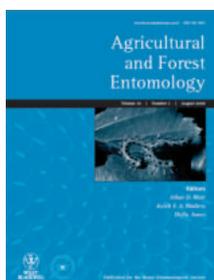


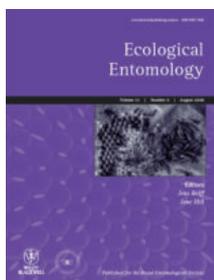
antenna

**GAME THEORY,
BUT NOT AS YOU KNOW IT**

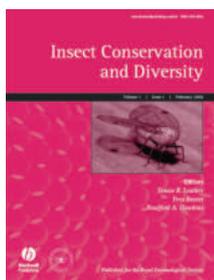
Publications of the Royal Entomological Society



Agricultural and Forest Entomology provides a multi-disciplinary and international forum in which researchers can present their work on all aspects of agricultural and forest entomology to other researchers, policy makers and professionals. UK RES Members: print £88, online £44
2018 print or online prices: UK £882, Euroland € 1,123, USA \$1,631, Rest of World \$1,899
2018 print and online prices: UK £1,103, Euroland € 1,404, USA \$2,039, Rest of World \$2,374



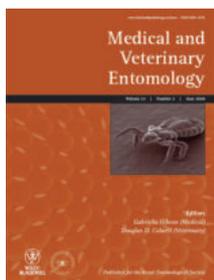
Ecological Entomology publishes top-quality original research on the ecology of terrestrial and aquatic insects and related invertebrate taxa. Our aim is to publish papers that will be of considerable interest to the wide community of ecologists. UK RES Members: print £146, online £73
2018 print or online prices: (with Insect Conservation and Diversity) UK £1,462, Euroland € 1,862, USA \$2,710, Rest of World \$3,160
2018 print and online prices: UK £1,828, Euroland € 2,328, USA \$3,388, Rest of World \$3,950



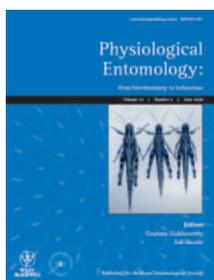
Insect Conservation and Diversity explicitly associates the two concepts of insect diversity and insect conservation for the benefit of invertebrate conservation. The journal places an emphasis on wild arthropods and specific relations between arthropod conservation and diversity.
UK RES Members: print £89, online £45
2018 print or online prices: UK £894, Euroland € 1,138, USA \$1,652, Rest of World \$1,924
2018 print and online prices: UK £1,118, Euroland € 1,423, USA \$2,065, Rest of World \$2,405



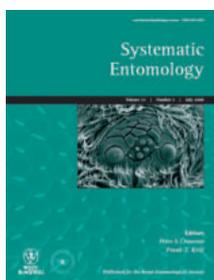
Insect Molecular Biology has been dedicated to providing researchers with the opportunity to publish high quality original research on topics broadly related to insect molecular biology since 1992. *IMB* is particularly interested in publishing research in insect genomics/genes and proteomics/proteins.
UK RES Members: print £144, online £72
2018 print or online prices: UK £1,444, Euroland € 1,834, USA \$2,669, Rest of World \$3,111
2018 print and online prices: UK £1,805, Euroland € 2,293, USA \$3,337, Rest of World \$3,889



Medical and Veterinary Entomology is the leading periodical in its field. The Journal covers all aspects of the biology and control of insects, ticks, mites and other arthropods of medical and veterinary importance. UK RES members: print £85, online £42
2018 print or online prices: UK £848, Euroland € 1,082, USA \$1,571, Rest of World \$1,833
2018 print and online prices: UK £1,060, Euroland € 1,353, USA \$1,964, Rest of World \$2,292



Physiological Entomology is designed primarily to serve the interests of experimentalists who work on the behaviour of insects and other arthropods. It thus has a bias towards physiological and experimental approaches, but retains the Royal Entomological Society's traditional interest in the general physiology of arthropods. UK RES Members: print £78, online £39
2018 print or online prices: UK £784, Euroland € 996, USA \$1,444, Rest of World \$1,686
2018 print and online prices: UK £980, Euroland € 1,245, USA \$1,805, Rest of World \$2,108



Systematic Entomology encourages the submission of taxonomic papers that contain information of interest to a wider audience, e.g. papers bearing on the theoretical, genetic, agricultural, medical and biodiversity issues. Emphasis is also placed on the selection of comprehensive, revisionary or integrated systematics studies of broader biological or zoogeographical relevance.
UK RES Members: print £137, online £69
2018 print or online prices: UK £1,372, Euroland € 1,746, USA \$2,537, Rest of World \$2,961
2018 print and online prices: UK £1,715, Euroland € 2,183, USA \$3,172, Rest of World \$3,702

Subscription and correspondence concerning back numbers, off-prints and advertising for the seven principal journals of the Society should be sent to the publishers, John Wiley & Sons Ltd, 9600 Garsington Road, Oxford OX4 2DQ. (cs-journals@wiley.com)

Antenna (Bulletin of the Society). Free to Members/Fellows. Published quarterly at an annual subscription rate of £50 (Europe), £55 (outside Europe), \$90 (United States). This journal contains entomological news, comments, reports, reviews and notice of forthcoming meetings and other events. While emphasising the Society's affairs, *Antenna* aims at providing entomologists in general with a forum for their views and news of what is going on in entomology. Subscriptions and advertising enquiries should be sent to the Business Manager at The Mansion House, Chiswell Green Lane, Chiswell Green, St. Albans, Hertfordshire AL2 3NS and any other enquiries to the Editors.

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

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

CONTENTS

- 2 Editorial
- 3 Correspondence
- 6 Article – Entomologist on Board
- 10 Article – Missing New Zealand stickman found in UK
- 14 Article – ‘Palmageddon’ revisited
- 18 Society News
- 35 Book Reviews
- 45 Diary



COVER PICTURE

PhD candidate Louise Malmgren carefully considers her next move.

Photo by Roman Zipaj

Bulletin of the Royal Entomological Society

The Royal Entomological Society
The Mansion House,
Chiswell Green Lane, Chiswell Green,
St. Albans, Hertfordshire AL2 3NS
E-mail: antenna@royensoc.co.uk

Editors:

Peter Smithers
(University of Plymouth)

David R. George
(Stockbridge Technology Centre)

Richard Harrington
(Rothamsted Research)

Editorial Assistant:

Jennifer Banfield-Zanin

Consulting Editor:

Prof Jim Hardie

Assistant Editors:

Prof Adam Hart (University of Gloucestershire)

Prof Hugh Loxdale MBE (Cardiff University)

Dr Tom Pope (Harper Adams University)

Ms Alice Mockford (University of Worcester)

Business Manager: Registrar

COPY DATES

For *Antenna* 42 (2) – 1st April 2018 (DG)

For *Antenna* 42 (3) – 1st July 2018 (RH)

Diary Copy date:

five days before *Antenna* copy date above.

Any facts or opinions expressed in this bulletin are the sole responsibility of the contributors. The Royal Entomological Society and the Editors cannot be held responsible for any injury or loss sustained in reliance thereon.

The Royal Entomological Society

The Mansion House, Chiswell Green Lane,
Chiswell Green, St. Albans, Hertfordshire AL2 3NS.
Tel: 01727 899387 • Fax: 01727 894797
E-mail: info@royensoc.co.uk

The Royal Entomological Society is a scientific society founded in 1833 and incorporated by Royal Charter in 1885 for the improvement and diffusion of entomological science exclusively.

Officers 2017/2018

President: Prof M. P. Hassell CBE (F)

Honorary Treasurer: Prof J. A. Pickett, CBE (Hon FRES)

Honorary Secretary: Dr A. K. Murchie (F)

Honorary Editorial Officer: Prof L. M. Field (F)

Vice Presidents: Dr M. Cameron (F), Dr S. Beynon (F),

Other Members of Council:

Dr J. A. Stockan (F), Dr A. D. Watt (F)
and Dr A. Oxbrough (F)

Chairs of Standing Committees:

Prof J. A. Pickett CBE – *Finance Committee*

Dr A. K. Murchie – *Meetings Committee*

Prof L. M. Field – *Publications Committee*

Dr J. Banfield-Zanin – *Membership Committee*

Prof J. A. Thomas OBE – *Insect Conservation*

Dr R. O. Clements – *Library Committee*

Dr L. A. N. Tilley – *Outreach and Development*

Registrar and Chief Executive:

Mr W.H.F. Blakemore E-mail: bill@royensoc.co.uk

Deputy Registrar and Director of Finances and Business:

Ms K. L. Whiteford E-mail: kirsty@royensoc.co.uk

Deputy Chief Executive and Director of Outreach:

Dr L.A.N. Tilley E-mail: luke@royensoc.co.uk

Director of Science:

Prof R.J. Hardie E-mail: jim@royensoc.co.uk

Regional Honorary Secretaries:

Dr D. George (North), Dr J. Stockan (Scotland),

Mr P. Smithers (West), Dr A. Helden (East England),

Dr S. Arnold (South East), Dr A. Murchie (Northern Ireland)

Library: Mrs Valerie McAtear, Librarian (lib@royensoc.co.uk)

The Library is open to Fellows and Members from 9.00am to 3.30pm Monday to Friday. The Library is not open on Saturdays and Sundays or public holidays, and such other times as may be notified in *Antenna*.

Subscription Rates 2018

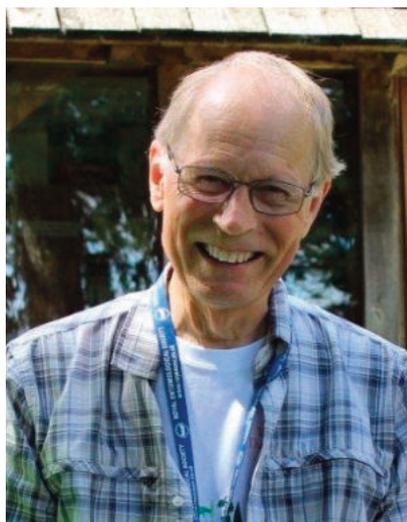
The following are the subscription rates due on 1st March 2018: Fellows £62; Members £56; Students £33; Fellows and Members over 65 £40. The journals of the Society are available to individual Fellows and Members at preferential rates via the Subscriptions Department at The Mansion House. *Antenna* is supplied free of charge to Fellows and Members not in subscription arrears. **Cancellation of Journal subscriptions must be notified to Subscriptions Department before the 31st October in the year preceding cancellation.**

Printed by Andrew Smith Print Ltd

Chelmsford, Essex

email: andrew@asmithprint.co.uk

EDITORIAL



Welcome to the first edition of 2018. The new year is always a time of potential change, a chance to take a different perspective on the coming year, and so in this spirit *Antenna* offers a cover that features an entomologist rather than their muse; one of only four since 2005, but one that flags the first of a series of articles on entomological board games. Here, Mandela Fernandez-Grandon introduces us to a fascinating array of games based on insect biology. I can see future conference evenings where the bar is filled with these sessions, as entomologists go head to head in games such as Waggle Dance.

We also have the mysterious news of the first ever recorded male of a New Zealand stick insect turning up in the UK, plus an update by Peter Cranston aptly entitled 'Palmageddon'. This details the devastation being wrought to date-palm plantations in the USA and to decorative palms in Europe by weevils of the genus *Rynchophorus*. We also have reports from projects funded by Society grants, news from several SIG's and profiles of the latest batch of Society-funded scholars on the Harper Adams MSc in Entomology. Plus, of course, a diverse array of book reviews.

The spirit of change continues, as I have decided to step down from the role of Editor. I have been editing *Antenna* since the end of 2005 and felt that it was time to make way for a fresh perspective on the world of entomology.

My time as editor has seen the role evolve from an organiser of submitted material to the voracious pursuit of any material that is relevant to entomology in the 21st century and of potential interest to our readers. In my early years in the role, the copy flow was sporadic but with the change to the A4 full-colour version the flow of copy has gradually increased. The now constant flow of articles offers the Editors considerable choice, and a new diversity of material that reflects the ever-widening field of entomology and the peripheral interests of entomologists themselves.

