antónia Monteiro (Singapore) introduced the Genomics and Development section with her plenary lecture on "The origin and evolution of novel gene regulatory networks". The substance of her presentation was based on an analysis of development of the border ocelli (Nijhout, 1991: 26) across the whole of the Nymphalidae. According to Monteiro, eyespots, and four out of five genes expressed in eyespots, have the same single origin near the base of the nymphalid tree [the two basal groups

excluded being the Danaeinae and Libytheinae], leading to the conclusion that this system originated through the co-option of pre-existing, modular gene regulatory networks, and these were subsequently modified in increasingly sophisticated ways.

In all of this, *B. anynana* held centre stage as a key 'lab rat'. Based on the observation that there is considerable variation in the plasticity of expression of particular eyespots in this species, one can ask the question not only how, but also where and when in the phylogenesis of the Nymphalidae this plasticity originated. It seems the molecular tools and model systems are now available that should enable these questions to be answered.

Another fascinating paper in this session, by Marcus Kronforst (Chicago) and co-authors, described how a single gene, doublesex, is now known to be responsible for the control of female-limited polymorphism in *Papilio polytes*. This work has recently been written up in *Nature* (Kunte et al., 2014). Thanks to genomics, our understanding of the intricate mechanisms underpinning continuous and discontinuous variation in butterfly colour patterns is now advancing at a remarkable pace.

On the edge of the wetlands at the mouth of the Acheron river I saw two *Danaus chrysippus*. The milkweed butterflies exemplify many key aspects of butterfly biology, perhaps most notably chemical ecology and the many issues surrounding larval food preferences and specialisations. Somewhat to my surprise, relatively few papers given at Turku addressed larval food, and these were scattered

across several sessions. This could reflect the growing emphasis of *in vitro*, laboratory-based molecular methods that give more predictable results for the now all-important student theses. If so, butterfly biology must be mindful of its roots in basic natural history – something Robert Ricklefs (2012) has recently emphasised for the whole of ecology and evolutionary biology. Notable contributions on larval food relationships were given, at species level, by the irrepressibly entertaining Mike Singer ("One butterfly, six host shifts"), and in a multidisciplinary presentation at family level by Niklas Janz, regarding questions of host range and diversification.

Another favourite childhood butterfly was also flying at my Greek resort – *Vanessa atalanta*. The Red Admiral is unusual, although not unique, in being partial to both rotting fruit and nectar as sources of 'refreshment'. The dramatic differences between larval and adult feeding can be highly significant for butterfly biology, but this thread was not strongly represented at Turku. No paper was given on pharmacophagy, or comparing fruit and nectar feeding, while just two touched on polyandry as a source of female material 'income' affecting fecundity – which can be influenced by the feeding activities of adult males as well as the females themselves. Three papers explored diversity patterns and population dynamics in fruit-feeding butterfly assemblages, but not the energetics involved. Perhaps this aspect of butterfly biology should be the subject of a dedicated session at a future meeting.

Plenty of clouded yellows were in evidence at Parga. I find a certain irony that, in the early days of 20th century butterfly genetics, some of it – such as the work of H.C. Gerould on *Colias* polymorphism – became associated with the now widely (but not entirely) discredited eugenics movement. This was based on genetic determinism – in the sense that 'good' and 'bad' genes of themselves controlled what an organism (specifically you!) would become, and what its (your) descendants would become also. In other words, genetics was seen as highly predictive. To some extent, even if state-controlled eugenics movements have largely been abandoned, the idea of genetic determinism is still with us. "Gene for" talk in vernacular parlance is still widely heard regarding various



Day 3. Discovering the waitresses thought we were very friendly people! Author with (left to right) Michael Boppré, Nils Ryrholm, Niklas Wahlberg and Krusnamegh Kunte, at conference banquet, Piku-Pukki Island. [Photograph courtesy of K. Kunte.]



Day 4. The group photo! Conspicuous at the front, far right, is André Freitas. [Photograph: K. Kunte.]



Left: Deepa Agashe nectaring at Turku. One of the rising stars based at NCBS, Bangalore, where 'BoB 8' is due to take place in 2018, Deepa has a special interest in bacterial evolution – a subject area of ever increasing importance for butterfly biology. [Photograph: R.I. Vane-Wright.]; Right: Ilkka Hanski, “legendary Finnish metapopulation biologist”, at the conference banquet. [Photograph: R.I. Vane-Wright.]

genetic diseases, and even psychological traits. But the idea of ‘bean-bag’ genetics has largely been abandoned (Rao & Nanjundiah, 2011), with the realisation of the highly interactive nature of the whole genome, and its dynamic relationship with cellular metabolic processes (e.g. Shapiro, 2011).

Following publication of Willi Hennig’s *Phylogenetic Systematics* in 1966, many biologists protested that his methods could not reliably infer phyletic relationships – and even if they did, cladograms were an insufficient or inappropriate basis for ‘good’ systematics. For a time three approaches – evolutionary, phenetic and cladistic – vied for supremacy. Some 50 years on, cladistics has largely prevailed, and genetics is no longer the science of powerful predictions, but increasingly of retrodictions. Based on the amazing advances in molecular methodology, genetics (and proteomics and genomics) has become the dominant data source with respect to Hennig’s aims – extending right up to exploration of the ancient diversification of life (at the level of domains) and right down to within-species studies, as in phylogeography. This change in perspective, from London 1981 to Turku 2014, was very evident. At the London meeting no papers were presented on systematics (Phillip Ackery’s well known paper was written after the event, especially for the symposium volume). In Turku cladograms were abundant, in both talks and posters – with Paul Brakefield going so far as to say “systematics and

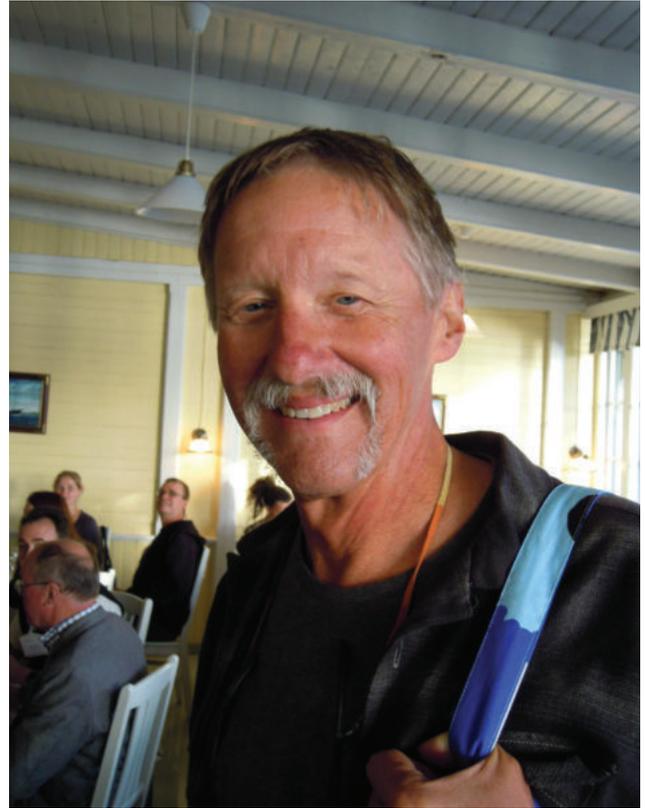
phylogenetic reconstruction remains the foundation of ‘all good things’.”

There were other striking differences between Turku 2014 and the RES meeting held 33 years earlier. Thirty-three papers were presented in London with a total of 43 authors; in Turku there were almost 100 talks with an average of 3.75 authors per paper. Turku also featured over 120 posters – far, far more than the handful exhibited in London. These ‘statistical’ differences reflect the great increase in multidisciplinary scientific work over the intervening decades. This can also be appreciated from the structure of the meeting. The London event had six basic and one applied themes: populations and communities; food; predation, parasitisation and defence; genetic variation and speciation; sex and communication; migration and seasonal variation; and conservation. The studies presented within this structure were largely grounded in one or other of the primary disciplines of 20th century biological sciences, notably genetics, ecology, ethology and evolution. In some (but not total) contrast, the eleven main themes at Turku were more overtly interdisciplinary: population biology and conservation; evolutionary ecology; genomic basis of adaptations; genomics and development; butterfly movement; sexual selection; ecology and evolution; butterflies as hosts; systematics and diversity; evolutionary phylogenetics; and behavioural ecology. Papers on closely-related subjects were often placed in different sessions.

Highlights of Turku? Inevitably any such list is very personal – especially as

it was not possible to hear all talks. I felt the ‘Paris’ presentations from Mathieu Joron’s group on *Heliconius numata* polymorphism were exceptional. Then there were the bravura performances of Naomi Pierce and Antónia Monteiro. A paper by Jaap de Roode (Emory) on the neogregarine parasite *Ophryocystis elektroscirrha* and ‘self-medication’ in Monarch butterflies was fascinating, although it seemed to raise as many questions as answers. But perhaps for me the most exciting moment came in the very first talk, by legendary Finnish metapopulation biologist Ilkka Hanski (Helsinki) concerning an effect of flight muscle activity.

In Glanville Fritillary (*Melitaea cinxia*) butterflies from fragmented versus non-fragmented landscapes, recent work in ‘ecological genomics’ strongly suggests that “differences in gene expression between the landscape types reflect genomic adaptations to landscape fragmentation” (Somervuo et al., 2014). Hanski reported how his extensive team of researchers had investigated over 1800 genes differentially expressed between the two landscape types. Genes significantly more strongly expressed following just 15 minutes of flight activity also had higher basal levels of activity in butterflies from the fragmented landscapes – from which it appears that butterflies from dissected landscapes, where there is a selective premium on movement, “are genetically primed for frequent flight”. In the words of one of Hanski’s students, “these studies have revealed that metapopulation dynamics and habitat fragmentation causes selection



Left: Felix Sperling (Alberta), lead organiser of BoB 6, gave an outstanding day-4 plenary on the species problem, as applied to butterflies. [Photograph: R.I. Vane-Wright.]; Right: Ron Rutowski, master of butterfly semiotics. [Photograph: R.I. Vane-Wright.]



Pierce lab reunion, Turku 2014. From left to right: David Lohman, Naomi Pierce, Gerard Talavera (front), Sami Schar (back), Marianne Espeland, Roger Vila. [Photograph courtesy of Naomi Pierce.]

pressure on an intricately connected set of genes and pathways. At the organismal level these genes translate to phenotypic traits which are also connected in multiple ways and make up the so called “life history syndrome” (Kvist, 2014: 29).

Such complex links between behaviour (flight activity), selection (move/not move), metabolism (muscle anoxia in present case) and gene expression reflect one of the major strands in the emergent discussion regarding physiology and evolution (Shapiro, 2011; Noble, 2013; Noble et al. 2014). They also reflect a contemporary ‘systems view’ of the processes of life (Capra & Luisi, 2014). And yet, how does spatial metapopulation biology differ from phenotypic plasticity induced by temporal change? – as in the remarkable phenomenon of seasonal polyphenism so familiar to butterfly workers.

Perhaps another message is that, as long suspected (consider the hypothetical diagram of Hennig, 1966: 57), so much more is going on at the cryptomorphic level as opposed to the literally obvious phanermorphic level (to use the distinction of Huxley, 1955) – despite the latter being the level of variation that inspired so much of the early interest in butterfly biology (wing pattern polymorphism, crypsis, mimicry, colouration etc.). Following the work of early specialists like Gerould and Hovanitz, it was discovered that ‘alba’ versus ‘male-like’ females of *Colias* butterflies have many associated but cryptic physiological

differences. For sure it is not an accident that another key person in this recent step in unfolding the *Melitaea cinxia* story is Chris Wheat (Stockholm) – a former student and collaborator of Ward Watt, one of the greats of *Colias* physiology. Following in Ward’s footsteps, Chris is now addressing the issue of the “central metabolism” of butterflies, using a genomics approach.

All those attending Turku 2014 have a huge debt to lead organiser and Professor of Genetics, Dr Niklas Wahlberg (Department of Biology, University of Turku), his co-organiser Dr Marjo Saastamoinen (Department of Biosciences, University of Helsinki), and their extensive band of symposium leaders and logistical and technical helpers (<http://nymphalidae.utu.fi/icbb2014/organization.html>). Turku itself proved a happy location, including a very warm welcome reception at the City Town Hall, and providing a venue for the most delightful symposium dinner, held at the banqueting pavilion on Pikku-Pukki island – a 30 minute ferry boat ride along the Aura River.

It would not be an exaggeration to say that the organisation was faultless. High standards, intensity and good fellowship characterized Turku 2014. With 230 delegates representing 28 countries – including the remarkable statistic that almost 10% came half way across the world from Brazil (for sure largely inspired by the irrepressible André Freitas, Campinas) – this was the largest BoB meeting yet.