One of the great privileges and pleasures of editing *Antenna* has been the ability to solicit material that dealt with topics that, as editor, I felt were important to the Society and the readership, and then to have the freedom to organise the contents to reflect them. *Antenna* now offers broad views of the entomological world, ranging from overviews of current insect-based problems and accounts of cutting-edge research, to the fringes where entomology mingles with the arts. Peter Cranston once told me that when he and Penny Gullan embarked on a new edition of their now classic textbook, the first place they looked to see what was new in entomology was *Antenna*. I hope that *Antenna* will continue to present the frontiers of entomology, reflecting on and reporting the enormous diversity of the insects themselves, the increasing complexity of the science that endeavours to understand them, and the equally diverse spectrum of the entomologists who conduct the research.

Throughout my involvement with *Antenna* it has always been a team enterprise, so I would like to offer an enormous vote of thanks to the rest of the team for their help and support over the years. Initially to Greg Masters, who showed me the ropes and taught me to push the boundaries. Then laterly to David George and Jennifer Banfield-Zanin, who have brought order and structure to my more free-form editorial style. Also to Andrew Smith who organises the layout and printing of the magazine; my thanks for his tolerance and patience as he juggles the contents to fit them into multiples of four pages. They have all been extremely flexible, accommodating and ready to embrace new ideas, an attitude that I believe has allowed *Antenna* to become the much loved communication that it is today.

Lastly, I would like to offer a very warm welcome to Richard Harrington, who is taking on the vacated role. I hope that he will enjoy his time as editor as much as I have. I will still be involved and on the lookout for articles (on behalf of the editors) and will also continue to organise the book reviews. The *Antenna* team would like to wish all our readers a prosperous and successful 2018.

Peter Smithers

Guidelines for submitting photographs

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

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

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

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

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

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



300dpi



72dpi

CORRESPONDENCE

Observations of a wingless Bumblebee Queen

In early April 2017, I found a wingless Large Earth Bumblebee queen, and I could not have foreseen at the time that she would stay with me until September. Here I describe my observations made during this time, and the bond formed between us that would never have materialised had she been able to fly. I am neither a scientist or bumblebee expert, but I suspect my observations may be of interest to the community of entomologists.

Found early in April on a particularly wet and windy day, she looked rather poorly, being both cold and damp, so I gently picked her up and gave her a sugary water mixture and then left her sheltering in a patch of heather in my garden. I checked on her some hours later, expecting her to have crawled off, but she remained in the same place looking not much better, so I took her indoors that night due to the inclement weather. I kept her in the house for a few days, under a domed mesh cover with a base measurement of 30x30cm. Inside was a plastic box containing a piece of black soft cotton for her to hide, as well as a shallow plastic lid with sugar water. During these days, I contacted the Bumblebee Conservation Trust to enquire as to why she had no wings. I was informed that it may be Deformed Wing Virus, a disease that causes bees to emerge from the pupae with crippled or extremely reduced wings. I have since learned that there could be other causes as well after being in contact with Prof. Lars Chittka (Queen Mary University of London). It is because of my correspondence with Professor Chittka that I find myself writing this piece in which I will try to remain objective! This is quite difficult as Bee, as I named her, actually became my little pet.

I set up a garden for her in a large crate and covered it with a net to keep other bees from pinching her pollen and nectar. I provided her with sugary water and carried her to the wild flowers and brought wild flowers to her. The garden was not fully escape proof, but I felt that I had to take a chance and give her the opportunity of living as normal a life as possible. However, on the first day I put her in it, she disappeared from the enclosure!

I thought that this was the end of the story and that I had tried my best. Three days later she emerged, looking somewhat dishevelled and I and my husband were overjoyed to see her! She was thirsty, so she came onto my hand straight away and I let her drink some sugary water from my finger. Drinking from my finger was something she had done right from the very beginning. If I did not know before, then from this day I knew that I was responsible for the wellbeing of this bee.



Bee never behaved to me as if she felt threatened or aggressive. At no point did Bee attempt to sting me and the only time she lifted her middle leg (a defensive posture) was perhaps when I moved just a bit too quickly into her space. She was always shown respect but I have no fear of bumblebees so perhaps she felt this. Can bees sense your fear? Perhaps. It was noticeable that when other people took Bee in their hand, she appeared anxious to return to my hand, perhaps because of the familiar scent.

Being naturally sociable, she would sometimes look a bit “down” when she had been left on her own for a number of hours. One time was when I came home from work having left her in her garden, I went to look for her. I couldn’t find her at first and stood back to watch for a minute or so. Sure enough, she had felt the vibration and came out looking all bright and expectant with her antennae up and forward. She was neither hungry or thirsty but climbed into the palm of my hand and had a snuggle! On another occasion she was left for a while in her indoor retreat as the weather was dreadful. She was sitting with her back to me, so I scratched nearby so as not to frighten her and immediately it was as if her whole being lit up and she came right to me. She did spend a lot of time snuggled in my hand. I think that she probably appreciated the warmth and perhaps the natural rhythm of my body is like that of a bumblebee nest. Who knows!

In the early months she attempted to fly on multiple occasions, vibrating her wing muscles, and her legs would lengthen as if she was trying to push herself off the surface. She almost looked humiliated having failed to fly, and would crawl into my hand and hide her face for one to five minutes, almost as if she was embarrassed (a bit like us as humans). After a “cuddle” she was fine. By cuddle I mean that she would let me stroke her either with my finger or up close with my nose, and cuddle into my cheek. She would crawl onto my nose and clean herself. That must be a good viewing platform for a bumblebee! She didn’t really try to fly much later in the season.

She was meticulous in her grooming, even towards the end of her life. The morning routine consisted of grooming, then she would relieve herself and finally she had a drink. Of the various wildflowers I offered in the enclosure, she seemed to favour yellow flowers, especially buttercups. If she was on my hand I could tell when she needed to defecate. She would perform what looked a bit like a dance and looked around and made sure she put her tail end off my hand or arm or wherever she was. She would not “wee” on me. I don’t know if that was respect or if she saw me as an extension to her nest. Either way, if it landed on me, it was an accident. A house trained bee!

She made sort of clicks/buzzy sounds when she was in close contact with me and was happy to sit and groom, eat, drink and sleep on my hand. We were both very comfortable with each other, and many people admired this bond. She was totally relaxed with me. People have a bond with their dog or cat and even their hamster. I think I have proved here that you can have a relationship with an insect! She thrived with my care and company. It could be said that she just saw me as a place to receive her rewards, like flowers and a drink, but I do think she felt the security and affection. I will leave that for the reader to decide.

Bee was found on 11th April and stayed with me till she died on 15th September. I never expected her to live a few days in my care, let alone over five months! She far outlived healthy queens of this species, which typically die in the peak of summer. It is not without a tinge of sadness that she has gone, but I have learned so much from her, as have many people who have followed her story, and it was a real privilege to be able to have this bond with her.

You may read this with some scepticism or disbelief. I have tried not to be too sentimental and tell the tale as it was. But hear this – when you have been close enough to feel the warmth and smell the lovely waxy scent of her body, you too will know you have spent a wonderful summer with a very special bee.

Fiona Presly
Inverness

A bee as pet – a bee psychologist’s perspective

Fiona Presly contacted me in the summer of 2017, when her bee was still alive, and I was immediately captivated by her story. A friendship between a bumblebee queen and a human? A cynic might comment that it is unsurprising that a human might benefit from such a relationship – after all, even virtual and robotic pets can engage in human caring feelings and improve wellbeing. It might be that in humans there is a hereditary predisposition for looking after animals – e.g. primordial farmers who looked after animals kept for meat, dairy, clothes or guarding would have done better than those that did not. But what about the bee? Why would a bee queen suspend her natural instinct to view a creature many thousand times its size as an enemy, and instead seek its proximity? Is it conceivable that an insect could even recognise individual humans, let alone form an attachment to them in the way that domesticated animals do? Pet owners are often too ready to read human-like states of mind into their beloved animals, so there is a danger of misinterpreting animals’ behaviours towards the humans they interact with habitually. Humans are good at reading other (human) minds, to some extent, but in using this ability, they perhaps sometimes tend to anthropomorphise in reading animal minds¹– and indeed even many scientists studying animal cognition and emotions are guilty of this offence². But Fiona Presly does none of this. Her wording is very restrained – e.g. she acknowledges that the apparent affection displayed by the bee might have arisen because the bee had come to associate Mrs Presly’s hand with reward, and because its scent might have come to signify safety and warmth. In this interpretation, Mrs Presly’s reading of her bee’s behaviour is in line with that of most scholars working on invertebrate behaviour and learning.

It is now clear that bees are remarkably intelligent, and can display phenomena such as counting³ and simple tool use⁴. Yet for a long time, scientists have shied away from exploring the possibility that insects might have emotion-like states. Emotions are by definition subjective and in animals can only be diagnosed by making inferences from animals’ behavioural and

physiological states triggered by certain environmental conditions that are at least broadly similar to the conditions that would trigger similar states in humans⁵. Few people, however, have difficulties appreciating that a bee (or wasp) can be in an “aggressive mood” – and indeed the stimuli that can make a bee angry are not wholly dissimilar to those that can make a dog or human belligerent. And this illustrates an important case-in-point: emotions are survival-related (perhaps survival-critical) states that are not necessarily computationally complex and certainly do not require a large brain. Natural selection might not look kindly upon individuals that do not know fear, mothers who are indifferent to the loss of their offspring, or social animals for whom it does not “feel rewarding” to be in their social setting. A bumblebee queen’s natural biology directs it to found a colony in spring and raise daughters to assist with nest construction, provisioning and defence. It is therefore plausible that she should feel, in the broadest terms, a sense of reward from not being solitary.

Fiona Presly’s bumblebee queen, because of her winglessness, was deprived of founding a colony, but is it plausible that an insect might “find comfort” in the company of a human? Honeybees can be trained to recognise a photo of a human face⁶ - and indeed some wasps can recognise one another individually⁷, but while such individual recognition may be a key ingredient to forming a “friendship”, it is still a long distance from an “affectionate” mutual interaction. Yet most owners of “conventional” (mammal or bird) pets, and the scientists that study such interactions, would not hesitate to diagnose a form of emotion-like attachment. Conversely, entomologists, indoctrinated by the view that insects are efficient but hard-wired “reflex machines”, have been slow in exploring the possible emotional repertoire of insects. Sometimes it takes an outsider’s careful observations, such as Mrs Presly’s, to generate fresh views and prompt important questions.

Many animals’ “default setting” is to form attachments primarily to conspecifics and to greet members of other species with reservation. But pet-human interactions certainly show that these “default settings” allow considerable flexibility. Certainly associative learning – the provision of food, shelter, warmth, by the human (and the features identifying that human, be they visual or olfactory) – plays a crucial role in forming such attachments. But the interactions described by Mrs Presly are nonetheless far from trivial – how does a bee “know” that the nose belongs to the same “entity” as the hand that provides the reward? As someone who has had the unfortunate experience of being stung by a *Bombus terrestris* queen – the largest stinging insect in Europe – I would not advise anyone to place such a bee on your face unless you know that you have as good a rapport with that individual as Mrs Presly did!

References

- ¹ Spence CE et al (2017) Trends Cogn Sci 21: 333-343
- ² Chittka L et al (2012) Phil Trans Roy Soc 3671: 2677-2685
- ³ Skorupski P et al (2018) Phil Trans Roy Soc 373: 20160513
- ⁴ Loukola OJ et al (2017) Science 355: 833-836
- ⁵ Perry CJ et al (2016) Science 353:1529-1531
- ⁶ Dyer A et al (2005) J Exp Biol 208: 4709-4714
- ⁷ Sheehan MJ, Tibbetts EA (2011) Science 334: 1272-1275

Lars Chittka

School of Biological and Chemical Sciences, Queen Mary, University of London, Mile End Road, London E1 4NS, UK

Antenna

As the Royal Entomological Society’s Editorial Officer, one of my responsibilities is to ‘oversee’ the publication of *Antenna*. I must say that this has been a pleasure to do, as *Antenna* has grown and developed into the highly informative and entertaining publication you are reading today. This success is in no way down to me, but to the hard work of the Editors (and now the Assistant Editors and the Editorial Assistant). One of the current Editors, Peter Smithers, was already in post when I took over as Editorial Officer and I was immediately reassured that this publication was in excellent hands. Since then I have really enjoyed working with Peter (and now Dave George as the other Editor), who has always been enthusiastic, creative and hard working. It is therefore with sadness that we are saying goodbye to Peter as an *Antenna* Editor. However, I am pleased to say that his decision to stand down as an Editor does not mean he is severing all ties with the publication, having volunteered to still be involved in book reviews and articles on our Honorary Fellows. I would therefore like to say, on behalf of the RES, and I am sure all of you readers, a huge thank you to Peter for all he has done for *Antenna*. I would also like to take this opportunity to welcome our incoming new Editor, Richard Harrington; he has a hard act to follow but I am sure that he and Dave, along with the rest of the team, will take *Antenna* forward, leading it from strength to strength.

Lin Field



Entomologist on Board



G. Mandela Fernandez-Grandon

Natural Resources Institute
Chatham Maritime
Kent
ME4 4TB

Board games have changed. Many of us grew up with staples of Monopoly, Scrabble and Risk, but in the many decades since those games were designed most of us have overlooked the waves of innovation that have arisen in the board game market. The most important change has been the rise of what are commonly known as 'Euro' games coming from a post-war, conflict averse Germany. These games take a focus on more subtle player interaction, no player elimination, and a succinct playing time.

Increasingly people have been turning back to board games as a great opportunity for fun and social interaction away from a screen. These games can see a variety of themes from putting on a fireworks show, subsistence farming in the 16th century, dress-making in the rococo period, overseeing the rise and fall of dynasties in the early civilisations of ancient Mesopotamia, to name but a few of my favourites, but of course no form of entertainment would be complete without its fair share of our favourite six-legged friends, the insects.

As an entomologist and board game enthusiast I'd like to invite you to find out about some of the great board games currently available featuring the

finest of the Arthropoda. While there are many more out there (most people don't realise that near 1,000 'designer' board games are released each year) I'll provide a brief overview of a few of the best examples of entomological entertainment to be explored and for whom I think they might suit. To help see what draws a person to this fascinating world of entomology, I've spoken to the designers of these games and asked them why they chose insects as their inspiration.

The Family Game:

Entomologists and non-entomologists alike have been charmed by the fascinating behaviour and charismatic nature of honey bees. It is no wonder then that Waggle Dance, with its colourful and friendly art, is also a delight. This is a game for the family which allows each player to oversee every element of your very own bee colony to try to produce honey the quickest. The game plays 2-4 players, with each starting the game with a handful of worker bees represented by colourful dice. The game is set over a series of days and nights. At the beginning of each in-game day you roll your worker dice which will determine which actions are available to you, but



Waggle Dance
Mike Nudd
£22.95
Grublin Games Publishing
2-4 Players
30-45 minutes

just because you roll dice don't fall into the trap of thinking this is all luck. Oh no. No dice rolls are objectively better than others and it requires a good strategy to use your workers to their greatest efficiency. You can send them out to compete to do various tasks such as building new cells and collecting nectar or you can keep them in the hive to tend to eggs, move nectar or produce honey from nectar. As the game progresses, you'll see your colony grow and become more efficient as everybody races to make that honey.

The game will finish when a player has produced the target amount of honey. One of the real strengths of this game is that the target can be changed depending on exactly how much time you have available. You can play a short game, which will take around 15 minutes per player, a medium game lasting 30 per player, or the long game taking around 45 per player.

The bright colours, simplified art style and wonderful components all combine to make this game a pleasure to have on the table, but don't take away from its credentials for entomological accuracy. The game does

well to bundle in many facets of bee life in a streamlined experience which flows smoothly after players get to grips with the mechanisms.

The designer, Mike Nudd, informed me that his original idea to set the game as managing a bee colony came from the appealing symmetry of using 6-sided dice and hexagonal playing pieces. He enjoyed the elegance of this and wanted to keep the recurring number going which is where the Hexapoda stroll into view, one leg at a time. It was also his intention that this title would be lightly educational with a hope to make bee behaviour fairly intuitive to the player and portraying it in a somewhat realistic manner. In this I think he has certainly achieved his goal and I can only hope that his plans to extend the line of games to other insect species becomes a reality.

Although it may seem complicated at first with so much going on, the clear rulebook and great design means most players will have a grip of how to run their colony after the first round is through.

Appropriately this game is much like the bee colonies it depicts. While it all



During the night phase of the game entomologists collect in their hard won nectar. Left-Right: Daniel Bray FRES, Anthony Abbott, Louise Malmgren & Jill Joiner. Photo by Roman Zipaj.

seems harmonious and simple upon first sight, the more study we commit and insight we gain reveals more complexity to be found, and even the occasional hint of meanness.

Who is it good for?

Although I suggest this one as a family game, partly because the aesthetics and components make it an inviting and accessible game, there is a caveat. If you aren't familiar with many modern games this one might seem a little intimidating at first, so I wouldn't recommend this for children under 9. Children 9 and older should be able to grasp how it works, while adults will be able to explore the more nuanced strategic play which can be achieved.

Gaming for Two:

Hive is a wonderfully tactical and tactile battle of wits for two players. The game sees each player placing or moving ants, grasshoppers, beetles, spiders (I don't know how that arachnid snuck in there) or bees in order to form a hive. The aim of the

game is to entirely surround the other player's bee which will give you the victory. Each insect (and that spider) has its own specific rules for movement allowing them to sneak around, jump over or even climb on top of the hive.

Many people I introduce this game to say it reminds them of chess, and it is easy to see why. The game consists of each player having identical pieces with specific rules on movement. There is no luck in this game and it requires a high level of strategic planning to be played well. However, I would also argue that this modern gem has many advantages over chess; an entomological theme, a simpler ruleset and a much shorter playtime. In addition, the play feels more dynamic and the absence of a board means this is a very portable game that can be played almost anywhere with a surface (it's even water proof).

The absence of luck in this game can lead to a highly rewarding experience as you discover new plays or you see your strategy fall into place after many turns of planning. This ability to form



Hive Pocket
John Yianni
£14.95
Gen42 Games
2 Players
15-20 minutes

clever strategic plays might make it sound too challenging for younger players but this is not the case. The game recommends an age of 9+ for players and this can be a great exercise for those younger kids in strategic forward planning.



Insect behaviour specialist Sarah Arnold considers her next move carefully as I close in on her Queen Bee. Photo by Roman Zipaj.

As wonderful as this game is, I must confess that it is not so heavily entwined with its entomological theme. Hive's designer, John Yianni, tells me that the game was initially designed using square pieces but it simply didn't work that well. It was when he moved to using hex shapes that the game came to life and that image of the hex shapes expanding to create the board as the game develops, made the bee and hive theme a perfect fit.

There are nice attempts to tie some of the actions of the pieces to the insects depicted, e.g. the grasshopper jumps in a straight line over pieces, the scurrying of the ants around the hive, but ultimately this is about as accurate a representation of insect behaviour as chess is a representation of warfare.

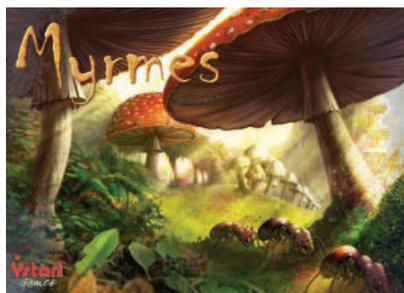
Who is it good for?

Firstly, I recommend the Pocket version which is available and I've shown here. This version offers a nice compact, travel ready format in addition to having ladybirds and mosquitoes join the mix. The portability and durability of this game are a great advantage. It can be played in airports (even on airplane flight trays), out in the field, in the pub or pretty much anywhere. It takes little time to explain the rules and only around 15 minutes to play so if you've got one other person available to play and fancy a stimulating insect-themed diversion this is a great choice.

Only for the serious gamer:

The idea of learning new rules can certainly put many people off the idea of gaming. Learning a series of complex and interwoven rules will narrow down your audience further. So why do it? Well in some of these clever and complex designs we can find great rewards. This is where the game Myrmes stands tall.

Myrmes sees each player running their own ant colony in the hope of expanding and utilising the landscape to become the most dominant colony around. The game is set over the course of three years, each divided into four seasons. In each season the players will work with changing weather to effectively forage, send soldiers to defend the colony, expand their colony and try their best to appease their Queen. Of the games mentioned, this one gives the greatest entomological accuracy and feel. The



Myrmes
Yoann Levet
£40
Ystari Games
2-4 Players
60 - 120 minutes

designer, Yoann Levet, set out to make a game about resource management. From that ants, with their meticulous and brilliant systems of acquiring and storing resources, were the natural

movement easier and farm aphids to help meet my colony's food demands.

The game is rich in the myrmecological theme, sprawling across the table with systems delicately interwoven to create a harmonious working whole, much like the ant colonies themselves.

Who is it for?

The complexity and depth of this game mean it is something of a commitment, both in time and concentration. Myrmes plays 2-4 players and is, in short, for the serious gamer who is keen to take the time to explore a game with a few friends who are willing to do the same. The game is recommended for ages 13 + but is most likely to be enjoyed by adults, preferably those with an interest in ant colonies.



The components and central board where players will be able to send out their ants to explore, establish pheromone trails, exterminate threats and exploit aphids.

choice. After he had decided on a theme the mechanisms which run the game were all inspired by the real behaviour of ant colonies. Yes, there are inconsistencies but details like using your nurse ants to tend the eggs are a joy to interact with. There is strong evidence that Yoann has done his homework which would make it a pleasure for any myrmecologist to be absorbed in this world for the 1-2 hours it takes to play this game. As a chemical ecologist who did most of my undergraduate studies and PhD with aphids, my fascination was sealed when I saw I'd be able to leave pheromone trails to make my colony

Summary

Great entomological themed games are all around us; hopefully some will even educate as they entertain. I've only taken time to cover a slither of what is on offer with every year seeing new ways to approach running ant colonies, being a ladybird foraging for aphids, guiding the evolution of arthropods, and many other fantastical takes on the natural world around us. These are all yours to discover.

If you're interested further, I'd always welcome entomologists to get in touch and I'm happy to give some tips, and who knows, maybe we'll even get a game of something at a future ENTO.



Figure 1. The first recorded male *Acanthoxyla* individual. This stick insect was found in Penzance, England but the natural range of the genus is New Zealand. (Photo credit: David Fenwick).

Missing New Zealand stickman found in UK

The recent discovery of a male stick insect in Southern England is a world first: the first male of the genus *Acanthoxyla* ever recorded. He was found half a world away from his species' natural range in New Zealand. *Acanthoxyla* stick insects are common but until now they have all been female. The discovery was made by local experts who collaborate with New Zealand evolutionary ecologists specializing in invertebrate diversity. The original identification of the male as *Acanthoxyla inermis*, the New Zealand unarmed stick insect, was made by Paul Brock (Scientific Associate, Natural History Museum, London) and Malcolm Lee (UK National Phasmid Recorder) based on the shape of the animal, and knowledge of the species introduced to the area (Brock *et al.* 2018). Because this was

the first of its kind, no comparative material was available. We were initially sceptical because we are surrounded by eight morphological forms of endemic *Acanthoxyla*, but no male has ever been reported. However, a preserved leg (shed naturally by the male while in captivity) was posted to NZ and mitochondrial DNA sequence data obtained. This confirmed the morphological ID – supporting the very first male *Acanthoxyla* specimen ever recorded anywhere (Figure 1).

The mitochondrial DNA sequence indicates that the stickman's mother was a UK-based *Acanthoxyla inermis* (a smooth species) and he must have arisen via the loss of one chromosome from the normal female complement. Like many insects including grasshoppers, cockroaches and dragonflies, sex determination in stick

**Steve Trewick
& Mary Morgan-Richards**
Massey University, New Zealand



Figure 2. A spiny green *Acanthoxyla* feeds on native New Zealand pohutukawa flowers (Myrtaceae). *Acanthoxyla* is an obligate parthenogenetic New Zealand stick insect lineage that includes many different forms, but no males... until the new record in England.

insects involves two X chromosomes for females (XX) and just one X chromosome to make a male (XO). So accidental loss of an X chromosome during egg production can produce ‘mutant’ males where none have existed before. Remarkably, despite loss of just one copy of a sex chromosome, the resulting males are morphologically indistinguishable from males produced normally by sexual reproduction (in species where this happens). They have the characteristic male traits including “claspers” on the tip of the abdomen that are used to grip the female’s abdomen during copulation. However, it appears that males formed this way are usually infertile.