At least one of the primary organisers of each of the six previous ‘BoB’ symposia was present in Turku. Following the original London event, run through the RES, special credit is due to Sören Nylin and Bengt Karlsson (both present in Turku) for organising the 1994 meeting at Stockholm University (Wahlberg et al., 2013). This was the key step in making BoB the regular event it is now. Since then, all meetings have not only been organised by university workers, they have also been run independently. This may be part of the reason why these meetings always evoke a wonderful spirit of cooperation and friendship – something even the waitresses noticed during the Pikku-Pukki dinner! I feel confident this great tradition will be maintained at the National Center for Biological Sciences, Bangalore, where Krushnamegh Kunte will be organiser-in-chief for BoB 8, in 2018. NCBS is a postgraduate research centre, part of the great Tata Institute of Fundamental Research. Over the past 10 years, NCBS has developed a highly significant Ecology and Evolution programme (<https://www.ncbs.res.in/node/152#evolutionary>). This will be the first time for BoB outside Europe or North America. The future for the Biology of Butterflies is bright.

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Insects are the business

The challenges to insect farming for human consumption in the UK

The recently published white paper, “*Commercialising Edible Insects*”, which was sub-titled, “*How to Market the Impossible*”, outlines the case for promoting insects as a protein source for humans. The title demonstrates very clearly the present attitude to insects as food, while the contents of the report are a concise account of the nutritional evidence for insects as food and also examine a number of recent enterprises that are opening up this emerging market. Its publication highlights the rapidly growing interest in this field and the importance placed on it in governmental circles. The production of insect protein seems destined to become an important issue over the next decade.

Peter Smithers

To explore the ways that this sector might expand in the UK, I talked to Jo Wise, who runs a vast insect farm in

Cambridgeshire. Monkfield Nutrition has been in business for more than thirty years and now produces millions of insects each year for the pet trade. With the growing interest in producing insects for human consumption across Europe and now in the UK, Monkfield Nutrition has begun to explore the possibility of offering a selection of its range for this market.

So what are the challenges that they face? I rang Jo Wise to talk over the challenges and opportunities that Monkfield will be facing as they move into this novel area of the market.





What changes will Monkfield have to make in the production methods in order to offer the insects for human consumption?

In reality, very few. Their insects are already reared under optimum conditions in order to maximise animal health and maximum output. There would possibly be more detailed record keeping in order to monitor the history of each batch, but farming protocols would generally remain as they are. The problem at the moment is the lack of legislation to control and maintain standards. Until these are in place it is difficult to estimate how production methods will be affected.

Cost is probably the most important factor, as at the moment production is geared to a market that requires small numbers of insects to feed reptiles or arachnids, but if the insects are for human consumption then much larger numbers will be required by each purchaser. While a few crickets will feed a lizard it would take several hundred to feed a family of humans. At present costings, crickets would be an expensive meal.

Automating the packaging and distribution of the products is one way

that could bring the price down, but it could also be that increasing the volume of insects produced may offer significant economies of scale.

A better knowledge of the nutritional requirements of the insects being farmed could also lead to an increase in the efficiency of production. In order to address this, Monkfield are initiating a research programme with Nottingham University to determine

the nature of these requirements and develop more efficient and cost effective feeds.

Monkfield Nutrition are not the only people exploring this field (see the SIG article on page 31 of this issue) so I am sure that these challenges will be surmounted, and insects reared for human consumption will be available in shops and restaurants in the UK in



Entomophagy, a new Special Interest Group

Peter Smithers

The rapidly increasing interest in insects as human food and as feed for livestock reached a critical point last November, when Nick Rousseau called a meeting of interested parties to discuss where we were in the UK in relation to this rapidly expanding topic. Nick, who is involved in this on a personal basis, is well placed, as a result of working at the Department for Business, Innovation and Skills, to have a good knowledge of the bodies that might be interested in this area. As a result, he assembled a group with a wide range of interests, from academics to insect farmers to food technologists, bankers and representatives from funding bodies. The meeting took place as part of the Food Matters Live trade fair and exhibition that was held at the ExCel Centre in London. Following an informal discussion it was decided that a permanent group should be formed, and as the RES had offered to support such a group the new Entomophagy SIG was inaugurated.

The SIG would like to extend an invitation to anyone who would join the network in order to offer relevant skills, contacts or resources or just express an interest. The formation of this SIG is an excellent opportunity to pool expertise and develop ideas at a time when the production of insect-based food/feed products is in its infancy in the UK. This report outlines the current situation in the UK and provides brief sketches of the projects and businesses that are emerging in this field.

Insect Protein contributing to the Human food chain. Notes on the current situation in the UK

Nick Rousseau

Widely accepted facts:

Global Situation and Opportunity

Projections of human population growth and shifts in food choices and patterns of consumption point to the emergence of a substantial challenge in providing for the future demand for protein:

- Selective insects, when farmed under carefully managed conditions, can provide a highly nutritious and low carbon footprint with a low water basis, plus a remarkably high feed conversion rate into edible protein. If these insects are reared on materials that are currently waste products from other food production processes, this could be a highly efficient method of protein production with wider benefits for waste reduction.
- Insects are a regular and accepted part of the diet in a great many human cultures, but not in the developed world which has associated insects with dirt, poverty and disease and a strong “yuck” factor.
- Insects’ bodies also contain a wide range of other materials that could have even greater commercial value across a range of application areas, e.g. biomedical.

Insects could form part of the search for more and sustainable protein in two ways:

- They could be eaten directly by humans;
- They could be introduced into the diet of livestock that humans then eat.

Each of these scenarios presents significant scientific and business challenges, however each could represent an opportunity to new businesses to develop as demand patterns change.

Insects as feed for livestock

The growing cost of feed for livestock in the UK is currently of great concern. The UK imports a vast quantity of feed in the form of soya from Latin America. Our dependence on this external supply makes our livestock sector vulnerable to price increases and is expected to make our meat products increasingly over-priced compared to countries that are starting to accept alternatives.

Developing successful models for incorporating insects into the human food chain in this way could also reduce the land footprint of livestock and become a part of the solution to increase protein supplies.

Insect-based products for human consumption

The story around human consumption of insect-based food products is more complex.

There is currently an increasingly mainstream debate regarding the potential for people in the developed world to accept insect-based products into their diets.

This could be a fad that will only ever appeal to a tiny minority of the Western population and will have no real impact either as a major new part of the nutrition landscape or as a viable way of reducing pressure on global protein consumption (which is largely driven by Chinese dietary shifts towards Western, meat-based diets).

However, I think there is evidence that could cause one to question that:

- The fact that this debate is occurring demonstrates that the concept is entering the western mindset and is likely to create an openness to experiment.
- In the USA, retail outlets where you can now buy an insect-based Chapul bar are widespread - clearly American retail outlets are taking this seriously, possibly reflecting the fact that the USA represents a very large and diverse market where there will be many people seeking gluten free, protein rich, “paleo” or otherwise meat-free options.

- As a result of this, demand for cricket farming in the US is growing faster than they can produce crickets.
- A New York-based food startup called Exo Inc., the maker of insect-based protein bars has recently raised \$1.2 million in new seed funding.
- It is reasonable to expect that if insect-based products can be produced which are healthy, nutritious, tasty and largely disguise the insect origin (in the same way that a steak does not resemble a cow) then they will spread from these narrow niches into the mainstream.
- If Chinese diets are being influenced by Western patterns it may be possible to achieve this shift together. In particular, in China there is great suspicion over the integrity of locally-produced food products following a number of Chinese scandals. The UK has a strong partnership with China where the integrity of our industry is respected. This opens opportunities for UK-sanctioned products to have high market penetration potential.
- The smart recipes do not have pure insect flour, etc. but introduce it as a proportion of the “normal” ingredients to add flavour, protein, etc.
- If we can introduce insect-based protein at the 5% level, and displace 5% of current protein consumption then it will make a meaningful difference to global protein challenges.

But all this brings some serious challenges

A great deal of research is required to underpin efficient, cost effective, low carbon insect farming which can deliver high-yield products and exploit wider bi-product opportunities.

There is a need to build innovative farming facilities based on this research. In particular, for those enterprises creating products from insects for human consumption, having insect farms in the UK will make a major difference to their ability to build a viable business. Currently they have to import their raw materials from US, Canada, Thailand or the Netherlands.

There is a need to test and confirm the market and business models for insect based food and feed products – including sourcing the raw material on which they are to be fed, distribution arrangements, storage, etc.

There is a need to put in place clear legislation that safeguards consumers, reassures the public and imposes reasonable regulations on farmers and producers which reflect the realities of insect-based materials and the risks to health involved in insect farming.

Public attitudes need to be substantially shifted toward seeing insects as being entirely appropriate for human consumption with an understanding of the benefits of livestock fed on insects and/or insect-based products. There could be common ground across these two areas as the public is educated about the challenges of feeding the world and is persuaded to see insects as a valuable source of protein.

Position on this globally

Netherlands and US are currently leading the pack with strong activity in South Africa, France, Spain and Belgium. The first conference on this topic attracted around 480 participants and I counted 23 from the UK.

Current position in the UK

Currently in the UK, from my own research, we have:

- Aside from a EU funded project being led by FERA focusing on insects for animal feed and another funded by Innovate UK, also involving FERA, there is minimal/no research into this area currently underway.
- There are a handful of entrepreneurs who see the opportunity and are creating niches for themselves, with some success in building a customer base and converting people to accepting their products (see below).
- There are large number of entomologists, food scientists, experts in food innovation, and others who could form a sizeable community to develop this new technology and convert it into economic activity and shifts in protein consumption in the UK and beyond.
- Funding bodies, BBSRC, ESRC and Innovate UK are all willing to look at this if strong funding applications were submitted, and a Global Food Security Programme that brings these together with DEFRA, BIS and DFID that could be a focus for galvanising UK interest and activity.
- An internationally well-networked research and innovation community that could rapidly draw on and partner with people around the world would lead to the UK becoming a major leader in this area, instead of just a follower.

Who's Who in the UK Entomophagy Community

Research

Proteinsects

Taking forward a number of investigations into how insects could be introduced as animal feed (see *Antenna* 38 (1)).

Insect Farms, Restaurants and Food Products

Monkfield Nutrition (see article in this issue).

Ento

Pop-up restaurants and insect based foods (see *Antenna* 38 (1)).

Grub

A restaurant serving sustainable foods including insects (see article in this edition).

Hot Buzz

Louise Rezler

From being told not eat worms in the garden as toddlers to watching horror films where aliens look like insects or insects look like aliens, we are programmed from a young age to think that insects are not food. Hot Buzz wants to help people to see that insects are not only food but that they are tasty and nutritious. At our pop-up dinner parties our recipes are inspired by cultures where insect eating is an age-old tradition and we serve dishes with influences from the hills of Cambodia and Thailand to indigenous groups of Mexico and villages of Nigeria. We are working on an insect take on some familiar munchies as well and we can't wait to unleash



Hot Buzz began because insects are amazing; delicious, high in nutrients, and with great potential to reduce pressure on our planet's resources. Already over 25% of the world's population include insects in their diet and their high protein content, as well as benefits such as zinc, calcium, iron, and fibre, make insects an excellent ingredient. We want to put insects on the menu and see them there to stay!

You can find out more about Hot Buzz and their quest for delicious insect meals at:

<https://www.facebook.com/HotBuzzFood>

<https://twitter.com/hotbuzzfood>

louiseqt@yahoo.co.uk

Grub

Our mission is to bring tasty insect dishes to the British palate; to spread the word about this under-used food and its benefits; to value sustainable food, as we value the planet on which it grows. First and foremost, we are committed to good foods: flavoursome creations, with nutritional values that will surprise and delight.



Nutrition is important in more ways than one. We keep ourselves stocked up with fresh, tasty ideas that help us grow. With a plentiful supply we will carry on serving up delicious new foods to inspire and excite British taste buds.

We value sustainable thinking. Insects are such a great food because they don't use up resources like cows or sheep do. Day to day, Grub will try to be more like a cricket and less like a cow: think of us as low-maintenance.

<http://www.eatgrub.co.uk>

Novelty insect foods and snacks

Crunchy critters



Crunchy Critters offers a bespoke range of carefully selected edible insects tailored to appeal to the most discerning of palates. Be the first to hear about new and exciting products before they hit the shelves by following us on Facebook.

<http://www.crunchycritters.com>

Bushgrub

Bush Grub is a family run business based in Kent specialising in the weird and wonderful world of edible bugs and insects, cocktail-inspired lolly pops and chilli based chocolate bars. Our products include our officially licensed ITV *I'm a Celebrity Get Me Out Of Here* range of edible bugs and insects, our very own *Bush Tucker Trial* gift set.



<http://www.bush-grub.co.uk>

Edible

Edible was created in 2000 to broaden the minds and open up the palates of those of us in the western world who are fairly limited in culinary terms. After years of travelling to the farther flung regions of the globe, and seeing all manner of unique and unusual delicacies being consumed, our founder decided that he would like to make these experiences available to us.



Edible Unique

EDIBLEUNIQUE
*** GOURMET EXOTIC ***



This is the online shop front for the Farmed Insect Company that imports insects from SE Asia.

<http://www.edibleunique.com>

<http://www.thefarmedinsectcompany.com>



The Weaver's Tale, Aad the Ant Hunter

(collecting weaver ants in Thailand)

While he was at primary school, Aad once took a live centipede into class with which he terrorised the girls. Naturally, it was not long before the teacher sternly requested our hero to step up to the front of the class. Eying the multi-legged arthropod, the teacher forced Aad to stuff the wriggling creature down the front of his pants!!! This you might think was enough to ensure a young boy would shun creepy crawlies for the rest of his days. But, no, thirty years later, having done his chores on his mother's fish farm, our incorrigible arthropodologist regularly grabs a five-metre long bamboo pole and a plastic bucket, hops on his motor bike, and hastens to Sikhoraphum's public park to collect what are known in Thailand as "ant's eggs". These are in actual fact ant cocoons containing protein-rich pupae, which are offered for sale in the local market.

The sheer number of ants in a robust weaver ants' nest, a cylinder of leaves sewn together high up in a tree, makes the theft of their cocoons a task that is well beyond the scope of the faint hearted, for the agitated ants don't just

take to the nearest foliage en masse – they drop off the tree onto whatever, or whomsoever, happens to be at a lower elevation.

While the average over-dressed (by western standards) Thai manages to brush most of these irate bombardiers away, the tourist, bare feet in sandals, knees exposed to the tropical sun, pale face gazing intently skyward, gives the insects a far better opportunity to press home their attack. I myself unhooked most of a dead ant from my hernia scar fully four hours after taking a shower in a deluge of weaver ants. This made me wonder whether there wasn't a possibly lucrative market for live weaver ants, discounted in packs of 50 or 100, in hospitals where they still sew your innards back together with cat gut.

While tropical centipedes can give you a poisonous bite, ants tend to prefer a sharp nip with formic acid so victims of an ant attack normally live to see the six o'clock news. The worst that can happen is that you master a few new dance steps while discovering parts of your anatomy that had never

Leigh Plester
digilude@gmail.com



For Aad, it's all in a day's work; he parks his motor bike among the trees lining the park's rectangular pond.



First he looks for a tree with a weaver ants' nest in it. There's no shortage of colonies.



Raising his long pole, he threads it dexterously between his hands, and begins to shake the net at the end of it underneath the nest.





There seem to be far more adults than pupae in the haul, but within a short while Aad announces that he has a thousand Baht's-worth of "eggs" - equivalent to around 21 euros - in his plastic bucket. To prevent the ants from climbing out and invading his motorbike on the way home, the lad smears fine potato flour on to the ants, leaves, and cocoons trapped in the bucket. Then it's off to market with his booty.



Oh, yes, that story about the centipede Aad was forced to shove down the front of his pants at junior school – it's absolutely true.

How do I know? Because my wife was one of Aad's junior school classmates at the time. She has no fear of live insects and other arthropods, either. Moreover, like so many locals she is partial to a snack of weaver ants' cocoons, as well as chilled locusts, silk moth pupae, or barbecued mole crickets. Her gut has the kind of scope normally expected of the entomology section in a museum of natural history. As a Finn, I stick with hens eggs, but Aad continues to make some welcome extra cash robbing weaver ants' nests of their cocoons.

Why I Joined the Twitterati: Blogs, Tweets & Talks – Making Entomology Visible

Simon Leather
Harper Adams University

Last November 6th it was two years exactly since I tweeted my first tweet and almost two years since my blog went public. This article is an update of a blog post from 2013 and a written reminder of the talk I gave in St Andrews at ENTO13. It is thus an opportune moment, I feel, in which to assess how things have progressed since then and to see if I can convert other oldies and not-so-oldies to make that leap into the world of public social media.

For many years I had held the whole concept of social media in contempt – Facebook and Twitter, for me, represented the very epitome of mindless gossip and tabloid extremism. I saw them as entirely the domain of the chattering classes and the idle young. Perhaps an extreme view, since some of my children, a number of my colleagues, my wife and even my mother-in-law were on Facebook. Still, as someone who did not get a mobile phone until March 2013 (and only because at the time, during the week, I was living alone, and my wife feels that it is a sensible thing to have in case of emergency), I guess I was just living up

to the image of the techno-refusenik.

That said, I have always felt that the job of a scientist is to communicate and having always had a desire to teach and pass on my enthusiasm for entomology to others, I have not been remiss in coming forward. I did actually have a fling with public engagement way back in 1981 when I worked in Finland and developed their early warning system for cereal aphids. My research actually appeared in the national farmer's magazine (Figure 1) (Leather, 1982a) almost simultaneously with my official scientific publication (Leather & Lehti, 1981).

My subsequent career as, firstly, a forest entomologist with the Forestry Commission and then as a university teacher at Imperial College, was pretty much that of the typical academic, with the occasional appearance on the radio and the rare television interview, plus the odd reference to my work in the national or local newspapers.

Mainly however, I was, until about the turn of the century, just communicating with my peers, i.e. publishing scientific papers and facilitating communication between



Figure 1. My first attempt at public engagement, Finland 1982.

other entomologists; I seem to have spent the last twenty years or so editing journals, first cutting my teeth on the Royal Entomological Society's house journal *Antenna*, and then moving on to *Ecological Entomology* and for the last eight years as Editor-in-Chief of *Insect Conservation & Diversity*. So there I was facilitating the dissemination of entomological knowledge around the world and busy doing my own entomological research and training future entomologists by running the only entomology degree in the UK and also of course supervising lots of PhD students. All very commendable indeed, but perhaps a bit limited in scope?

Round about the turn of the century I started to get really fed up with the ignorance shown about entomology and the bias towards vertebrates by funding bodies and journals. I started going into schools and giving talks to the general public whenever possible, trying to draw people's attention to the importance of insects by giving talks with titles such as 'Biodiversity: Think Small and Local', in which I extolled the virtue of insects and other invertebrates living around us rather than feeling that ecology was solely confined to the large charismatic mega-fauna living in exotic tropical locations. As time passed and people's attitudes seemed not to be changing, I got even more provocative and my talks to local Sixth Formers was retitled 'Death to polar bears and pandas?'

I also found that I was getting more and more irritated and desperate in print, producing papers and articles with titles such as *British entomology in terminal decline?* (Leather, 2007), *Conservation entomology in crisis* (Leather, 2008), *Institutional vertebratism threatens UK food security* (Leather, 2009), *Do shifting baselines in natural history knowledge threaten the environment?* (Leather & Quicke, 2010).

It was obvious that there was a problem; the misconception that the general public tend to have, in that all insects are either pests or things that sting or bite them and need to be stamped on (Leather & Quicke, 2009), needed to be addressed. Some of the entomological misconceptions were amusing but being entomologically pedantic, still wrong, for example a cartoon in *The Guardian* newspaper of Wednesday 14th August 2013 showing two moths with the wrong number of

limbs, the Top Trumps Bugs edition which has cards with arachnids, annelids and crustaceans; annoying but perhaps excusable. Some misconceptions were just plain inexcusable as in this quote from India Knight's column in *The Sunday Times* of 15th August 2010:

"...**disgusting** hoverflies, hoovered them up, **despite knowing** that the adults are **harmless** and larvae good for gardens. **I really hate insects** apart from **bumblebees especially** in the kitchen.."

The problem has been neatly summed up by others too such as Mark Spencer from the Natural History Museum in an interview with *Horticulture Week* on 30th July 2010:

"Even if the government decided to put natural history on the primary curriculum, how would it do so with **teachers who don't have the basic skills?** They are often **terrified of the natural world** – they **scream at the sight of insects** and tell the children **'don't touch'**. The whole point is to engage them, but when people are frightened of handling soil, then we have a problem."

One of my PhD students, Fran Sconce, whom I have known since she was an undergraduate, had for some time been extolling the virtues of social media as a means of scientific communication and finally convinced me that it was time to make the leap and to move into a different environment, and thus was born @Entoprof (my Twitter handle for those of you have not yet joined up) and my blog *Don't Forget the*

Roundabouts.

The first thing I found when I ventured into the Twittersphere was that there were lots of old friends out there, some of whom I hadn't seen since I was an undergraduate, and even my old school (Ripon Grammar School) started following me. There were also a lot of ex-students, not all of whom are entomologists, despite all my efforts!

On a more serious note, I found increased opportunities for outreach and meeting people I didn't even know existed and I made new professional links here and internationally. Surprisingly, given that I subscribe to a huge number of journal alerts, I have also found Twitter a great way of finding out about research that is going on that I would otherwise have missed. I have also, of course, had great fun continuing my fight against institutional vertebratism (Figure 2).

As a direct result of the above I was asked to contribute to an issue of *Animal Conservation* (Leather, 2013) and with my new friends entered into public debate with *BBC Wildlife Magazine* which resulted in even more coverage for entomology (Figure 3).

I now also use Twitter to interact at conferences, and at INTECOL13 was the tenth most retweeted and mentioned participant, which I think is a good thing for entomology in general.

I have to confess that I have been really inspired and have thoroughly embraced the concept of social media, even to the extent of setting up a Twitter account for the Entomology

Fighting against the vertebrate bias



Figure 2. An example of my twitter campaign for more insect coverage in conservation and ecology journals.

BBC Wildlife August 2013

SPINELESS WONDERS
Our poll had a single invertebrate candidate. Were we biased?

Some entomologists were unimpressed that a lone spineless candidate – the seven-spot ladybird, championed by Buglife – was standing in our national species poll. They took us to task on Twitter, with one post suggesting that, like much of the media, we are guilty of “institutional vertebratism”.

Is this fair? Should we have challenged people’s expectations by featuring more insects in the vote? Are all invertebrate shortlists the way forwards?

“The ‘token’ invertebrate in polls like this is invariably an insect, terrestrial and brightly coloured,” complains Sally-Ann Spence, who runs ‘manibeast’ roadshows in Wiltshire. Yet of the known animal species on Earth, just 4 per cent are vertebrates. It’s the invertebrates that are tirelessly recycling, fertilising, pollinating and purifying, and creating the food source at the base of myriad food-webs. They deserve better.

Simon Leather, professor of entomology at Harper Adams University in Shropshire, argues that an anti-invertebrate rhetoric is entrenched in scientific funding bodies, as well as in the media. He points out that grants favour research into vertebrates, especially megafauna. “A minute fraction of the money channelled into nature conservation finds its way into conserving invertebrates,” he says.

Here at *BBC Wildlife*, we do our best to celebrate spineless wonders, and in the past two years have published features on harlequin ladybirds, red crabs, insect sign language, purple emperors and bumblebees.

The last time *BBC Wildlife* had an insect cover star was back in September 2009, when a painted lady did the honours.

BUTTERFLY INVASION
Why millions of painted ladies swept into Britain this year

WHAT DO YOU THINK?
Are the media biased against invertebrates, or do they reflect what we want to read? Write to share your views – for contact details, see p94.

Figure 3. BBC Wildlife grudgingly acknowledges that they may not give insects the coverage they deserve.

MSc I run at Harper Adams University, @EntoMasters, and also a blog for them to use, *Mastering Entomology*, which can be found at <http://aphidsrus.wordpress.com/>

My latest venture with the aid of Janine Heath, @JanineHarperVJ, our PR and Media Relations manager is the A-Z of Entomology, the first letter of which you can view at the following link if you want to learn about aphids <http://www.youtube.com/watch?v=liBt59teaGQ>.

I have also found that the mental discipline of writing a blog article every ten to fourteen days or so has helped me get back into the habit of writing papers rather than just editing and commenting on those produced by my students. Even more gratifying is that some of my blog posts are being picked up by other blogs and also in two cases so far, led to published journal articles (Leather, 2014, 2015).

So yes it has been a great two years and a heart-felt thank you to all my

Twitter followers (Tweeps), now standing at 2330, and to all of those people that follow and read my blog. I really have found this foray into the world of social media both useful and educational. It has been a great eye-opener. I can heartily recommend joining Twitter. And of course a really big vote of thanks to Fran for finally convincing me that I should join the Twitterati.

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Society News

Insect Festival 2015

Dr Gordon Port

Following the success of previous years the Insect Festival, IF15, will be taking place in York again in July this year. IF15 on Sunday 5 July 2015 is a celebration for anyone with a fascination for insects – from exhibitors and traders to wildlife groups and the general public.

As in 2013, the event will start with activities before and after the day (for details see the website <http://www.royensoc.co.uk/content/insect-festival-2015>). In particular we plan to have some presentations on the Saturday (4 July) evening. The Sunday event will take place at the Yorkshire Museum Gardens, with exhibits and a range of other stands and activities being held in the beautiful 14th century Hospitium and surrounding grounds.