Britain is now home to several stick insect species (Phasmida) from Europe, Asia and the Pacific (Lee 2012). The species that have adapted to living in the wild in the UK are female-only

(parthenogenetic) lineages, three of which derive from New Zealand (*Acanthoxyla inermis*, *Acanthoxyla geisovii*, and *Clitarchus hookeri*). Most multicellular organisms, including stick insects, reproduce sexually having females and males, but there are some insects that use a combination of asexual and sexual reproduction. Although asexual reproduction can be advantageous in the short term, such as enabling rapid population increase and range expansion, lineages that cannot reproduce via sex are usually short-lived on an evolutionary time scale.

Stick insects are therefore providing the opportunity to compare the evolutionary and ecological outcomes of different reproductive strategies, through the study of lineages that have evolved to reproduce without males and those that can do it either with or without (Scali *et al.* 2003; Milani *et al.* 2010).

Reproductive diversity in New Zealand stick insects is typical of the range in phasmids worldwide. The genus *Acanthoxyla*, that comprises many morphologically-distinct lineages, has attracted attention because the entire group lacks males. Each species of *Acanthoxyla* differs in how spiny it is, the presence/absence of abdominal flanges, and the sculpturing of its eggs (Figure 2). There is also plenty of variation in cuticle colour and patterning: the spectrum includes individuals that are almost black, bright green, beige or nearly white, some are uniform, others patterned, and many have prominent dark spines. But every individual (until now) is female and produces viable daughters without fathers.

A hybrid origin for the genus involving the ancestor of a related endemic bisexual species, *Clitarchus hookeri*, has been inferred from a

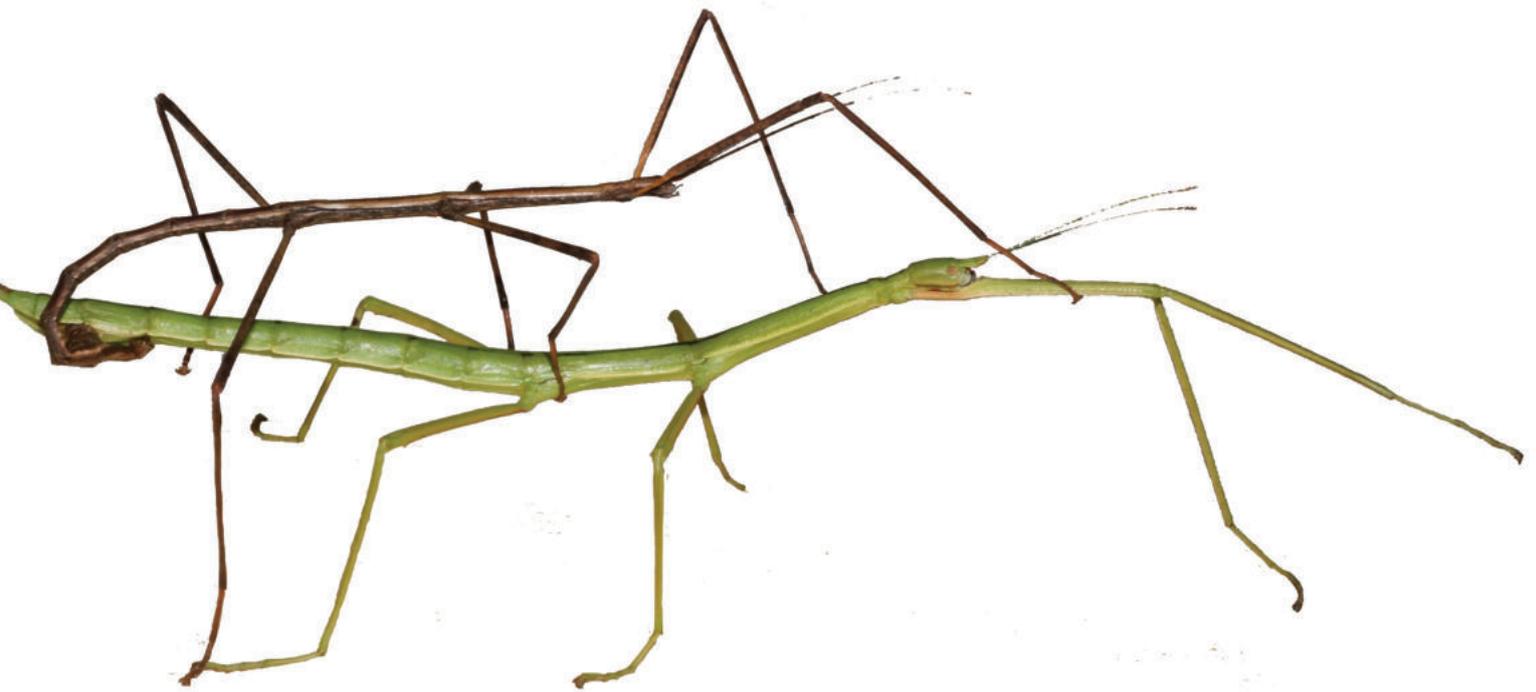


Figure 3. A pair of the New Zealand common tree-tree stick insect *Clitarchus hookeri* in copula. The female is descended from an individual from the Tresco, Scilly Island parthenogenetic population, but the male in this experiment came from a natural sexual population in northern New Zealand.

combination of genetic markers (Morgan-Richards & Trewick 2005; Buckley *et al.* 2008; Morgan-Richards *et al.* 2016). It has also emerged that many lineages of *Acanthoxyla* are mosaic triploids having cells with either two (diploid) or three sets of chromosomes (Myers *et al.* 2013), indicating the original combination of parental genomes. This association of polyploidy and hybrid origin has been identified for many organisms, including stick insect lineages in Europe and North Africa.

Another New Zealand stick insect species that has established in the UK is *Clitarchus hookeri* (Figure 3). In its native range this species has some populations that reproduce sexually, and some populations comprising only females that reproduce parthenogenetically (Morgan-Richards *et al.* 2010). Together they present a classic pattern called geographic parthenogenesis, where sexual populations occupy more hospitable and environmentally stable regions towards the equator and the all-female lineage southwards (in the southern hemisphere) to cooler, younger habitat (Figure 4). Genetic data show that the New Zealand parthenogenetic lineage is derived from a sexual population and whilst experiments show that once formed the parthenogenetic lineages have limited ability to return to sexual reproduction when males are available.

In the UK a parthenogenetic population of *Clitarchus hookeri* is established on the Isles of Scilly. This almost certainly originated from

accidental introduction as eggs accompanying New Zealand plants shipped to the Tresco Abbey gardens in the early 1900s. Work is continuing to discover whether this UK population was derived from a sexual or parthenogenetic New Zealand population. By comparing population genetic markers we will be able to infer the likely origin and thus likely reproductive strategy of the ancestor. In addition, eggs from the *Clitarchus hookeri* population on Tresco have been taken to New Zealand and raised in captivity for three generations. Once adult, the females are given local *Clitarchus hookeri* males who are happy to mate with them. The ability of the females to use the sperm for sexual reproduction is being monitored to assess the capacity of females that have resulted from a known number of parthenogenetic generations to regain sexuality. This will help answer fundamental questions in biology about the costs and benefits of sexual reproduction in animals.

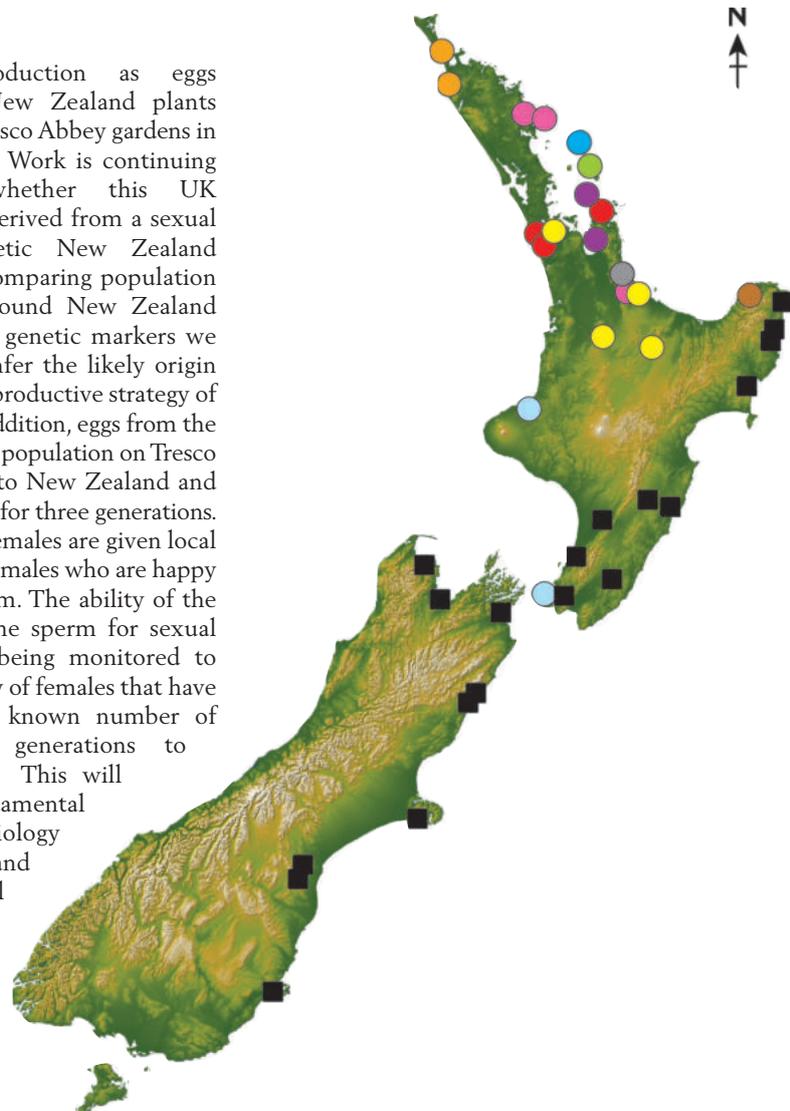


Figure 4 *Clitarchus hookeri* shows a pattern of geographic parthenogenesis in New Zealand with higher genetic diversity in northern (toward the equator) sexual populations and less diverse southern all-female populations. Sexual populations are indicated by circles, and colours indicate different genetic lineages. Black squares show parthenogenetic populations. Cooler, younger habitat was most probably colonised since the last Pleistocene glacial, and achieved more rapidly by parthenogenetic individuals with their numerical advantage.

References

- Brock PD, Lee M, Morgan-Richards M, Trewick SA. 2018. Missing stickman found: the first male of the parthenogenetic New Zealand Phasmid genus *Acanthoxyla* Uvarov, 1944 discovered in the United Kingdom. *Atropos* 60: 16–23.
- Buckley TR, Attanayake D, Park D, Ravindran S, Jewell TR, Normark BB. 2008. Investigating hybridization in the parthenogenetic New Zealand stick insect *Acanthoxyla* (Phasmatodea) using single-copy nuclear loci. *Molecular Phylogenetics and Evolution* 48: 335–349.
- Lee M. 2012. The Distribution of the UK's Naturalised Stick insects – 2012 Update. *Phasmid Study Group Newsletter* 129: 25-31.
- Milani L, Ghiselli F, Pellecchia M, Scali V, Passamonti M. 2010. Reticulate evolution in stick insects: the case of *Clonopsis* (Insecta Phasmida). *BMC Evolutionary Biology* 10:1–15.
- Morgan-Richards M, Trewick SA. 2005. Hybrid origin of a parthenogenetic genus? *Molecular Ecology* 14: 2133–2142.
- Morgan-Richards M, Trewick SA, Stringer I. 2010. Geographic parthenogenesis and the common tea-tree stick-insect of New Zealand. *Molecular Ecology* 19: 1227-1238.
- Morgan-Richards M, Hills SFK, Biggs PJ, Trewick SA. 2016. Sticky genomes: using NGS evidence to test hybrid speciation hypotheses. *PLOS ONE* 11: e0154911.
- Myers SS, Morgan-Richards M, Trewick SA. 2013. Multiple lines of evidence suggest mosaic polyploidy in the hybrid parthenogenetic stick insect lineage *Acanthoxyla*. *Insect Conservation and Diversity* 6: 537–548.
- Scali V, Passamonti M, Marescalchi O, Mantovani B. 2003. Linkage between sexual and asexual lineages: genome evolution in *Bacillus* stick insects. *Biological Journal of the Linnean Society* 79: 137–150.