Interest in IF15 has already been high and many of the exhibits and activities are being planned, however, if you wish to contribute or take part in other ways please get in touch with the convenors Luke Tilley, Gordon Port and Peter Smithers (luke@royensoc.co.uk; gordon.port@newcastle.ac.uk; P.Smithers@Plymouth.ac.uk).

Library News

Valerie McAtear

There are far too many new entomological books being published for The RES to buy them all so one of the most difficult tasks for the Librarian is to choose which should be added to the Library. As our Fellows and Members are spread across the world and many of you travel widely the library has to cater for all geographical areas as well as ensuring that equal value is given to all insect orders.

If we are lucky, authors or their publishers donate a copy to the Library and for this we are very grateful. Otherwise it is for me and my wonderful Library Committee to select the books to be purchased. The Library Committee now meets once a year and part of the meeting is devoted to browsing the selection of books that Ian Johnson of Pemberley Books kindly brings for us to examine. Some of these are his choice and some requested by members of the Committee. We also welcome suggestions from any Fellow or Member of the Society.

A member of the Committee who has been particularly active in suggesting books is Dr Glenda Orledge and I am very sorry that due to changes in her University commitments she has decided to resign from the Committee. Glenda is a great supporter of the library and has served on the Committee for many years. She was a great help to me when I became RES Librarian. I know that our Chairman Dr Clements and the rest of the Committee will miss her valuable contributions to our meetings. Thank You Glenda for all your hard work.

Below you will find our latest selections and some Donations to the Library:

New Additions to the Royal Entomological Library

The following titles have been added to the Library. If you would like to borrow any of them please contact val@royensoc.co.uk

Coleoptera Books

Bruschi, S. – *Calosoma of the World*

Evans, A.V. – *Beetles of Eastern North America*

Lawrence, J.F. & A. Slipinski – *Australian Beetles Morphology, Classification & Keys*

Leschen, R.A.B. & R.G. Beutel – *Handbook of Zoology Coleoptera, Beetles Volume 3: Morphology & Systematics*

Thomas, J., Bowstead, S., Eccle, T & C. Rayden – *The Coleoptera of The Witherslack Area of Cumbria*

Diptera

Drew, R.A.I. & M.C. – *Romig Tropical Fruit Flies of South-East Asia*

Jaschhof, M & C Jaschhof – *The Wood Midges (Diptera: Cecidomyiidae: Lestremiinae) of Fennoscandia and Denmark*

Stubbs, A & M Drake – *British Soldierflies and their Allies*

Fossils

Penney, D. & J.E. Jepson – *Fossil Insects An Introduction to Palaeoentomology*

Wichard, W. – *Overview and descriptions of Tricoptera in Baltic Amber Spicipalpia and Integripalpia*

General Entomology

Alford, David V. – *Pests of ornamental trees, shrubs and flowers: a colour handbook*

Brock, Paul D. – *A Comprehensive guide to Insects of Britain & Ireland*

Lockwood, J.A. – *The Infested Mind: Why Humans Fear, Loathe and Love Insects*

Marshall, S.A. – *Insects, Their Natural History and Diversity*
 Royal Entomological Society – *Evolution of Insect Mating Systems*
 Shuker, D.M. & L.W Simmonds – *The Evolution of Insect Mating Systems*
 Van Emden, H.F. – *Handbook of Agricultural Entomology*
 Schoonhoven – *Insect-Plant Biology*
 Wajnberg, E. & S. Colazza – *Chemical Ecology of Insect Parasitoids*

Hemiptera Books

Samborn, A.F. – *Catalogue of the Cicadoidea (Hemiptera: Auchenorrhyncha)*

Hymenoptera Books

Amiet, F, Muller, A. & R. Neumyer – *Fauna Helvetica Apidae 2*
 Balatrix, R., Galkowski C., Lebas C. & P. Wegnez – *Fourmis de France*
 Turillazzi, Stefano & P. Wegnez – *The Biology of Hover wasps*

Lepidoptera Books

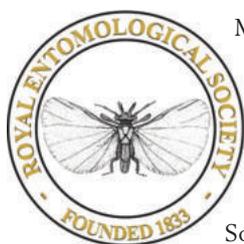
Howse, P. – *Seeing Butterflies New Perspectives on Colour, Patterns & Mimicry*
 Neild, A.F.E. – *The Butterflies of Venezuela Parts 1 & 2 Nymphalidae*
 Nel, J & T Varenne – *Atlas des Lepidopteres Gracillariidae Lithocolletinae de France*
 Leraut, Patrice – *Moths of Europe Volume 4: Pyralids 2*
 Ronkay, G & L Ronkay – *Noctuidae Europaeae Volume 7: Cucullinae II*
 Ronkay, L, G Ronkay, P. Gyulai & Z. Varga – *The Witt Catalogue. Volume 7 Erebidae I*
 Smith, D.A.S. – *African Queens & Their Kin, A Darwinian Odyssey*

Orthoptera

Rowell, C.H.F. – *The Grasshoppers (Caelifera) of Costa Rica and Panama*

EntoMasters on Tour – The Royal Entomological Society

Richard Prew



Monday the 3rd of November saw the Harper Adams Entomology and IPM students make their way down to The Mansion House situated outside of historic St. Albans for a visit to the hub of Entomology in the UK – The Royal Entomological Society. Coming in from the drizzly

November morning we were met with tea, coffee, an array of delicious biscuity treats and friendly faces, much needed after being stuck in M1 traffic for a number of hours.

Founded in 1833 and granted its royal charter by Queen Victoria in 1885, the principal aim of the Society is 'to promote the dissemination of knowledge in all fields of insect science and to improve communication between entomologists'. The Society, once situated in 41 Queens Gate, London, moved out of the capital in 2008 to the fantastic premises they inhabit in St. Albans today which has enabled a greater amount of funding to be allocated to research, journals and a number of awards for recognising achievement. Many fellows of the Society are well renowned and famously include Charles Darwin, Alfred Russell Wallace and Harper's own Professor Simon Leather (Signatures can be found in the obligations book – here is Darwin's! <https://twitter.com/EntoProf/status/529359332157448192/photo/1>).

After dosing up on hot drinks and biscuits we were shown into a small lecture room and listened to talks provided by members of the Society. First up was Society's Director of Science, Professor Jim Hardie, who welcomed us and gave us

an insight into the history of the Society including what insect is on the logo.

The floor was then handed over to Dr Luke Tilley, Director of Outreach and coordinator of National Insect Week, who reinforced the importance of communication and enthusiasm about insects to the wider population and the need to inspire the next generation of potential entomologists. National Insect Week, organised by the Royal Entomological Society, brings together partners and multitude of hardworking



Refreshing English Drizzle



Above: Kelleigh and Aidan enjoying the spread; Right: Hundreds of years old and still extraordinarily vibrant.



volunteers who all share a keen interest in the science, history and conservation of insects to pass on their knowledge to the public and happens every two years across the United Kingdom (For more information on insects and how to get involved in National Insect Week 2016 visit www.nationalinsectweek.co.uk/).

As a short interactive exercise for practicing these communications skills we split into small groups and composed short fact files on various insects and tweets on a couple of journal articles. These needed to be eye-catching, interesting and be understandable from the viewpoint of someone who does not necessarily have a scientific background. Even though it was only a bit of fun it got the creative juices flowing and certainly made us think outside of the box.

Following this we had a delicious buffet lunch (the miniature Yorkshire puddings being my personal favourite) along with a cheeky glass of wine and were given the opportunity to explore the Society building. One thing that is noticeable when you first walk in is the fantastic collection of books that is spread throughout the ground floor. These

all centre around the Royal Entomological Society library which holds very well preserved, rare books, some pre-dating 1850 and all managed by the society's librarian Val McAtear. Val brought out some examples and was incredibly trusting enough to let the Harper Students handle and look through them!

After perusing the RES merchandise and purchasing everything from books to umbrellas it was finally time to brave the M1 and head back up to Shropshire. On behalf of the Harper Adams Entomology and IPM Masters I would like to thank the Royal Entomological Society for their hospitality and a great day out.

Royal Entomological Society Scholars

ANDREW CUTTS

I am studying MSc Entomology at Harper Adams University to develop my knowledge of insects. Each new personal discovery makes me want to learn and understand more about this group of animals. I want to learn as much as I possibly can and then utilise this new knowledge in a positive manner.

I have trained in biological recording and species identification and worked professionally as an ecologist. This has been as a field assistant, helping ecological consultancies carry out bat and newt surveys. However, I feel that insects are overlooked in the field of ecology services and wish to learn more about them. I intend to utilise my learning to raise the level of interest in insects and to disseminate knowledge amongst ecologists and others.

In a former role, working as a primary school teacher, I made a particular effort to raise the level of positive interest in insects and other invertebrates. I am glad to say that the children I worked with were typically enthused and loved to learn more about these fascinating creatures. When I left post

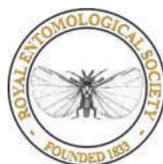


as a teacher my pupils all said that they had really enjoyed learning about bees, millipedes, spiders, slugs, etc. This made me feel proud and I know that this learning will remain with them as a positive experience through their lives.

I am particularly looking forward to studying the 'Biology and Taxonomy of Insects' and 'Ecological Entomology' modules. I absolutely love learning about what makes species unique. On a holistic level I am fascinated by what joins different species together within specific habitats. 'Biology and Taxonomy of Insects' will allow me to get inside the insects through dissections and see exactly how they function. For me, being able to physically touch the insects and study their behaviour will ingrain knowledge much more firmly than theoretical research alone. The 'Ecological Entomology' module will widen my knowledge of ecosystems through the addition of the insect element -

something that I believe to be pivotal in truly understanding an entire ecosystem.

Upon completion of MSc Entomology I would like to set up my own business. This will be an amalgamation of my skill sets including: wildlife film making, photography, ecology, writing, and teaching. Being awarded a bursary from the RES has allowed me to save a significant amount of money to put towards this venture. I want to put my knowledge of nature to positive use and in particular raise awareness of insects with children. Having taught at primary school level I know that this is achievable as long as the resources and knowledge are available and accessible. I feel that it is particularly important to engage the younger generation with the natural environment. Instilling a sense of pride in being responsible for the world around us begins with the little things - insects.



JOSH JENKINS SHAW

I distinctly remember the moment an insect first caught my eye. It was in Italy and the insect in question was a Hummingbird Hawk-moth which zoomed past me in search of a source of nectar. I was completely bemused by the moth's size, how could something so bird-like evolve into a drab-brown moth?! I eventually located the individual feeding and, much to my annoyance as a young and inquisitive naturalist, the moth barely spent two seconds at one flower before transferring itself a few metres in half a second.

Not long after this encounter I found myself armed with a net and jars catching brilliant butterflies in the south of France, then a year later waking up early in the morning in my Kent garden to inspect the contents of my new moth trap. What ensued was an obsession with Lepidoptera; trips to see Duke of Burgundies and Heath Fritillaries only helped spark my enthusiasm more. Occasionally, large black beetles with orange bands would appear in the moth trap. I learnt these were Sexton beetles (or more precisely members of the genus *Nicrophorus*). By this point I was about seventeen years old and the inquisitive side of me certainly hadn't subsided. Beetles became my new obsession and soon enough, I eagerly began collecting them. Much pocket money was spent on taxonomic keys and a beginner's microscope. All I required now was a decent box to put my precious specimens in. This led me to the Natural History Museum and the Coleoptera collections manager Max Barclay who kindly gave me several boxes. Still inquisitive, I asked if I could volunteer in the beetle collection. Fortunately the answer was yes and I spent the summer working in the most amazing resource of biodiversity in the world. All I could think was, 'I really want to work here one day!'

Three years have passed since my time in the beetle collection at the Natural History Museum and now with the help of a Royal Entomological Society scholarship I am fortunate enough to be pursuing an Entomology master's



course at Harper Adams University in Shropshire. Here, in the suitably rural landscape, I am surrounded by some of the best entomologists in the UK and like-minded course mates. My eyes are constantly being opened to new facets of the entomological world and I hope one day I can give something back to help the next generation of entomologists. Thank you RES for helping me pursue my dreams!

KELLEIGH GREENE

Some of my fondest childhood memories include catching African Praying mantis nymphs (*Miomantis caffra*) in the back garden; it was in those early years in Africa that my fascination for insects began, and over the years this interest has continued to grow and develop. I have a great appreciation for the important roles insects play in ecosystems, and my ultimate goal is to devote my life's work to the conservation and knowledge of insects through a career in research and education.

Whilst studying Natural Sciences at the University of Cambridge, I had my first encounter with British moths during an ecology field trip. I was instantly enamoured! The population decline of some species of British lepidopterans is an issue that I am especially passionate about. Gaining the skills necessary to assess insect populations accurately and produce effective management plans, by studying the "Ecological Principles and Decision Tools" and "Ecological Entomology" modules, is therefore imperative to my goals in lepidopteran conservation. Additionally, knowledge of a wide range of species, as will be gained during the "Biology and Taxonomy of Insects" and "Biodiversity and Ecosystem Services" modules, is important to any entomologist involved in public outreach activities and education, and is therefore of significant interest to me.

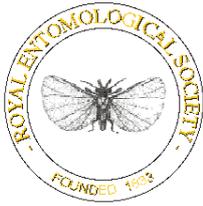
A topic that made a lasting impression on me was that of the responsibility of scientists to share their work with the public, covered while studying science communication with the Open University. I am committed not only to advancing entomological knowledge through research, but also in working towards dispelling the myths and misconceptions about insects that so many people still hold. Through public outreach activities, such as "Insect Days" for families or schools, or by writing articles and other materials accessible to a wide audience I hope to inspire interest in insects and the environment. My experience as a further education Animal Management lecturer has afforded me the opportunity to develop the skills required for keeping an audience engaged, both in informal settings such as these, and in formal lessons. It has also instilled in me a deep enthusiasm for helping students achieve their potential, and following the MSc in Entomology at Harper Adams I aim to involve



myself in guiding new generations of higher education students through their own studies.

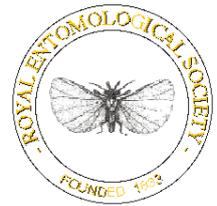
Receiving the Royal Entomological Society scholarship has allowed me to take up my place on the MSc in Entomology, which I would otherwise not have been able to do, and has given me the ability to focus completely on my studies without the distractions of financial difficulties. I am immensely grateful for the opportunity the Royal Entomological Society has given me, and am looking forward to exploring a future in entomology that is filled with exciting possibilities.





SCHEDULE OF NEW FELLOWS AND MEMBERS

as at 3rd December 2014



New Honorary Fellows

None

New Fellows (1st Announcement)

Dr David Steven Hubble
Mr John Walter Phillips
Dr Shin G Goto

Upgrade to Fellowship (1st Announcement)

None

New Fellows (2nd Announcement and Election)

Dr Dimitrios N Avtzis
Dr Joel González-Cabrera
Dr Elham Mohamed Ahmed Salama

Upgrade to Fellowship (2nd Announcement and Election)

None

New Members Admitted

None

New Student Members Admitted

Mr Jordan Tobias Ryder
Miss Claire Jennifer Blowers
Miss Bryony O'hara Sands
Mr Andrew John Cutts
Mr Kyle Shackleton
Miss Katherine Beadle

Re-Instatements to Fellowship

Rev Fr Dr Savarimuthu Ignacimuthu

Re-Instatements to Membership

Mr Jasper Hubert

Re-Instatements to Student Membership

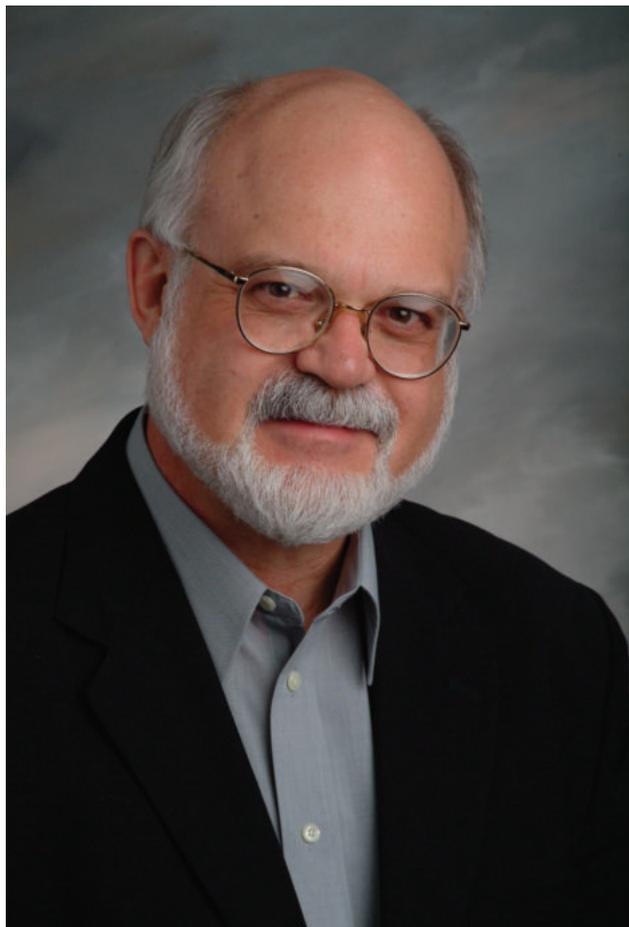
None

Deaths

Dr J M Cherrett, 1969, Anglesey
Dr J T C Sellick, 1961, Kettering
Mr R A Tribbeck, 1955, Stoke-On-Trent
Mr B O C Gardiner, 1947, Cambridge

The Wigglesworth Memorial Lecture and Medal Award 2016

Professor John G Hildebrand, University of Arizona, USA



John Hildebrand was born and grew up in Boston, Massachusetts. From the age of five he was fascinated by living creatures (and especially arthropods and reptiles) and passionate about classical music. After completing high school, he entered Harvard University expecting to major in music but still with an eye on biology. An extraordinary general-education course in 1960 in what today would be called integrated science, taught by George Wald, changed those priorities.

As an undergraduate John had the good fortune to do research with John Law, which led to a first journal article in 1964. After completing his baccalaureate degree with high honors in biology, Hildebrand moved to New York City to join the graduate programme at the Rockefeller Institute (now Rockefeller University), where he earned his Ph.D. in biochemistry under the mentorship of Fritz Lipmann and Leonard Spector in 1969.

While a doctoral student, John learned of the birth of the new interdisciplinary field of neurobiology and, in a chance encounter with Kenneth Roeder's little book *Nerve Cells and Insect Behavior*, about what today would be called insect neuroethology. Reading that book in a single evening set him on the scientific pathway he still follows fifty years later.

Postdoctoral research experience with Edward Kravitz in the world's first department of neurobiology, at Harvard Medical School back in Boston, enabled John's transition from bacterial biochemistry to arthropod neurobiology. He joined the faculty of that department in 1972. In 1980 he was recruited to a professorship in the Department of Biological Sciences at Columbia University in New York. His wanderings might have ended there, owing to his love of that great city, had it not been for a unique opportunity to develop a new academic unit devoted to insect neurobiology and behavior at the University of Arizona in Tucson. The Arizona Research Laboratories Division of Neurobiology was inaugurated in 1985, and in 2009 became the Department of Neuroscience. In 1988 John also co-founded the University's renowned Center for Insect Science.

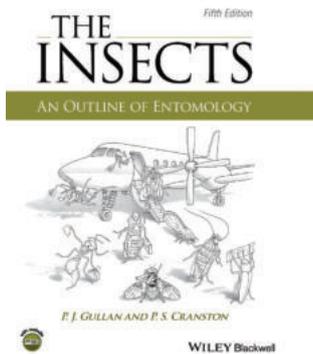
John's research combines neurophysiological, behavioural, chemical-ecological, anatomical, molecular and developmental approaches in a multidisciplinary programme addressing problems of the information-processing mechanisms, behavioral roles, functional organization, and postembryonic development of the olfactory system in insects. His programme's goal long has been to understand the olfactory bases of beneficial and harmful behaviours of insects that impact human health and welfare.

John is past president of the Association for Chemoreception Sciences (AChemS), International Society of Chemical Ecology, and International Society for Neuroethology. He is a member of the U.S. National Academy of Sciences and currently serves as its Foreign Secretary. He also is a member of the American Philosophical Society, American Academy of Arts and Sciences, and the German Academy of Sciences 'Leopoldina'; a foreign member of the Norwegian Academy of Science and Letters and the Royal Norwegian Society of Sciences and Letters; an Honorary Fellow of the Royal Entomological Society (UK), and a fellow of the AAAS, Entomological Society of America, and International Society for Neuroethology. Among his other honors are the Silver Medal of the International Society of Chemical Ecology, the Founders Memorial Award of the Entomological Society of America, the Max Mozell Award for Outstanding Achievement in the Chemical Senses from the Association for Chemoreception Sciences, and a Max Planck Research Award and a Humboldt Research Prize from the Alexander von Humboldt Foundation.

Book Reviews

The Insects: An Outline of Entomology

By P. J. Gullan and P. S. Cranston



The 1st edition of 'The Insects: An Outline of Entomology' was the recommended entomology textbook during my undergraduate days at Wye College. The book quickly became very well-thumbed and the now slightly battered copy sits on a shelf in my office today. The clear layout, engaging text and breadth of subjects covered made this book a superb introduction to many aspects of entomology for me and many others.

Twenty years later and the 4th edition of this book is recommended reading for the current crop of students studying entomology at Harper Adams University. With arrival of the 5th edition I was keen to see how this textbook has continued to evolve.

With 18 chapters covering everything from the diversity and conservation of insects, external anatomy, insect physiology and pest management, the 5th edition has lost nothing in terms of breadth. A clear focus of this edition has been to include the effects of human activities on insects. This includes warming of the planet as well as global trade in insects. This has been covered in a new chapter entitled 'Insects in a Changing World'. This chapter nicely highlights how insects respond to changes in climate, and that this is of immediate concern for the spread of crop pests as well as insect-borne diseases affecting domestic animals and people. In addition, sections on how insect ranges may change due to global commerce and the accidental passenger insects that impact agriculture, health and the natural

environment seems particularly timely. This situation is caricatured on the front cover of this new edition, in a tribute to Canadian insect illustrator Barry Flahey.

The latest edition of the book has also kept pace with molecular genetic techniques and the role that these approaches have had in transforming so many areas of entomology. In particular, the role that molecular studies have had in informing our ideas of evolutionary relationships at all levels are considered and updated from previous editions. In addition, techniques, such as 'DNA barcoding' are clearly described and their roles in revealing the true diversity of insects at species level considered.

A constant feature of the design of this book from the very first edition has been the use of 'boxes' for material tangential to the main text but of topical (although perhaps ephemeral) importance. For example, in the opening chapter recognition is given to the dynamism provided by 'non-mainstream' entomologists such as through citizen science initiatives. With each new edition the number of 'boxes' has increased as the effects of ever-more insects spreading and damaging plants of interest to humans are reported. As a consequence some boxes from previous editions have either been downsized and merged with the text or discarded.

Overall I am delighted to see that the 5th edition of this textbook has retained the format and style that so attracted me to entomology some 20 years ago. At the same time, each edition, and the 5th edition is no exception in this, has responded to developments in technology and concerns that drive the field of entomology. I am delighted to see that I will have no hesitation in recommending the latest edition of this textbook to our students.

Dr Tom Pope, Harper Adams University

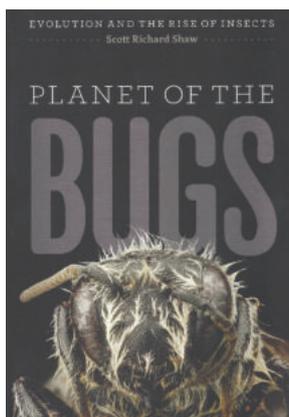
Planet of the Bugs: Evolution and the Rise of Insects

Scott Richard Shaw (2014)

ISBN: 978-0-226-16361-1

256pp, \$27.50/£19.50 (hard back)

University of Chicago Press



Following a short prologue of the author's thoughts as he wandered through a rain forest in search of an entomological time-machine, Chapter 1 introduces the reader to the remarkable diversity of insects that live on Earth today, including some of the more bizarre or unusual examples. Also introduced here are various definitions of the species concept (as applied to insects) and how we name and classify them. The author explains the hyperdiversity of insects in terms of small body size, their ability to fly and the evolution of complete metamorphosis, but notes that a better understanding will only be gleaned by looking in more detail at their evolutionary history as laid down in their fossil record.

The rise of the arthropods is the focus of Chapter 2 and recounts the evolutionary history of pre-insect organisms during the Cambrian explosion. The success of arthropods is in large part due to the pros of having an external skeleton, rather than the internal skeleton seen in vertebrates. This is ably demonstrated using the evolutionary history of trilobites as the main example, with the interesting observations that these creatures had not yet mastered the art of possessing such form, due to their inability to shed their old skeleton in a consistent and efficient manner or to recycle the materials from the old skeleton into the new one – problems not encountered by insects.

Chapter 3 considers the transition of animals from the aquatic to the terrestrial realm during the Silurian, focussing on the earliest arthropods such as chelicerates and myriapods. Here the author refers to the myriapods as the ancestors of insects and while this is the traditional view based on morphological evidence, more recent molecular studies consistently indicate Crustacea, either in part or entirety (e.g. Grimaldi, 2010; Strausfeld & Andrew, 2011), although no reference is made to this fact.