Fig. 1. Dying palm trees (*Phoenix canariensis*) on Mediterranean coastline of France. Ink drawing by Karina McInness, from Gullan & Cranston (2014)

‘Palmageddon’ revisited

Five years ago Penny Gullan and I introduced readers of the 5th edition of our textbook to a potentially damaging introduced insect under a provocative title – ‘Palmageddon’. We described how in 2010 an arborist felled a Canary Island date palm (*Phoenix canariensis*) in affluent Orange County in Southern California and found it to be infested with larval and adult weevils. Initially the weevil species was believed to be *Rhynchophorus ferrugineus* (Curculionidae), the red palm weevil, previously unreported in North America but a problem especially in invaded areas of Asia, the Middle East, and Mediterranean Europe. For example, the marine frontage at film festival venue Cannes in France was losing many palm trees (Fig. 1), as had much of the Mediterranean coastline. In California, serious concern was expressed for the invasive weevil’s spread and the loss of iconic urban and coastal palm trees (think Hollywood) and the threat to the multimillion-

dollar commercial date production in the Coachella Valley.

Mark Hoddle, a ‘Kiwi’ biocontrol entomologist in exile at the University of California, Riverside, rapidly established a multidisciplinary research team. First some taxonomy: using molecular techniques the weevil was found not to be the red palm weevil *R. ferrugineus* (orange with black maculation) but *Rhynchophorus vulneratus*, typically black with a red thoracic stripe (Fig. 2) and actually highly polymorphic in colour in parts of the native range. The species comes from Indonesia, with the invading population in California possibly originating from Bali. The good news was that the commercial red palm weevil pheromone worked in California for *R. vulneratus*. The Orange County infestation at Laguna Beach was controlled using bucket traps with fermenting dates and pineapple mash plus the pheromone lure, felling and destruction of infected

Peter S. Cranston
Canberra, Australia



Fig. 2 (top). The palm weevil *Rhynchophorus vulneratus*.

Fig. 3 (bottom). The South American palm weevil, *Rhynchophorus palmarum*

palms, and systemic and contact pesticide treatments of selected palms. The last live weevil was found in 2012 and in early 2015 the United States Department of Agriculture (USDA) declared the eradication complete. Hoddle estimated eradication at a cost of just over US \$1 million (Hoddle *et al.* 2017).

So why are headlines of ‘Palmageddon’ recurring in the popular press? In the case of the UK it was based on interception of a red palm weevil infesting a European fan palm

purchased from an Essex garden centre. Quoted at some length in the UK *Daily Telegraph*, ‘entomologist’ (sic) Max Barclay, of the Natural History Museum, noted the northwards shift of French populations, and with others identified quarantine failure and expressed a fear for the ornamental palms of the south-west of England. In the USA a new weevil infestation of the South American palm weevil, *Rhynchophorus palmarum* (Fig. 3) is killing palms in southern San Diego County. Popular press headlines predicted the impending demise of all

of southern California’s ornamental, native, and commercial palms.

So what is going on now? We turn again to Mark Hoddle’s group for insights. The South American palm weevil *R. palmarum* that in 2010 had been found associated with dying Canary Islands date palms in north-east Mexico has spread northwards. This pest probably has simply “hop scotched” its way from tropical jungles where it resides naturally through once inhospitable desert regions because of human-planted ornamental Canary Island date palms. These artificial palm ‘oases’ have provided stepping stones for the weevil to spread vast distances. Following initial detection in Tijuana, by the California Department of Food and Agriculture (CDFA) spread into urban areas in San Diego County on the US side of the border was expected. Again using a network of bucket traps primed with fruit and commercially available pheromone for *R. palmarum*, adults were found at distances of 3 miles north of the border. Given the known ability of adult weevils to fly tens of miles in day, the threat to southern California was evident, but in 2013 funds were withdrawn during one of the state’s frequent budget ‘crises’. In 2016, however, survey of northern Tijuana by Hoddle and his colleague Cristóbal Socha showed many dead palms, some even causing threat of fire by dead crowns falling across powerlines. Furthermore, widespread palm death in southernmost California was becoming evident in San Diego County as far north as Chula Vista just to the south of metropolitan San Diego. The South American palm weevil invasion may be far more serious than that ever posed by the “red palm” weevils from Asia, as this American congener vectors the red ring nematode (RRN), which causes lethal red ring disease in palms. The nematode is not yet in California, but is known from Mexico where invasive populations of *R. palmarum* originated. Curiously, no specialized body structures are required for moving RRN so should this pathogen come into sympatry with other species of *Rhynchophorus* they will likely spread it too.

In the case of *R. palmarum* in California, control would be much less straightforward (and far more expensive) compared to the outbreak isolated to Laguna Beach. Clearly the rapid response team’s intensive and



Fig 4. Mark Hoddle dining on commercially reared larvae of red palm weevil, Thailand.



Fig 5. Removal of a deceased Canary Island date palm tree (*Phoenix canariensis*), California.

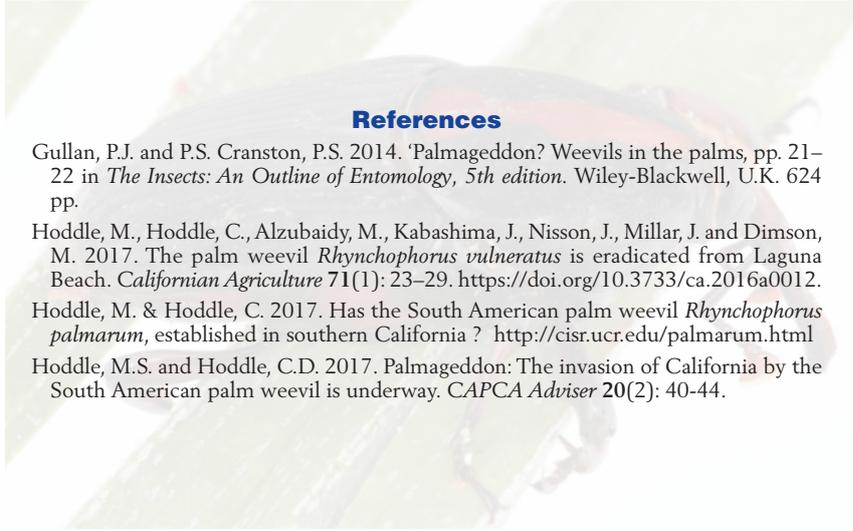
multi-pronged attack in Laguna Beach caught the *R. vulneratus* incursion in time, and further introductions of this pest seem unlikely. Indeed there is a suggestion that the Laguna outbreak may have originated in an illegal importation of live larvae as a 'bushmeat' from Southeast Asia where it is a delicacy (seen in Fig. 4 dined upon by Mark Hoddle). In contrast, the outbreak in San Diego is already widespread and unless control is undertaken in Tijuana at the same time as a programme north of the border, there will be continuing re-invasion of trans-border migrants, 'wall or no wall'.

So what is the scenario for southern California with impending arrival in the palm dominated greater Los Angeles area? Although California's date industry has been valued at US \$65 million and ornamental palm tree sales at \$70 million per year, control (and eradication) seems unlikely. This is not least because initial infection predates visible crown death (by at least 3 months) and concealed spread surely will continue. Dead ornamental trees are very expensive to remove (Fig. 5). Both private citizens and civic services will be faced with costs of many tens of millions of dollars for horticultural excision. Although palms are an integral part of the urban landscape, already proposals are for replacement with less thirsty and more shade-producing urban landscape trees to cope with known issues of water shortage and elevated temperatures of global warming (no denial in California!). Fortunately, thus far at least, the sole Californian native palm, *Washingtonia filifera*, seems unaffected and although a much less common ornamental tree, it may increase in popularity and continue to provide nest sites for hooded orioles.

Whatever happens, it will not be the first time contemporary North American landscapes have lost 'flagship' tree species. Chestnuts declined from 3–4 billion trees to a few hundreds in the last century due to blight caused mainly by a pathogenic fungus (*Cryphonectria parasitica*), and all species of ash are susceptible to die-off from the recently invasive Asian emerald ash borer (*Agilus planipennis*, Buprestidae). Urban entomologists will continue to be in demand studying the consequences of inadequate quarantine inspection in a careless horticultural trade.

Meanwhile *R. ferrugineus*, the red palm weevil, continues its inexorable spread across the globe, with serious consequences arising from killing a range of economic palms. Even isolated date palms at remote oases in the Middle East and North Africa, oil palms in plantations and coconuts on Pacific islands are infested. Not only are the adult weevils flighted but also human-induced spread is hastened by the international trade in live, but weevil-infested, palms for landscaping. In combination with predation by the coconut hispine beetle, *Brontispa longissima* (Chrysomelidae) and the coconut rhinoceros beetle, *Oryctes rhinoceros* (Scarabaeidae), coconuts are in serious trouble throughout the Pacific. Ignorance of entomology by horticulturalists and arborists and reticence of governments to fund research and control is indeed costly.

Thanks to Mark Hoddle (University of California Riverside) for discussions, the Center for Invasive Species Research for use of their photographs, and to Karina McInnes for her line drawing.



References

Gullan, P.J. and P.S. Cranston, P.S. 2014. 'Palmageddon? Weevils in the palms, pp. 21–22 in *The Insects: An Outline of Entomology, 5th edition*. Wiley-Blackwell, U.K. 624 pp.

Hoddle, M., Hoddle, C., Alzubaidy, M., Kabashima, J., Nisson, J., Millar, J. and Dimson, M. 2017. The palm weevil *Rhynchophorus vulneratus* is eradicated from Laguna Beach. *Californian Agriculture* 71(1): 23–29. <https://doi.org/10.3733/ca.2016a0012>.

Hoddle, M. & Hoddle, C. 2017. Has the South American palm weevil *Rhynchophorus palmarum*, established in southern California? <http://cisr.ucr.edu/palmarum.html>

Hoddle, M.S. and Hoddle, C.D. 2017. Palmageddon: The invasion of California by the South American palm weevil is underway. *CAPCA Adviser* 20(2): 40-44.



Society News

Council Matters

The first meeting of the new Council was held on the first Wednesday of October and chaired by the President, Prof. Mike Hassell. The President duly welcomed Dr Alan Watt as a new Trustee. Prof. Mary Cameron, Dr Sarah Beynon and Ms Fran Sconce accepted the positions of Vice President for the forthcoming session, for which the President expressed his thanks. The President further advised that Prof. Chris Thomas from the University of York had been elected as President-Elect.

Dr Tilley, as Deputy Chief Executive, gave an overview of the York Insect Festival held on Sunday 2nd July at York Museum Gardens and Hospitium. Despite the non-delivery of some merchandise due to a cyber attack on TNT, the festival went well, with over 1,500 members of the public attending. Dr Tilley explained that following the success of the festival in York, the Insect Festival had expanded to another event held in Bristol Museum and Art Gallery on 23rd September 2017. On this occasion 1,800 members of the public turned up. The nearby nature reserve served as an excellent site for 'bug hunts' and the festival was preceded by a talk and flea circus by Dr Tim Cockerill on the Friday night. Dr Tilley thanked the staff at Bristol Museum for

facilitating the festival and explained that they were keen to repeat the event in two years' time. Dr Tilley also mentioned the visit by some members of Council to Daneway Banks nature reserve during the summer. The President said that he thoroughly enjoyed the tour of the reserve, despite not seeing any adult Large Blue butterflies and thanked Prof. Jeremy Thomas for showing them around.

Ms Kirsty Whiteford, as Deputy Registrar, reported that Ento'17 had been a very successful meeting despite comparatively low numbers, which was probably due to a similar meeting in Uppsala at the same time. All the Council members who attended said that they had thoroughly enjoyed the meeting and its venue. The President commented that there was a certain symmetry as Dr Gordon Port had convened the first Ento'97 meeting in Newcastle 20 years previously. Ms Whiteford also gave an update on progress with Ento'18. All arrangements are in hand and Dr Oxbrough had produced a comprehensive information booklet for dissemination at Ento'17. The meeting programme is largely confirmed with details available on the Society's website.

The Registrar reported that the Marsh Christian Trust had generously agreed to support the Westwood

Award with an annual prize of £1,000. Some discussion ensued around broadening the scope of the award as it would now be annual rather than biennial. The main considerations were to expand beyond a specific monograph to an 'outstanding taxonomic work'; however, the scope will be reviewed as part of the relaunch process.