In chapter 4 we are introduced to the first definitive hexapod fossils, such as *Rhyniella* and *Rhyniognatha* from the Devonian Rhynie chert of Scotland. Again, here it is inferred that myriapods were the ancestors of insects (p. 64) and reference is also made to the presence of spiders in the Devonian, though the oldest known fossil spider is actually Carboniferous; presumably the author is referring to Trigonotarbida or Uraraneida.

Chapter 5 considers the Carboniferous origins of insect wings, including a discussion of the various hypotheses for their evolution, e.g. the paranotal lobe, solar panel, gill and surface skimming hypotheses. That wing flexion also originated during this period is also highlighted as a significant point allowing a diverse radiation of insects. We are introduced to the presumed behaviour and ecology of some of the more primitive forms, such as palaeodictyopterans, griffinflies and the primitive roaches.

The Palaeozoic Era came to a close at the end of the Permian, as a result of the largest extinction event in the history of life on Earth and this forms the focus of Chapter 6. Reading the book it is almost possible to visualize the turnover of the various insect groups during this stage of their evolution, where new innovations such as complete metamorphosis provided some groups with a significant advantage over others. Reference is made to some of the extinct orders, such as Miomoptera, being known from fossil wing fragments so difficult to interpret that their systematic status is unclear. While this may be true, it somewhat understates their palaeodiversity. For example, occasional body parts are preserved and more than 100 different species have been described from Europe, Asia, North and South America, Australia and South Africa.

Chapter 7 focuses on the post extinction recovery of insects, the evolution of new orders and the rise of the dinosaurs, including, rather speculatively, how they may have exerted selection pressure on insect diversity and vice versa. This is followed by the evolution of ecto- and endo-parasitism (particularly in Hymenoptera, but also lice) in the Jurassic (Chapter 8), along with anal trophallaxis in termites. Here, the author advocates that insect feeding was a major driving mechanism in the evolution of flight in birds and also enlightens us to the largest organism ever described by an entomologist (I expect very few of you will guess what this was!).

The Cretaceous witnessed the diversification of the angiosperms or flowering plants and this had profound implications for the evolution of insects, particularly the plant-pollinator co-radiations, as detailed in Chapter 9. Other significant events covered include the radiation of social insects and, of course, the demise of the dinosaurs. In Cenozoic reflections (Chapter 10) the author explains how diversity promotes diversity, resulting in the inordinate number of insect species today, from their origins around 400 million years ago. This is also the period when mammals diversified and humans became the 'dominant' species on Earth, at least in terms of their ability to alter the landscape. The implications of such behaviours and their consequences for insect biodiversity are briefly discussed.

As a postscript, the author introduces us to his 'buggy universe hypothesis', which goes along the lines of: the living universe is full of bugs because on any planet where life evolves into multicellular animals, and where photosynthetic plant-like organisms colonize the land, the most abundant and diverse creatures will be small exoskeletal forms approximating arthropods. In theory, and given the evidence presenting in the preceding chapters, this does not seem unreasonable. As a final call, any potential future universe explorers are reminded to pack their entomology nets and collecting jars as they will likely be needed!

There is considerably more to each of the chapters than the entomological elements mentioned above. In short, it is the author's view of the history of life on Earth and how insects have influenced it, in addition to how it has influenced their diversity. The acknowledgements demonstrate that the various chapters have been proof read by relevant leading authorities. 31 black and white photographs of fossil and extant insects punctuate the text, in addition to eight colour plates; the latter are all of extant insects. The book ends with supporting notes to the chapters, suggested reading and an index.

The book is very well written in a manner accessible to the layperson as well as a more academic audience. The physical production is excellent and there are only a few very minor typographical inconsistencies (e.g. in capitalization of Earth and Period); otherwise the editing is very tight. The lack of reference citations throughout (though there are additional notes) reduces the 'academic' value of the work and as with any story told on the basis of extremely incomplete facts (i.e. the rather sparsely documented insect fossil record), much of the prose must be read with a rather speculative eye. Although fossil insects provide the basis for much of the story, there is very little mention of the incredible diversity of fossil insect deposits around the world (e.g. Penney & Jepson, 2014). Nonetheless, I thoroughly enjoyed reading this book and believe that it probably does provide a good general account of the rise of the most diverse group on the planet today.

References

- Grimaldi, D. (2010) 400 million years on six legs: On the origins and early evolution of the Hexapoda. *Arthropod Structure and Development* 39: 191–203.
- Penney, D. & Jepson, J.E. (2014) *Fossil Insects: An introduction to palaeoentomology*, 224 pp. Siri Scientific Press, Manchester.
- Strausfeld, N.J. & Andrew, D.R. (2011) A new view of insect–crustacean relationships I. Inferences from neural cladistics and comparative neuroanatomy. *Arthropod Structure and Development* 40: 276–288.

Dr David Penney

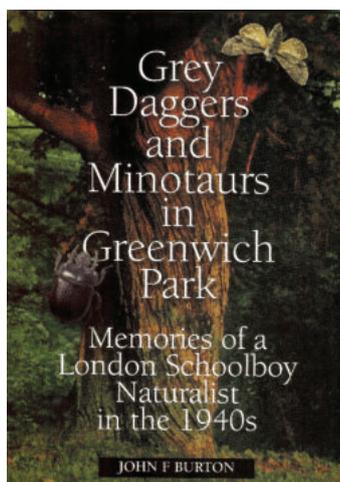
Faculty of Life Sciences, University of Manchester, UK

Grey Daggers and Minotaurs in Greenwich Park – Memories of a London Schoolboy Naturalist in the 1940s

John F. Burton

Softback 436 pages, 113 b+w illustrations. Clio Publishing, 2014

ISBN: 9-781782-802068 Retail price: £16.50



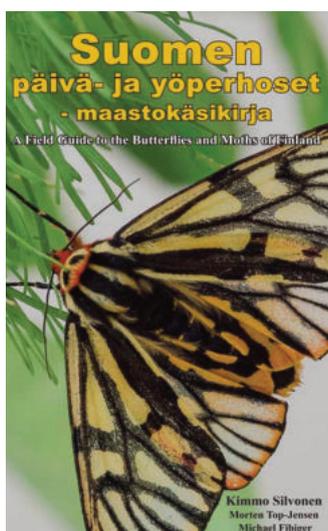
This book is a story of discovery for a London schoolboy who became captivated by the natural world in the early 1940s. John F. Burton began writing his natural history diaries in 1942, and by the time London had emerged from the smoke of the Blitz (which had tragically claimed one of his best friends) he was becoming an increasingly proficient young ornithologist and observer of life in a post-war landscape. However, this is not simply a collection of diary entries from the well-illustrated records of an enthusiast. It is a fascinating insight into the life and times of a developing naturalist, who went on to play a pivotal role in the growth of the RSPB's youth ornithologists' section, and became a well-respected natural history broadcaster and producer with the BBC. It is an illuminating and detailed account of the countryside and its inhabitants during the 1940's, and also, in the words of David Lindo, provides an important slice of social history. The book abounds with records and illustrations of many species that have long since succumbed to the sanitising encroachment of urban development, including Red-backed Shrikes, Great Crested Newts, huge Raft Spiders (found in the pools that filled bomb craters), and once thriving colonies of Pearl-bordered and Small Pearl-bordered Fritillaries. The sheer number of records made by the author is impressive, and includes many other note-worthy discoveries, including the first record of the Little Ringed Plover breeding in Kent. To a large extent, the book provides a chronicle of what once was, and the author expresses with lament the changes that have seen the loss of some of his old and favourite haunts, including Badger's Mount near Shoreham in Kent, which held what was probably the last colony of the *cretaceus* form of the Silver-studded Blue in Kent, prior to making way for the M25. Nevertheless, it provides a nostalgic account that will, no doubt,

bring back many happy memories for those who read it. It certainly reminded me of a time in my own childhood, when we could look out of the windows of our townhouse and watch the House Martins building their mud cup nests under the eaves. It also reminded me of another one of those seven green emeralds embedded in London's crown, Bushy Park, a more extensive and wilder affair than its Greenwich cousin, which similarly provides an unexpectedly rich island of natural history within the sprawl of the city's metropolis. This is a book of hidden delights, with its evocative descriptions of Stag Beetles flying at dusk on warm summer evenings, being immersed in birdsong in spring woodlands, and the recording of butterflies and all number of other species from one whose meticulous eye for detail absorbed all that any given habitat had to offer. The text is further enhanced by the many illustrations and photographs of plants, animals and habitats that accompany it. Of particular interest are the many interactions of the author with other natural historians of the day, and the book concludes with a selection of biographies of those who guided and influenced his progress. It was a delight to read this small slice of history.

Peter Sutton

A Field Guide to the Butterflies and Moths of Finland

(*Suomen päivä- ja yöperhoset – maastokäsikirja*)



The most comprehensive book on Finnish Lepidoptera for many decades falls on to my desk with a resounding thump: it weighs 1.3 kilos. Yet it is compact enough to fit into a camera bag, its covers thoughtfully encased in protective plastic to reduce abrasion from those expensive, knobbly Japanese lenses. "A field guide to the Butterflies and Moths of Finland (*Suomen päivä- ja yöperhoset – maastokäsikirja*)" portrays 1074 species in the wild, plus the same number of illustrations of set specimens set – well – at the end of the book. The advantage of a set specimen is, of course, that the hindwings are also exposed like a drooping old-fashioned petticoat. The book is published virtually entirely in Finnish. Sadly, with its 16 different noun cases and other complicated grammatical features Finnish is not the kind of language lending itself to piecemeal translation using a dictionary. However, each species is accompanied by its current scientific name, in addition to its Finnish and Swedish vernacular names, and there's a useful bone thrown to non-Finnish speakers under "English Advice" on page 12, viz. 'The book covers in detail the so-called old Macrolepidoptera, including the butterflies and skippers, and some other Families that are nowadays placed between Microlepidopteroidea and Pyraloidea'. So if you are out in the forest on a wet day and come across nothing more spectacular than a miserable little crambid, you are still quite likely to find it illustrated in the book.

Published in Denmark by Bugbook Publishing, the dazzling tome is largely the work of a Finn, Kimmo Silvonen, in association with Danish school teacher and inspector Morten Top-Jensen, who owns Bugbook Publishing, and Michael Fibiger, FLS, who published a prodigious amount of material on Lepidoptera before his untimely demise in February 2011. Illustrations are included from a host of insect photographers. Despite its linguistic disadvantage, this book is well worth its local price of around 90-100 euros for the magnificent illustrations alone. I'd even go so far as to say that most people familiar with the general concept of the hues and patterns displayed by different species of butterflies and moths would not find it too hard to identify a large proportion of the species contained therein were they e.g. to spend a holiday in Finland. Distribution maps help the enthusiast to separate the rare Lappish specimen from one picked up casually in a forest near Helsinki. Ova and larvae are also illustrated where appropriate – but a companion volume on the larvae is already in course of preparation, Silvonen not being the type to sit back twiddling his opposable digits as the accolades roll in.

Leigh Plester

The Neuroptera of Finland

(*Suomen Verkkosiipiset*)



occurrence of the adults, are clearly shown and the illustrations are superb. A dull grey map of Finland is overprinted in green to indicate specific distribution. There are many pages of identification keys but these are of use only to Finnish-speakers. In contrast, even a foreigner will find it easy to navigate through the illustrations of set specimens, all clearly labelled, on the final pages of this milestone publication.

Leigh Plester

Butterflies on their way northwards



up to, and including, 2012. Even solely as a well-illustrated identification guide to Finland's butterflies this section is well worth the book's price. The current NAFI list available off the internet to everyone comprises 113 species, including some that will be familiar to British entomologists. Over the 22-year monitoring period described the most commonly sighted species were the ringlet (*Aphantopus hyperanthus*), green-veined white (*Pieris napi*) and brimstone (*Gonepteryx rhamni*). However, Saarinen cautions that not all species are "locatable, observable and recognisable". Thus, the easily recognisable brimstone is probably over-represented in the 1991-2013 NAFI material. On the population expansion side the book picks out species that climatic conditions in Finland can be expected to favour during the second half of this century. Counts made so far already reveal a rash of species expanding northwards, with records of recently noted "new arrivals" in Lapland amounting to over 12% of the total number of butterfly species found there. On the downside, since the early 1970s butterfly populations confined to peat bogs and mires further south have been thrashed by land reclamation schemes for forestry and fuel purposes. An index based on observations in 1991-2000 and 2001-2010 reflects changes in Finland's butterfly populations. This 'butterfly gauge' is modelled on the lines of a thermometer, so that a decreasing species will be entered in the 'sub-zero' (BLUE) zone, and a flourishing one in the 'expansion' (RED) zone. The gauge can vary between -8 (BLUE area, or subzero on a real thermometer) and +8 (RED area). It comprises two factors associated with abundance and two linked to distribution, - i.e. 1) the annual abundance mean (individuals/day), 2) the two best and 2 worst summers in terms of number of individuals, 3) the annual mean in the monitoring quadrats, and 4) the monitoring frequency. The further a species is from the 'centre', i.e. zero, the greater the *change* over the monitoring period. On this basis, the index for the grizzled skipper (*Pyrgus malvae*) in Finland becomes -3, the butterfly's abundance appearing to have decreased by 35%. Its foodplant is the wild strawberry (*Fragaria vesca*), which is found in abundance right up to central Lapland. Kimmo Saarinen crams into this lavishly illustrated book a wealth of both information and speculation regarding the future of butterfly species in northern Europe. There is even a list of other European species that may possibly expand into the part of Europe we normally associate with long winters, iced-up lakes, and the aurora borealis flickering grandly above wintry vistas - our continent's Northern Dimension.