The Registrar provided an overview of the current situation with the Gardens of the Rose, as the Royal National Rose Society (RNRS) had very sadly gone into administration. The Society owns the land on which the Gardens of the Rose are set, which was leased back to the RNRS. The Society also has a pre-emption agreement with the RNRS for certain plots adjacent to the Mansion House and Gardens of the Rose. The Society's solicitor, Mr Willans, has been in ongoing contact with the RNRS administrators on these matters and much remains to be resolved. At the present time, the Society can take no action with respect to the Gardens of the Rose until the site is cleared by the administrators and a suitable point of access from the Society's premises can be created, which may depend on decisions regarding the pre-emption plots. The President thanked the Registrar and Mr Willans for their adroit handling of a difficult situation.

Conference Participant Fund Grant Report

Victoria J. Burton ^{1,2}

¹ Science and Solutions for a Changing Planet DTP, and the Department of Life Sciences, Imperial College London, UK

² Department of Life Sciences, The Natural History Museum, London, UK

Workshop: From micro to macro - methods to investigate soil biodiversity at the macroecological scale

This Conference Participant Fund Grant was used to fund travel (£89.94), three nights' accommodation (£159) and a contribution towards meals for a Soil Macroecology Workshop at Queen's University, Belfast, 20th-21st November 2017. Without this grant I would have found it very difficult to attend the workshop as it was announced after the

research training support grant (RTSG) associated with my PhD studentship had already been spent.

Macroecology seeks to understand ecology through the properties of the whole – examining ecological patterns at large spatial and temporal scales. In contrast, soil ecology has generally been studied at small spatial and temporal

scales and seeks to develop an understanding through the study of component parts as a 'bottom-up' approach. However, macroecological methods are increasingly applied to soil ecology (Decaëns, 2010; Orr, 2017) and this workshop will produce a timely review of macroecological methods and how they might be

applied to answer questions in soil ecology.

The workshop brought together national and international researchers from a range of disciplines related to either soil ecology, macroecology or both. Soil biology expertise encompassed a range of soil organisms, from microbes, micro- and macro-arthropods, to earthworms. We reviewed current macroecological practice, challenges in soil ecology, and how macroecological methods might be applied to solve these. After agreeing a structure of the paper we chose to focus on three priorities for research in soil ecology (Eisenhauer et al., 2017). Since my PhD research focuses on the effect of land-use on soil biodiversity (using both macro- and micro-ecological methods) I joined the subgroup looking at the impact of landscape context and

land use change on above-ground to below-ground linkages. Work on this review is ongoing with a final draft planned for April 2018.

A large proportion of soil biodiversity is comprised of insects and other arthropods (Giller, 1996), including ecosystem engineers (e.g. termites, ants) that have profound effects on soil structure and function. My involvement in this workshop supports the Society's aims to promote research in entomology, as the review paper will highlight methods that can further research of soil biotas. I am grateful to the Society for enabling me to attend this workshop, which was a great networking opportunity and continues to be a useful experience of a working group in addition to potentially adding to my publication record.

References

- Decaëns, T. (2010). Macroecological patterns in soil communities. *Global Ecology and Biogeography*, 19(3), 287–302. <http://doi.org/10.1111/j.1466-8238.2009.00517.x>
- Eisenhauer, N., Antunes, P. M., Bennett, A. E., Birkhofer, K., Bissett, A., Bowker, M. A., ... Powell, J. R. (2017). Priorities for research in soil ecology. *Pedobiologia*, 63(May), 1–7. <http://doi.org/10.1016/j.pedobi.2017.05.003>
- Giller, P. (1996). The diversity of soil communities, the “poor man’s tropical rainforest”. *Biodiversity & Conservation*, 168(5), 135–168.
- Orr, C. (2017). Detecting macroecological patterns in bacterial communities across independent studies of global soils. *Nature Microbiology*. <http://doi.org/10.1038/s41564-017-0062-x>

Entomology positively buzzing on Open Farm Sunday

Jennifer Banfield-Zanin

Entomology Project Leader, Stockbridge Technology Centre
jen.banfield-zanin@stc-nyorks.co.uk

On a blustery and overcast – but mercifully dry – mid-June morning, Stockbridge Technology Centre (STC) opened its parking barriers to the general public for the day and took part in the nationwide Open Farm Sunday 2017 campaign. Open Farm Sunday (managed by LEAF) is an annual day on which the farming industry opens its doors, welcoming young and old on-site to learn about what it means to be a farmer. Each farm is unique, and puts on different events that enable the public to discover the range of goods and services, and the types of work, that go into producing food and managing the nation’s countryside.

STC is a small horticultural research company and education charity nestled near Cawood in North Yorkshire. They have a well-established educational programme targeted towards food production already running, though it had a rather limited entomological content – not acceptable to the Entomology Team of two, both committed Fellows of the RES! Thanks to a RES Outreach Fund (ORF) grant award, they have been able to buy a number of materials to expand their capabilities, including sweep nets and



A particularly photogenic visitor putting the new equipment through its paces.



Left: Children helping to plant more Tansy and other insect-friendly plants; Right: Taking a look at the Tansy beetles in the existing Tansy patch.

basic identification keys. These were all put to the test as part of the entomology-focused activities at the STC Open Farm Sunday.

A plethora of invertebrate-based activities were run on the day and proved very popular with the visiting public. STC has several beehives, and these were put on display with our glasshouse manager (and resident beekeeper) enthusing the kiddies with their role in pollination. A long-suffering Ento-spouse was conscripted for face-painting and insect mask-making. STC is a Tansy beetle ark site, and children were put to work helping plant up an expanded area with both Tansy plants and other insect-friendly

plants for both the beetles and other invertebrates to enjoy, complete with the construction of a rather impressive minibeast mansion!

A sweep-netting area and ID area was put right next to entrance of the site with the materials purchased with the ORF grant. This activity turned out to be a sweeping success! All ages were drawn in, particularly while waiting for a tractor ride tour of the farm. There was, at worst, a consistent steady stream of children, parents and grandparents testing their sweep-netting and microscopy skills (at lunchtime), and normally a veritable swarm of people sweeping through the margins and surrounding the

microscopes set up for the public's use! The display of different types of insect pests (including an unusually bold vine weevil) and beneficials was also well-visited, with lots of gardeners of all ages keen to learn about invertebrate roles in the environment, and different ways to encourage them into their outdoor spaces.

All in all, a very successful, if tiring, day of entomology outreach and education! Thank you to the Royal Entomological Society for the kind ORF grant award that helped us make the day so interesting for the visitors, and will contribute to an expanded entomological outreach capacity for STC in the future.



Left: Visitors of all ages could try their hand at sweep-netting; Right: Sweep-net contents were brought to the ID Table, where keys and equipment were available for visitors to try and identify their catch.

Report on use of an Outreach Fund Award to study Auchenorrhyncha from Kibale, Uganda

Alvin Helden

Department of Life Sciences, Anglia Ruskin University, Cambridge CB1 1PT

Award £500

I used the award to part-fund the costs of carrying out my first year of insect collection for my present project, *Auchenorrhyncha (leafhoppers and relatives) of Kibale: initial species list, host plant associations and mouthpart morphology*. Specifically, the money went towards the administrative costs associated with applying for research permits and fees, specimen collection fees and export permits.

I travelled to Uganda, as planned in August 2017, spending 10 nights at Makerere University Biological Field Station (MUBFS). During my time there, I focused on collecting Auchenorrhyncha attracted to the moth trap (sheet) that was running each night. I also carried out some initial collecting using tree-beating, with a focus on the small tree species in the genus *Erythrococca*, and sweep netting. However, due to my responsibilities on the field course at the time, the non-moth trap sampling was limited this year. I hope in 2018 to travel a few days in advance of my students to enable some more intensive sampling of this nature.

In total, I photographed and collected approximately 240 individuals and am now working through mounting the specimens, and making and photographing genitalia preparations. I am also working to gather as many identification references as possible, to aid later species determinations. A selection of photographs taken in 2017 can be seen in Figure 1.

My plan for the future is to continue to collect specimens during and prior to the 2018 and 2019 field trips. Then to process all male specimens in order to produce an initial species list for Kibale by 2022, together with an accompanying series of photographs.

I would like to thank the Royal Entomological Society for supporting my work with an Outreach Fund Award during 2017.

Figure 1. Examples of Auchenorrhyncha sampled in Kibale National Park, Uganda in 2017.



The Royal Entomological Society

MSc Scholars 2017

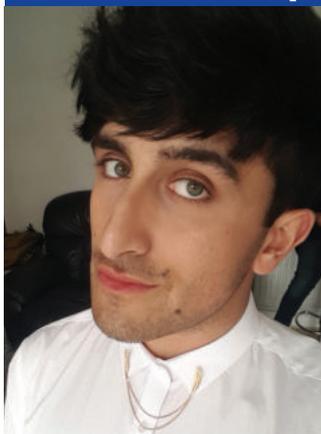
Simon Leather

Professor of Entomology, Harper Adams University

The Royal Entomological Society has for many years provided scholarships to aid aspiring entomologists wishing to study the MSc in Entomology, first at Silwood Park and since 2012, at Harper Adams University. Thanks to their generosity, the number of students applying to the course, and taking up a place on the course, has been increasing year on year. We are incredibly grateful to the Royal Entomological Society for their support and it is an indisputable fact that the availability of these scholarships has helped swell the numbers of entomologists graduating in the UK. We had an incredibly tough time deciding who to award the scholarships to and after much soul-searching picked the following from a very competitive field.

Here they are in their own words.

Aqib Ali



My fascination with insects and other terrestrial arthropods began at a very young age. It started with watching caterpillars in spider webs and the events which followed, and upturning rocks and watching the critters run off and hide for cover. My passion for entomology developed as I progressed through my undergraduate Zoology course at the University of Derby,

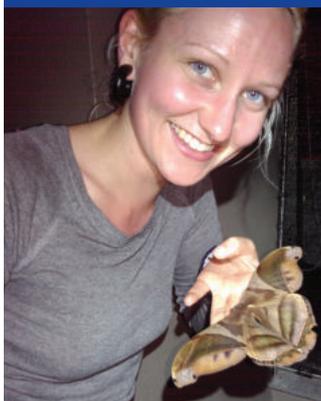
through modules like Applied Entomology. I fed this passion further by volunteering for several entomological positions, such as a pest management assistant for the entomology collections at Derby Museum and as a surveyor for the Butterfly Conservation Trust. I would now like to delve even deeper into this subject, to improve upon my existing knowledge, and to explore the many areas which I have not yet touched upon.

Insect behaviour is a topic which I enjoyed very much through my undergraduate studies. For my dissertation, I researched how relative mandible size affects the outcome of aggressive interactions between males in the cricket species *Platygyllus primiformis*. There is relatively little research in this area on Orthoptera compared to, for example, Coleoptera. I have started writing the manuscript to publish this study with my supervisor Professor Karim Vahed and

associate lecturer David Gee. The “Insect Physiology and Behaviour” module appeals to me because observing how insects behave and how they are so well adapted to their environment enthral me; and it would greatly add to what I learnt during my BSc studies. The “Ecological Entomology” module also interests me. Insect conservation is of great importance now, more than ever. With most of the funding being directed towards conserving charismatic megafauna, insects continue to suffer due to a range of anthropogenic factors. This module would provide me with a greater understanding of the interactions between insects, other organisms and the environment; and I believe this is essential for working towards conserving insect species for the health of our planet. In addition, the “Diversity and Evolution of Insects” module appeals to me because the evolutionary history of insects intrigues me greatly. This module would allow me to develop vital practical skills such as insect curation. I have little experience with this; therefore doing this module would benefit me immensely. However, I know I will enjoy all the modules being offered and I look forward to them helping me develop my ideas for the independent research project.

I would like to express my utmost gratitude to the Royal Entomological Society for awarding me this prestigious scholarship. Without financial aid, I would have struggled to accumulate the necessary resources to partake in this amazing opportunity. Free of any preoccupations, I look forward to progressing through this fantastic course and finding an area I would like to specialise in. All the while equipping myself with invaluable skills and experiences to go into further postgraduate study and to establish a career within the field of entomology.

Brinna Barlow



I would like to give thanks to the Royal Entomological Society for supporting my Masters studies with their generous bursary of £4,000.

I have elected to study Entomology because my career goal is to be a field entomologist working either on social insects or in the biocontrol sector. Undertaking a Masters in

Entomology may help me choose the trajectory of my career. It will also increase my chances of being selected for further study beyond the Masters itself. I have been unsuccessful in applications for PhDs and I believe that the ento-specific skills and knowledge attained during this Masters course will make me a more competitive candidate for Doctoral study.

“Biology and Taxonomy of Insects” and “Commercial and Practical Biological Control” are two modules that have particularly caught my attention. Taxonomy was not taught as part of my undergraduate degree, so I have limited experience in this practise. Taxonomy skills are invaluable to a field biologist and it interests me hugely. Biological control, as I have already mentioned, is a subject I may wish to study beyond this Masters and turn into a career. Of the PhDs I

have looked into, many centre on use of parasitoids as agents of biocontrol. Studying this module may help me decide if I wish to work in this field later on.

Since graduating from university I have regularly taken field work positions which are voluntary or low-paid in order to gain experience working as an entomologist. This has prevented me from building up significant savings. Before being awarded this bursary I was concerned about having to take out an extra loan on top of my government postgraduate loan. This may have forced me to take employment unrelated to entomology after this degree in order to pay back a loan with high interest rates. In being awarded this bursary, I now have every confidence in my budgeting skills that I can

make my postgraduate loan and my current savings work for me for the year. Without the burden of an extra loan accumulating interest I will be able to take up Doctoral study or lower paid jobs that will develop my career immediately following graduation from Harper Adams.

I am grateful to the Royal Entomological Society for taking a huge weight of worry from me. By gaining this bursary I feel welcomed with open arms into a field I adore. I will show my gratitude by active participation in this course, by making the most of my return to university, and by hopefully excelling in a career as an entomologist.

Thank you for your support.

Dan Gilbert



I've been incredibly passionate about Entomology since the age of seven, forcing my grandparents to keep jam jars to collect specimens in their gardens to take back into the house and attempt to identify (be it to a basic level) the animal I had collected. This soon grew into a much more scientific lust, moving towards taxonomy and identification down to a family/species level by the time I had finished GCSE's.

Insects have always amazed me; these small and certainly underrated animals make the world go round; be it pollination, prey for larger taxa or pushing plant evolution. Insects have a phenomenal impact upon the planet; however there is a huge shortage of Entomologists to study and to understand one of the most powerful animal groups on the planet. It baffles me and I certainly would like to contribute to this field, and because of this scholarship I hopefully can.

The lack of Entomologists also leads to the lack of academic routes into the field. After studying Zoology at the University of Reading and producing a thesis on Maltese Mantodean species, their ecology and colour morphology with many thanks to Dr Paul Hatcher, I can now continue

my studies at Harper Adams University with their MSc program.

I was attracted to study MSc Entomology at Harper Adams University for several reasons; Professor Simon Leather's prestige in entomology would certainly aid my future studies and possible employment opportunities with his connections to the Natural History Museum and the Royal Entomological Society. The modular system incorporates a large amount of my interests; I have a large interest in the evolution of insects and their origins largely thanks to my marine background of aquarist work at Bristol and Malta National Aquarium. Reading a large amount into *Devonohexapodus* and Branchiopoda. I have always been extremely interested in the Isopteran/Mantodean/Blattodean lineages and their evolution, the early evolution of *Raphidiomimula burmitica* and early mantodean evolution. The practical side of this module is most fitting to gain more experience in identifying insects, under microscopes and the use of keys.

I have funded my further education thus far and have collected a large sum of debt already. I have parents with limited means and they have tried as hard as possible to support me this far. This scholarship has not only helped me and my parents financially, but has actually allowed me to do this course as I wouldn't be able to fund it without the scholarship. Not only myself, but my parents and family are incredibly grateful to the Royal Entomological Society for this scholarship and hope it aides me into future study and work alongside the Society, its members and admirers.

Megan Lewis



If someone had asked me when I was a child what I thought my future would hold, an entomology career, or any career involving small insects for that matter, would probably not have been my first response. I would run half a mile from something as small as a thunder fly and struggle to remain in the same room as any eight-legged creature. So why is it that I want to study entomology?

The first time the idea of becoming an entomologist had occurred to me was in 2015 during a placement year in Pembrokeshire. I was previously under the impression that entomology would be impossible for me with little chance of remembering the multitudes of scientific names. It was only when I was introduced to Dr Sarah Beynon that my perspective changed and the entomological spark was ignited. Soon after, whilst working on my Honours Research project investigating agricultural grazing effects on dung beetles, I soon realised that it was possible. Studying these small creatures for my dissertation and realising that they weren't only a thing of Africa and elephant dung only strengthened my interest. It highlighted to me just how much I enjoyed hours of field work and long hauls hunched in a laboratory during identification stages, where yes, surprise, I successfully managed to remember some scientific names. This little

introduction to entomology has inspired me to discover more of this topic in which I have yet to properly venture.

Whilst I only have a small amount of experience, I believe this allows me to thoroughly look forward to the knowledge I will gain from each module and how this may help in future careers. Whether I become a ranger using entomology to a land management advantage, or a research role working with biological controls to improve agricultural effects on the environment. The 'Biology and Taxonomy of Insects', 'Diversity and Evolution of Insects' and the 'Ecological Entomology' modules are some that I'm interested in, as I believe they will give me a solid foundation on which to build my knowledge.

The award of this scholarship will be of great financial assistance to me in terms of reaching my goal of grasping entomology and sharing it with others. It will help greatly

towards my course deposit reducing financial concerns throughout the year. I believe it will allow me to learn about entomology in the wider environment whilst meeting likeminded people within this community at conferences and events. It will enable me to focus on enhancing my studies through further hands-on experience opportunities, such as volunteering at places like Dr. Beynon's Bug Farm or the Natural History Museum and attending in-depth courses on specific genera or families with the potential to eliminate the travel and accommodation costs needed for such activities. I am extremely grateful for the receipt of the Royal Entomology Society bursary and I am thankful for this opportunity which has further increased my excitement for what the future may hold whilst discovering the world of entomology.

Warren Minns



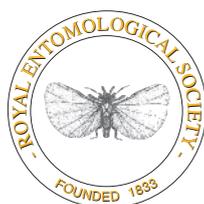
Since an early age, I have been fascinated with animals. The comparative ease of viewing and collecting invertebrates compared to higher animals, furthered my intrigue into the microcosm of the 'tangled bank' first proposed by Darwin... where each organism has its own ecological niche and the interactions between predators and prey and

parasitoids and hosts, along with the specific environmental conditions, determine the makeup of subsequent generations. This, combined with the incredible diversity and life histories of insects, has kept me captivated ever since. Throughout my BSc in Biology, whenever tasked with assignments, from Behavioural Ecology to Conservation, I tended to use insects as my examples. This amplified my knowledge on remarkable organisms such as the Frigate Island giant tenebrionid (*Polposipus herculeanus*) and the rhinoceros stomach botfly (*Gyrostigma rhinocerontis*). My dissertation was similarly geared towards insects, studying maternal effects and parental care in burying beetles (*Nicrophorus vespilloides*). The result of this is that I see my PhD and career being insect focused.

I have a particular interest in biocontrol, with an emphasis on the utilisation and inhibition of hyperparasitoids in the control of pest species. For this reason, the modules 'Commercial and Practical Biological Control' along with 'Pesticide Technology' are of particular interest to me. I look forward to learning about 'useful' Hymenoptera that are parasitoids of Lepidopterans and Pseudoscorpiones in the control of varroa mites within bee colonies. The knowledge garnered during my MSc on such species along with pesticide technology, will, I'm sure, be invaluable throughout a future career in biocontrol.

The receipt of the scholarship will enable me to invest in my own personal equipment, with an emphasis on sweep nets, aspirators, pinning and preservation materials. I would also like to purchase a microscope and camera to bring the beauty of the insect world to a wider audience. I would also like to be able to procure my own identification keys with a focus on the Braconidae, Ichneumonidae and Chalcidoidea. This will greatly improve my knowledge, by allowing for significant amounts of research in my own time away from the university. All of these purchases will enable me to become a more accomplished scientist and a more valuable asset to both the scientific community and agricultural industry.

I am incredibly thankful and privileged to have been awarded a scholarship from the Royal Entomological Society, the receipt of which will benefit me markedly in the pursuit of my goals.



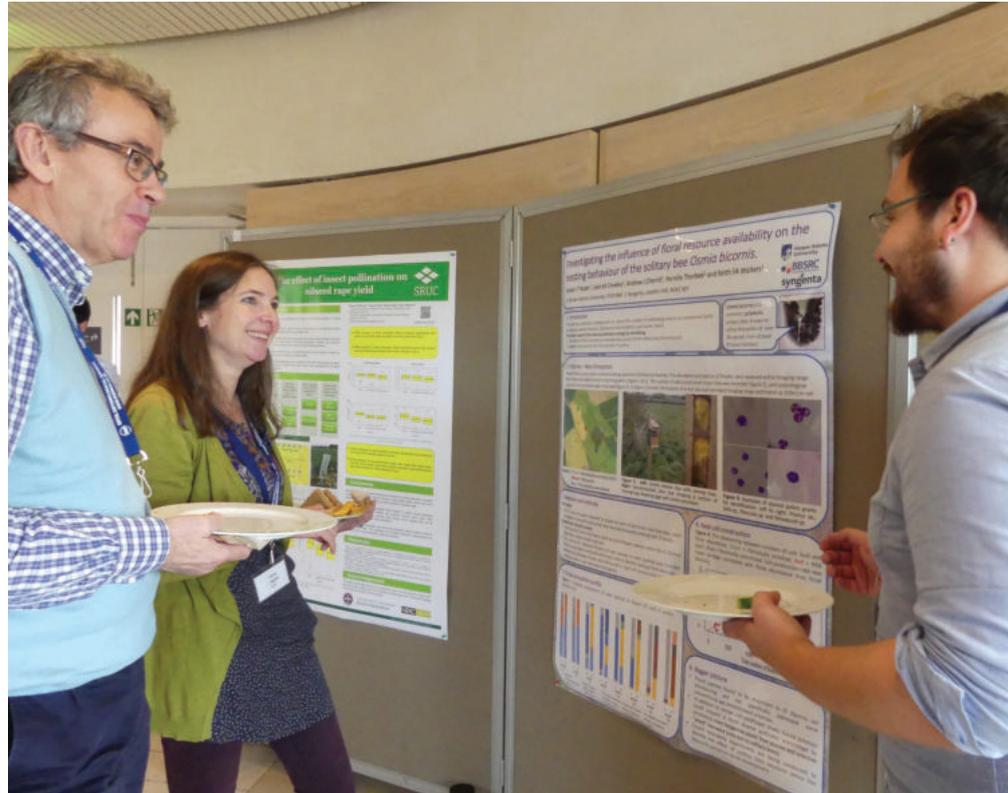
Insect Pollinator Special Interest Group Meeting National Museum Of Scotland, Edinburgh

24th October 2017

Richard Harrington

Pollination is a hot topic. So much so, that an assessment of the state of pollinators, pollination and related food production is a key programme of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), a body with membership from 127 governments. Adam Vanbergen (CEH) is a lead author of the assessment and was the meeting's keynote speaker. He outlined the structure and function of the IPBES and its pollination assessment programme, looking particularly at possible drivers of decline (including land-use change, climate change, intensification of agriculture, pesticides, GM crops, pests and pathogens, invasive species and interactions between these factors), risks from each driver and possible responses. Details can be found at www.ipbes.net/deliverables/3a-pollination.

After such a wide-ranging talk, Jess Napp's (University of Exeter) talk specifically on courgettes in the UK was quite a contrast. Courgettes offer huge amounts of nectar and pollen but 56% of the crop is able to set without pollination (parthenocarpy). Nonetheless there is a 39% yield increase with pollination and the value of pollinators is estimated at £166 per hectare. Jess raised the question as to whether the need for pollinators could be reduced by breeding parthenocarpy in some crops, seedlessness being an added advantage. In a similar vein, a poster from Stace Fairhurst (University of Edinburgh) provided data supporting previous suggestions that pollinators can boost oilseed rape yields even though the crop is capable of self-pollination. This was backed up by Fabrizia Ratto (University of Southampton), who presented a "Toolkit for Ecosystem Services Site-based Assessment" (TESSA), offering three methods to assess the value of pollination, each method being suited to a different level of technical skill and resource availability. The "Red method" was desk-based and gave least confidence. The "Amber method" required field visits and was



more reliable. The “Green method” involved exclusion experiments and was the most reliable. The protocols were used on the same site in an oilseed rape crop. The Red method estimated pollinator services to be worth £88 per hectare, the Amber method £92 and the Green method £167.