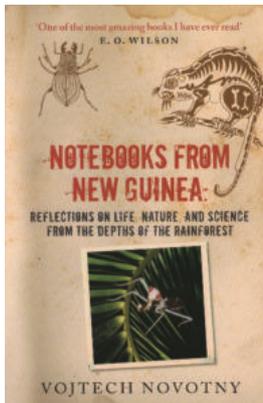
Leigh Plester

Notebooks from New Guinea *Reflections on nature and science from the depths of the rainforest.*

Vojtech Novotny

Oxford University Press

£9.99 ISBN 978-0-19-960964-2



Whilst this book has been in print for a number of years, I felt that in light of Vojtech's stunning presentation at the ECE meeting in York this summer, a current review of this book would bring it to the attention of a wider audience.

Notebooks from New Guinea is a remarkable account of the trials and tribulations experienced by Vojtech and his teams over a ten-year period. It details the many ways that local customs and superstitions have a profound influence on scientific research. For instance, failure to arbitrate between neighbours can, as did happen, lead to the burning down of your research station in reprisal for some ill fortune in the village. The notebooks are a collection of short accounts that reveal a colourful and vibrant world; characters such as the loyal research technician whose celebratory excesses lead to him breaking a transistor radio over the local chief head (triggering a rapid evacuation of the area by the entire research team), and villages that build runways and wait patiently for the arrival of western goods. A graphic explanation of why deaths resulting from road traffic accidents are always an even number is also mentioned. The Malaria intermetzo crops up on a regular basis throughout the book, reminding readers of the unpredictable and debilitating nature of this disease which is a constant hazard in the region. If you plan to visit the area this would be essential reading.

Vojtech has captured the essence of the fascinating island and distilled it into an informative, entertaining, sometimes shocking, but always beautiful set of prose. The simplicity and complexity, plus the violence and elegance of New Guinea life flows across the pages producing a montage of the author's experiences and

reflections.

Scattered throughout the book are the drawings of Benson Avea Bego, an artist and teacher who lives in the New Guinea highlands. These highly stylised images pose a delicacy and beauty that reflects the local understanding of the animals and people portrayed. Dramatic and intensely detailed, they are also extremely accurate, revealing the artist's knowledge and appreciation of the local fauna.

The science detailed in the author's plenary lecture at the ECE was impressive, but having read the notebooks these achievements are placed in a New Guinean perspective and become almost herculean. The notebooks are a synthesis of field ecology, anthropology and natural history written with great affection by a keen observer of the natural world.

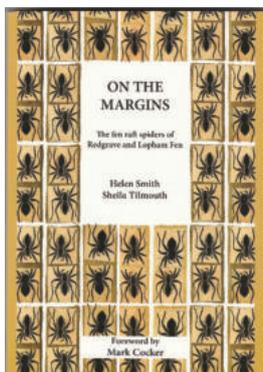
Peter Smithers

On the Margins *The Fen Raft spiders of Redgrave and Lopham Fen*

Helen Smith and Sheila Tilmouth

Langford Press

£15.00 ISBN 9781904078623



"On the Margins" is a truly holistic account of the life and times of one of Britain's rarest spiders. It is an account not only of the discovery, understanding and conservation of this spider but also of the people involved. It conveys the passion and dedication of the authors and also of their predecessors and successors; their triumphs and tragedies, the highs and the lows of ecological research in the field. The book details the way that both artists and scientists observe and report the natural world. It is a tale of long, arduous, careful and detailed observations that have revealed the secrets life of the fen raft spider.

On the margins is divided into four sections;

- A short history, of the fens and the spider.
- Life at the interface, recounts the natural history of the spider.
- A life in stages, details the spiders development and reproduction.
- On the move, is an account of the translocation and conservation projects.

The book is a wonderful fusion of art and science, blending the detailed observations of Helen Smith with Sheila Tilmouth's dramatic paintings, prints and photographs. The result is an intensely beautiful account of a heroic piece of research and conservation. Helen lucidly describes in great detail the history of the spiders discovery and its subsequent decline; the desperate attempts to save it from extinction and the herculean research programme that she then undertook in order to gain an understanding the biology of this species. While her account describes the practical difficulties of undertaking scientific research in the challenging conditions of the fenland pools and reed beds it does so with a poetical lyricism that results in some of the most powerful natural history prose I have encountered. The details are both precise and intensely beautiful, revealing a complex and dangerous microcosm that few people have explored.

Sheila's images fuse seamlessly with Helen's prose presenting a vivid and dramatic account of the spider, its habitat and the research programme. The diversity of image production techniques provides a range of styles which mirror the complexity of the ecosystem observed. Each new technique is accompanied by a detailed explanation of the process involved and the anticipated results.

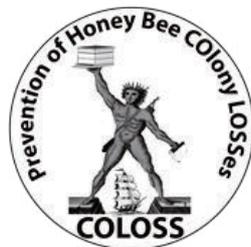
The combination of text and images chart two journeys, one in which the scientist gains an understanding of the ecology of the spider and a deep appreciation of the aesthetics of the world that exists at and around the fen surface, while the artist is drawn into the spiders' world becoming mesmerised by the details and structures that can be observed at this smaller scale.

"On the Margins" is, in Helen's own words, "a rare and privileged view of life at this unique interface."

Peter Smithers

PRESS RELEASE

from COLOSS



COLOSS,
Institute of Bee Health,
Vetsuisse Faculty,
University of Bern,
Schwarzenburgstrasse 161
3003 Bern, Switzerland.
www.coloss.org

[Immediate: 3/11/14]

The small hive beetle is in Europe to stay

The small hive beetle (*Aethina tumida*) is an exotic pest originally from South Africa which can infest honey bee (*Apis mellifera*) colonies, destroying combs and brood often causing total colony loss. It invaded the southern USA in the 1990s causing significant economic loss, and has later been found in Australia, Canada and elsewhere. It is subject to statutory control in most European countries, and contingency plans have been in place for some years in anticipation of its arrival.

On 11th September 2014 the small hive beetle was discovered by beekeepers in Gioia Tauro, in south west Italy. The source of the outbreak is currently unknown. Attempts were made to eradicate the beetles, by killing colonies and treating soil with insecticide, setting up a 20 km protection zone and 100 km surveillance zone around the infested colonies.

Subsequent investigation has found that it is present in 48 apiaries of 13 bordering municipalities, all of them concentrated in an area of 10 km radius. Italian beekeepers have asked that the policy of compulsory destruction be halted, and other measures to avoid spread be implemented.

Dr Franco Mutinelli of the Istituto Zooprofilattico Sperimentale delle Venezie² says: *"Our inspections have shown us that the beetle is found in strong bee colonies as well as weak ones, in freshly made combs as well as old ones, and in nucleus colonies as well as full colonies. However, until now the infestation appears limited to this area of Calabria region"*.

The President of the international honey bee protection network COLOSS¹ Prof. Peter Neumann says: *"The COLOSS association is greatly concerned about this discovery, which represents the permanent arrival of this pest into Europe. It is inevitable that it will spread to other European countries, but we cannot yet predict what its effects on the beekeeping industry will be. COLOSS members will work together to bring scientific results into practice for the benefit of beekeepers to help them fight this serious pest"*.

[Ends]



PRESS RELEASE

[Immediate 4/11/14]

A new era for IBRA publications.

IBRA is pleased to announce that it has signed a seven year deal with the Taylor & Francis Group to publish its two journals the *Journal of Apicultural Research* and *Bee World* from 1st January 2015. As well as IBRA's existing membership and institutional subscribers, the journals will now be available as part of the Taylor & Francis Online Journal Library and Taylor & Francis Online Collections.

The *Journal of Apicultural Research* is a peer-reviewed journal that publishes primary research and reviews on all types of bee. It will continue to be edited by the current editorial team in Argentina, Germany, Greece, Switzerland, Turkey, the UK and the USA. *Bee World* is the link between primary bee research and the practical beekeeper. It is a popular journal which features original articles and regular features on all aspects of beekeeping and all species of bees worldwide. The new *Bee World* editor will be Dr Kirsten Traynor of the University of Maryland, USA. She says: "*I look forward to building on Bee World's strong foundation and welcome two-way discussions on keeping this journal relevant to today's beekeepers and bee scientists*".

The deal will bring to fruition a long held desire of IBRA to make the entire archive back catalogue of the two journals, back to 1962 for the *Journal of Apicultural Research* and to 1919 for *Bee World*, available in online form for the first time.

Taylor & Francis Editorial Director Rod Cookson says: "*Taylor & Francis is delighted and honoured to be working with IBRA to publish Journal of Apicultural Research and Bee World. We will provide the journals with an excellent online platform and maximise their visibility for members, subscribers and other bee scientists and enthusiasts around the globe*".

IBRA Chairman Dan Basterfield says: "*This is a new era for IBRA's journals. This publishing deal will secure the future of our journals in the competitive world market for scientific journals, and will provide improved access to all parts of the world where there are beekeepers and bee scientists who need the information that IBRA can provide*".

[Ends]

Diary

Details of the Meetings programme can be viewed on the Society website (www.royensoc.co.uk/meetings) and include a registration form, which usually must be completed in advance so that refreshments can be organised. Day meetings typically begin with registration and refreshments at 10 am for a 10.30 am start and finish by 5 pm. Every meeting can differ though, so please refer to the details below and also check the website, which is updated regularly.

Special Interest Group meetings occupy either a whole day or an afternoon (check www.royensoc.co.uk/meetings for details).

Offers to convene meetings on an entomological topic are very welcome and can be discussed with the Honorary Secretary.

MEETINGS OF THE ROYAL ENTOMOLOGICAL SOCIETY 2015

Mar 4 **Verrall lecture by Prof. Sue Hartley, University of York**

"Sustainable Crop Protection using Natural Plant Products"

Venue: The Flett Lecture Theatre, NHM

Convenor: Dr Archie K. Murchie

Since the beginning of agriculture around 10,000 years ago, food production has been compromised by the pests and diseases which attack our crops. Globally around one third of food production is lost to pests, even with the use of pesticides and other modern methods of crop protection. Given the projected increase in demand for food (up to 70% increase by 2050 according to the UN) and the impacts of climate change on the spread and abundance of pest species, we urgently need new ways to protect our crops, preferably ones which are not dependent on scarce resources to produce and which do not harm the beneficial organisms in agricultural ecosystems. This talk explores a number of approaches which may provide these new methods of crop protection, based on capitalising on the natural defences of crop plants. These defences have often been lost from our crops because we have selected varieties with high yield at the expense of effective defence, but they still exist in wild ancestors offering us the possibility of restoring these weapons to our crops in the future.

4.00 pm Tea, coffee and biscuits will be available in the anteroom.

4.30 pm Welcome by Dr Andrew Polaszek on behalf of the NHM and Prof. John Pickett (President of the RES)

4.40 pm Lecture by Prof. Hartley

5.30 pm Depart. Please be aware that we need to close the lecture sharp at 5.30 pm to vacate the Museum before it closes. The Verrall Association meeting is in the Rembrandt Hotel, 11 Thurlow Place – a c. 5 minute walk from the Exhibition Road entrance to the Museum.

Mar 19 **Computing and Technology Special Interest Group Meeting**

Venue: Jodrell Lecture Theatre, Royal Botanic Gardens, Kew

Convenor: Mark O'Neill (mao@tumblingdice.co.uk)

Apr 16 **1st Annual Forest Invertebrate Meeting: Current Research and Future Challenges**

Venue: Edge Hill University

Convenor: Anne Oxbrough (anne.oxbrough@edgehill.ac.uk)

This workshop will provide a forum for researchers and stakeholders in the field of forest ecology to meet and to discuss current research and policy specifically related to forest invertebrates, including their management (e.g. pest species) and conservation within sustainable forest management. The target audience is academics, postgraduate students, practitioners and other stakeholders in the field of forest ecology, specialising in invertebrates. The audience size planned for this initial meeting is 25, though there is no upper limit.

May 26 **Joint Meeting of the Insect Ecology & Insect Conservation Special Interest Groups**

"Ant Ecology & Conservation"

Venue: Rothamsted Research

Convenor: Dr Jenni Stockan (jenni.stockan@hutton.ac.uk)

Confirmed speakers:

Prof. Francis Ratnieks

Prof. Lotta Sundström

June 3 **RES Annual General Meeting**

Venue: The Mansion House, St Albans

July 4-5 **Insect Festival (July 5th 10:00-16:00)**

Venue: Yorkshire Museum and Gardens, York

Convenors: Dr Gordon Port (gordon.port@newcastle.ac.uk),

Dr Luke Tilley (luke@royensoc.co.uk),

Mr Peter Smithers (P.Smithers@Plymouth.ac.uk)

The aim of the Insect Festival is to raise public awareness of insects and entomology, a great opportunity for young and old to discover the fascinating world of insects.

Sept 2-4 **Ento' 15 Annual Science Meeting and International Symposium**

Insect Ecosystem Services

Venue: Trinity College Dublin

Convenors: Drs Jane Stout,
Olaf Schmidt,
Archie K. Murchie,
Catherine Bertrand,
Stephen Jess,
Brian Nelson

Registration now open: www.royensoc.co.uk

Speakers confirmed to date:

Janne Bengtsson (Uppsala, Sweden)
Sarah Beynon (Pembrokeshire)
Jerry Cross (East Malling)
Tom Bolger (Dublin)
Dave Goulson (Sussex)
Alexandra-Maria Klein (Freiburg, Germany)
Simon Leather (Harper-Adams)
Craig Macadam (Buglife, Stirling)
Sarina Macfadyen (CSIRO, Australia)
Lynn Dicks (University of Cambridge, UK)
Charles Midega (ICIPE, Kenya)
Michael D. Ulyshen (USDA – Forest Service, USA)

2016

Sep 5-8 **Ento'16**

Venue: Harper Adams University College, Shropshire
Convenor: Prof. Simon Leather

Other Meetings

2015

7 Mar **Ground Beetle (Carabidae) identification workshop**

British Entomological and Natural History Society

Venue: Dinton Pastures, Reading

Convenors: Mark Telfer (Bedfordshire), John Walters (Devon)

Workshop will help beginners and experts alike to find and identify British and Irish carabids. The programme will start with a brief talk covering new topics of interest, followed by an identification session helping beginners to identify carabids to genus, as well as providing tuition on some of the more difficult genera for more advanced carabidologists. We can cover the key techniques (carding, dissection, and handling carabids for field identification) and cover any identification problems, with a little prior notice.

Contact: Dr. Mike Edwards, BENHS Indoor Meetings Secretary (m.edwards787@btinternet.com)

10 Mar **Aberdeen Entomological Club – Catriona McIntosh “Cat fleas: new approaches to a familiar pest”**

Venue: The James Hutton Institute, Aberdeen (3.30pm)

Contact: Dr Jenni Stockan (jenni.stockan@hutton.ac.uk)

14-15 **Introduction to Fly families (Diptera)**

British Entomological and Natural History Society

Venue: Dinton Pastures, Reading

Convenors: John and Barbara Ismay (both Long Crendon), Dipterists' Forum

This workshop introduces the order to beginners and we will place emphasis on the families for which Recording Schemes exist. Dipterists' Forum has produced a draft key, which BRC will print for each participant. The workshop includes tutorials throughout the two days, mostly on identification, but also on habitat preferences. Collection techniques and basic advice on how to store specimens will be covered.

Contact: Dr. Mike Edwards, BENHS Indoor Meetings Secretary (m.edwards787@btinternet.com)

28 Mar **Sawfly identification workshop**

British Entomological and Natural History Society

Venue: Dinton Pastures, Reading

Convenors: Andrew Halstead (Woking),
John Grearson (Ashton Keynes),
Guy Knight (Liverpool)

The workshop will deal with the identification of adult Sawflies for beginners, as well as helping those wishing to tackle more difficult genera.

Contact: Dr. Mike Edwards, BENHS Indoor Meetings Secretary (m.edwards787@btinternet.com)

- 11 Apr** **An introduction to the Hymenoptera aculeata**
British Entomological and Natural History Society
Venue: Dinton Pastures, Reading
 Convenors: Mike Edwards (Midhurst),
 Graham Collins (South Croydon)
 Day will start with an illustrated discussion of the main life-histories within group and then move to the microscopes for identification of these; using specimens held at Dinton Pastures, but also anything brought along by participants. It is not likely that much species-level identification will be covered. Keys to help you get to the aculeate groups will be provided.
 Contact: Dr. Mike Edwards, BENHS Indoor Meetings Secretary (m.edwards787@btinternet.com)
- 18 Apr** **Ichneumonidae general surgery**
British Entomological and Natural History Society
Venue: Dinton Pastures, Reading
 Convenors: Gavin Broad (NHM),
 Mike Fitton (NHM)
 Please bring along any ichneumonid specimens that you have tried to identify and would like confirming. Covering the nocturnal species, following recent work on species complexes, and answering any ichneumonid problems, as far as we are able.
 Contact: Dr. Mike Edwards, BENHS Indoor Meetings Secretary (m.edwards787@btinternet.com)
- 26 Apr** **7th International Conference on Fossil Insects, Arthropods and Amber**
-1 May **Venue: National Museum of Scotland, Edinburgh**
 Contact: Dr Andrew Ross (a.ross@nms.ac.uk)
- 31 May** **XIV International Conference on Ephemeroptera and XVIII International Symposia on Plecoptera**
-5 Jun **Venue: The James Hutton Institute, Aberdeen**
 Convenors: Craig Macadam (craig.macadam@buglife.org.uk),
 Dr Jenni Stockan (jenni.stockan@hutton.ac.uk)
 Keynote speakers: Dr Ben Price, Prof. Steve Ormerod, Dr William Darwall, Robert Boyle
 See <http://www.hutton.ac.uk/events/international-conference-ephemeroptera-and-plecoptera> for more details
- 13-15** **Benefits and Risks of Exotic Biological Control Agents**
May **Venue: Bornholm, Denmark**
 Contact: Dr Peter Brown (peter.brown@anglia.ac.uk)
 The IOBC (International Organisation for Biological and Integrated Control) was established to promote environmentally safe methods of pest and disease control in plant protection. This is an open conference of an IOBC Working Group on the Benefits and Risks of Exotic Biological Control Agents. Exotic insects (particularly predators and parasitoids) are the main study area; the use of ladybirds as biological control agents is a key theme. The conference will take place on the island of Bornholm, an unusual and beautiful location.
 See here for more information: <http://exoticbca2015.wordpress.com/>



author guidelines

We are always looking for new material for *Antenna* – please see below if you think you have anything for publication

AIMS AND SCOPE

As the Bulletin of the Royal Entomological Society (RES), *Antenna* publishes a broad range of articles of relevance to its readership. Articles submitted to *Antenna* may be of specific or general interest in any field related to entomology. Submissions are not limited to entomological research and may, for example, include work on the history of entomology, biographies of entomologists, reviews of entomological institutions/methodologies, and the relationship between entomology and other disciplines (e.g. art and/or design).

Antenna also publishes Letters to the Editor, Meeting Reports, Book Reviews, Society News, Obituaries and other items that may be of interest to its Readership (e.g. selected Press Releases). *Antenna* further includes details of upcoming entomological meetings in its Diary Section and features information and reports on RES activities including National Insect Week, Insect Festival and National, Regional and Special Interest Group meetings. Details of RES Awards and recipients are also covered, as is notification of new Members (MemRES), Fellows (FRES) and Honorary Fellows (HonFRES).

READERSHIP

Antenna is distributed quarterly to all Members and Fellows of the RES, as well as other independent subscribers.

INSTRUCTIONS FOR AUTHORS

Standard articles are normally 2,000-6,000 words in length, though shorter/longer submissions may be considered with prior approval from the Editorial Team. The length of other submitted copy (e.g. Letters to the Editor and meeting reports) may be shorter, but should not normally exceed 2,000 words. The use of full colour, high quality images is encouraged with all submissions. As a guide, 4-8 images (including figures) are typically included with a standard article. Image resolution should be at least 300 dpi. It is the responsibility of authors to ensure that any necessary image permissions are obtained.

Authors are not required to conform to any set style when submitting to *Antenna*. Our only requirement is that submissions are consistent within themselves in terms of format and style, including that used in any reference list.

PAGE CHARGES

There is no charge for publication in *Antenna*. All articles, including images, are published free-of-charge in full colour, with publication costs being met by the RES for the benefit of its membership.

REVIEW AND PUBLICATION PROCESS

All submissions are reviewed and, where necessary, edited 'in-house' by the *Antenna* Editorial Board, though specialist external review may be sought in some cases (e.g. for submissions that fall outside the Editorial Boards expertise). Receipt of submissions will be provided by email, with submitting authors of accepted articles being offered the opportunity to approve final pdf proofs prior to publication. Where appropriate, authors will be requested to revise manuscripts to meet publication standards.

SUBMISSION PROCESS

All submissions should be sent electronically to 'antenna@royensoc.co.uk', preferably in MS Word format with images sent as separate files (see above). Image captions and figure headings should be included either with the text, or as a separate file.

EDITORIAL BOARD

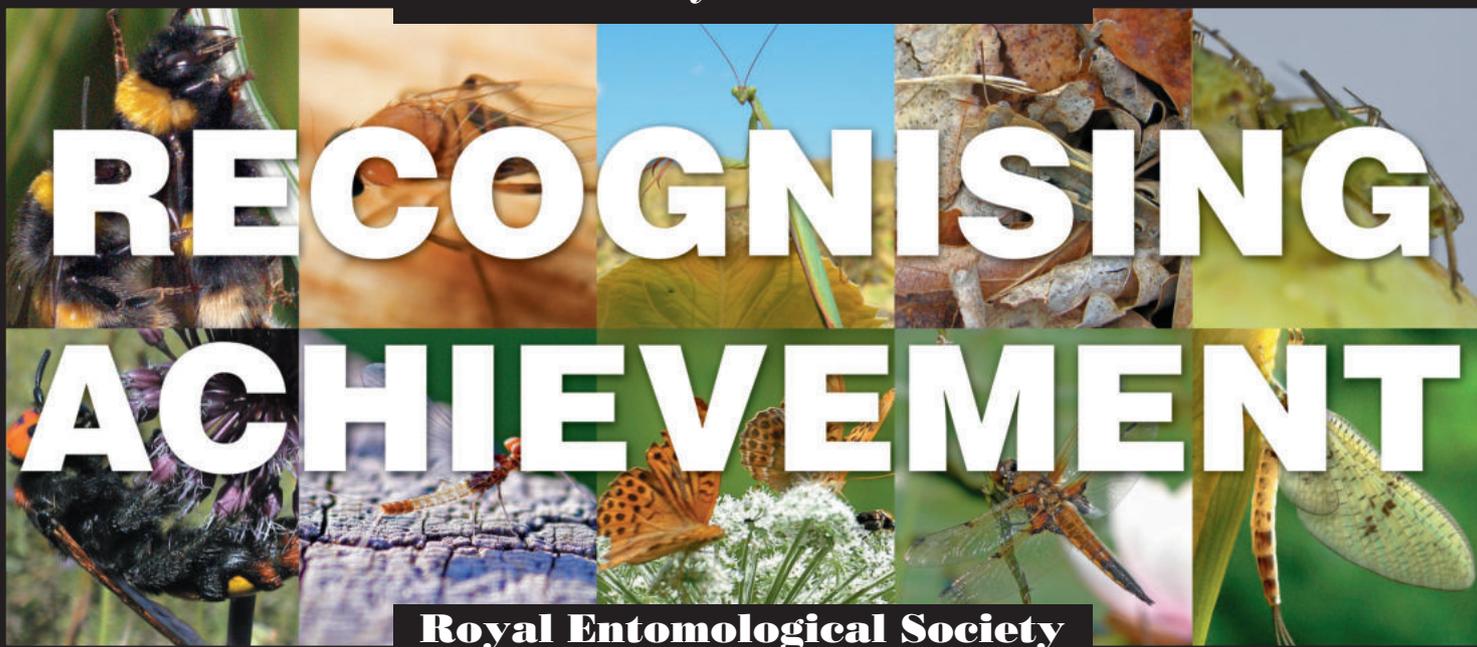
Editor: Peter Smithers (University of Plymouth)

Editor: David George (Stockbridge Technology Centre)

Editorial Assistant: Jennifer Banfield-Zanin (Stockbridge Technology Centre)

Consulting Editor: Prof Jim Hardie (RES)

Assistant Editor: Adam Hart (University of Gloucestershire)



**Royal Entomological Society
- Society Awards -**

For more details on these Society Awards please see www.royensoc.co.uk

**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: £600 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: £800 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.

**MARSH AWARD FOR EARLY CAREER
ENTOMOLOGIST**

Award Criteria: For an early career contribution to Entomological Science (up to 30 years of age, or, in the early stage of a research career) that is judged to be outstanding or exemplary with single or ongoing impact on the science. The Award is 'open' and not restricted to any particular discipline or specialised area of entomological science.

Prize: £1000 and Certificate



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