Two talks looked at potential methods for attracting and retaining pollinators in crops. Sandrine Chaillout (Rothamsted) is identifying and characterising floral volatiles of borage and red clover as potential bumblebee attractants, with a view to using them to draw bees into a variety of crops. Emma Joslin (University of Southampton) is examining the potential of lavender and thyme to enhance pollination in apple orchards through sustaining pollinator communities. A poster from Louise Hutchinson (University of Reading) showed a greater abundance of bees in an urban wildflower meadow than in adjacent unsown amenity grassland. Not surprising, but a demonstration of the potential value of wildflower areas in an urban environment.

Three posters involved *Osmia* bees. Nick Howe (University of Birmingham) considered the potential of the Red Mason Bee (*Osmia bicornis*) as a commercial pollinator, provided its dormancy could be broken when required. He showed how hexane, methoprene and temperature might be manipulated to achieve this. The same species was the subject of Jordan Ryder's (Harper Adams University) work. His field study in support of the National Pollinator Strategy found a preference for *Ranunculus* and *Salix*, neither of which are particularly helped in agri-environment schemes. The impact of floral resources on nesting behaviour was examined and cell construction rate found to be more strongly correlated with floral abundance than with diversity. Katherine Burns (National University of Ireland, Galway) looked at a related and threatened species from Florida, the Blue Calaminta Bee (*Osmia calaminthae*). She found that it requires open areas for foraging and that it may have competitive interactions with honeybees, all useful information in planning conservation strategies.

Peter Orrell (James Hutton Institute) examined the role of arbuscular mycorrhizal fungi (AMF) in pollination of strawberries. AMF are very abundant and form a secondary root system



providing access to water and nutrients. A glasshouse study using commercial hives found that there were fewer pollinator visits to AMF-inoculated plants but that pollinators stayed for longer, resulting in better yields. A social analysis suggested the potential for targeting pollination policies to different groups termed “progressive thinkers”, “knowledge growers” and “profit-centred traditionalists”.

Lorna Cole (SRUC) looked at how pollinators have responded to the EU's compulsory greening measures, under which larger farms must designate 5% of their arable area as Ecological Focus Area (EFA) in order to claim their single farm payment. Nitrogen-fixing crops (peas and beans) were found to offer very little for hoverflies and bumblebees but a clover mix performed well. Different options have different weights and Lorna suggested that weightings should be manipulated in favour of production-related options. Staying with environmental stewardship schemes, Vincent Doublet (University of Edinburgh) asked whether the increase in bee density due to wild flower margins might increase pathogen transmission as a result of increased contact between bees. The work has not yet reached a conclusion, but the potential implications are worrying.

Felipe Guapo (Maynooth University) and Dara Stanley (National University of Ireland, Galway) ventured into the contentious world of neonicotinoids, but from very different perspectives. Felipe looked at the effects of Clothianidin on bumblebee brains and

found a distinct difference in the brain proteome of treated and control bees. He concluded that exposure to field-relevant doses of Clothianidin impair neuronal communication in bumblebee brains. Dara investigated sublethal effects of Thiamethoxam on bumblebee learning, foraging and flower visitation. Exposed bees were slower than control bees (for part of the trial period) at learning an association between an odour and a sucrose reward. Exposed bees foraged for longer and carried less pollen, whilst more found their way home compared to controls.

Richard Comont (University of Worcester/ Bumblebee Conservation Trust) rounded off an excellent day with his description of BeeWalk, a citizen science project aimed at finding out more about the abundance of bees of all species. BeeWalk was set up ten years ago and involves a monthly transect from March to October. Two thousand people are now trained in bee identification and 373 transects were walked in 2016. There are enough data now to contemplate population dynamics studies.

The National Museum of Scotland was a fantastic venue. The view from the South Tower looked straight out at the impressive castle, and the museum staff looked after us extremely well. I'm sure we'll be back. It was a great meeting, and thanks are due to all involved, especially Mike Garratt (University of Reading), SIG Convenor, and Jenni Stockan (James Hutton Institute), the Society's Regional Honorary Secretary for Scotland.

Orthopterists' Special Interest Group Meeting Natural History Museum, London

1st November 2017

Richard Harrington

First a bit of history. The Orthopterists' SIG is not only by far the most regular, having held meetings every autumn since 1980, but also could be considered the prototype for the whole series. "But in 1980 SIGs didn't exist", some longer serving members may protest. Correct. The annual Orthopterists' meetings were initiated by Val Brown, then with Imperial College, the first being held at RES HQ at 41 Queen's Gate. There were three talks, 16 exhibits and more than 50 participants. The event was such a success that it was agreed to continue it, with four London-based organisations hosting it: the RES, the British Museum of Natural History Museum (now the Natural History Museum, NHM), the Centre for Overseas Pest Research (now the Natural Resources Institute, NRI) and the Open University (OU). In addition, the 1991 meeting was held at Queen Mary and Westfield College (QMW) and the 1992 and 1998 meetings at Imperial College and CABI respectively, both at Silwood Park. In 2003, the Orthopterists' Group became one of the RES Special Interest Groups and meetings were held at Queen's Gate until the Society's move in 2007. Since then, all meetings have been at the NHM, organised by Judith Marshall (NHM) and, since 2013, Björn Beckmann (Centre for Ecology and Hydrology, CEH), aided by Ed Baker (NHM). From 1985 until Björn arrived on the scene, David Robinson (OU) organised every meeting. To complete the list of organisers mention should be made of Reg Chapman (1982), Colin Hartley (1985), Richard Nicholl (1991) and Berit Pederson, who helped with the 2003 to 2006 meetings. A feature of the meetings is the après-entente buffet enjoyed by most attendees.

And so to 2017, a meeting with a record attendance of more than 60, thirteen quality talks, some excellent exhibits and, of course, the buffet. On arrival, I was immediately struck by an impressive piece of acoustic detection kit being demonstrated by Andrew Hill and Peter Prince (University of



The Buffet.

Photo by Megan Shersby

Southampton) which, as well as detecting orthopteran stridulation, has a wide range of potential applications including catching poachers through detecting gunshots. Each unit costs only £40 with the likelihood of becoming even cheaper (www.openacousticdevices.info).

The first talk looked at why adult male Desert Locusts (*Schistocerca gregaria*) and Migratory Locusts (*Locusta migratoria*) become bright yellow if crowded. Darron Cullen (University of Leuven, Belgium) is trying to find out why. He discovered, through mate choice experiments, that

females don't care about male colour but that the yellow colour reduces the occurrence of males wasting energy by mounting males. The signal combines with smell in *Schistocerca* and with sound in *Locusta*.

The next five talks were on crickets. Julie Sarmiento-Ponce (University of Cambridge) is studying how age affects the acoustic reaction response of *Gryllus bimaculatus*, finding the strongest response to male stridulation seven to 25 days after the final moult. Aqib Ali (University of Derby) is investigating whether weapon size (head and mandibles) influences fighting success in *Platygyryllus primiformis*. It doesn't. So the question remains what does? Are some individuals inherently more aggressive or, as a delegate asked, does fighting experience lead to more success? Karim Vahed (University of Derby) put the case for the Scaly Cricket (*Pseudomogoplistes vicentae*) being sequenced by the Sanger Institute, which is inviting school children and the public to select five winners from a shortlist. Knowing the genome sequence would help understand whether there is gene flow between the rare and small UK populations and French populations, and whether small populations are losing diversity. Few exopterygotes have been sequenced but the Scaly Cricket faces stiff competition from 41 other animal and plant species. Fernando Montealegre-Zapata (University of Lincoln), in a fascinating talk with magnificent pictures and sound recordings, described techniques for reconstructing the calls of fossil crickets and katydids from wing and scraper morphology. He concluded that high frequency calls pre-date bats by almost 100 million years. The presentation ended with a Jurassic soundscape of orthopterans and dinosaurs. Adam Bent (Anglia Ruskin University) brought acoustics into the 21st century by looking at how anthropogenic noise affects communication responses in *G. bimaculatus*. Traffic noise, in particular, reduces phonotactic ability and hence fitness through reduced mate finding.

A summary of the thermal biology of UK orthopterans was provided by Simon Springate (NRI). He summarised a range of methods ('grab and stab' probes, permanent probes and thermal cameras) to examine pre-flight and in-flight physiological and behavioural thermoregulation, and



Stethophyma grossum Large Marsh Grasshopper

Photo by Dave Browne

presented his findings to date and plans for future research. His investigations included the question of whether species exhibit "behavioural fever", whereby temperature is actively elevated to inhibit pathogen growth. Many species remain to be looked at but, so far, the latter phenomenon has not been observed in UK species.

Poet, childrens' author and orthopterist Tim Gardiner (Environment Agency) described his orthopteran odyssey "Geronimo the grasshopper", in which he blends scientific fact with fiction, aiming to entice the young into entomology. For the already enticed, Luc Willemse (Naturalis Biodiversity Centre, The Netherlands) described a new app for Android phones, "ObsIdentify", aimed at automatic identification of insects in the field from photos. So far the app includes Dutch butterflies, moths and bugs, with orthopterans to be added soon, and a separate version for plants. Megan Shersby (naturalist and writer) described her attempts to entice birders at Birdfair to become interested in orthopterans.

Squelching through New Forest bogs in search of the Large Marsh Grasshopper were Martin Harvey (CEH) and Paul Brock (NHM). We were treated to a summary of a report

completed only 14 hours previously. The survey updates that of Val Brown and Oliver Cheesman conducted in the 1990s. The species is confined to the New Forest and Dorset, but the speakers considered its outlook in the New Forest good. Jacqui Miller (RSPB) described surveys of three Dorset RSPB reserves for the same species. She has developed a standardised monitoring method and aims to advise on-site management to support the species, which requires a combination of high moisture levels and warmth for juvenile development and moulting. It has a limited dispersal ability and is vulnerable to barriers such as roads and rows of trees.

I went home with a great deal of new knowledge and a vital piece of information for my butterfly photography habit, courtesy of David Browne (wildlife photographer), who spoke about his exploits since the 1980s photographing UK orthopterans. I was taking photographs of the meeting using my Panasonic DMC FZ330 bridge camera, and he told me of a macro adaptor, which enables the macro setting of the camera to perform well from a greater distance. I'm sure that everybody else returned (after the buffet) equally pleased with the day. Many thanks to Judith, Björn, Ed, David and all present for a truly excellent meeting.

Insect Farming

The 2nd meeting of the Entomophagy Special Interest Group A joint meeting with the British Ecological Society and ADAS

Peter Smithers

Over the last ten years the potential of insect protein as both animal feed and human food has grown from an interesting idea to an emergent industry. Following the success of the first meeting at Nottingham University in 2016, the RES and ADAS decided to focus the next meeting on the production of insects in the UK. So, in the interest of connecting with as wide a range of interested parties as possible, the second meeting of the Entomophagy SIG was a collaboration with the British Ecological Society and ADAS. The BES had kindly offered the use of their meeting rooms at Darwin House in central London and ADAS had offered logistical support. The meeting was well attended with just over 100 delegates from across the industry.

As chair of the SIG, Peter Smithers welcomed everyone on behalf of the RES, thanked the BES for making the excellent facilities at Darwin House available and Mark Ramsden of ADAS for taking on the lion's share of the organisation. He then offered a brief personal perspective on the development of entomophagy in the UK before handing the chair to Mark Ramsden.

Mark Ramsden then introduced the day, stressing that the focus of the day was to network. He then went on to discuss insects in agriculture with special reference to insects as feed. He posed several questions for later discussion: What lessons can insect farmers learn from other branches of agriculture? Can funding for research be pooled to maximise the finances available? As producers, we need to be involved in establishing industry standards so how can we ensure this happens? How can the industry diversify the species that are farmed? He then introduced the five invited plenary speakers:

Nick Rousseau

from the Woven Network

Nick pointed out that Insects as food have a high profile at the moment and went on to outline the reasons that insects are a viable alternative to

conventional meats, and introduced the concept of insects as a super food. He discussed how insects could become a mainstreamed food with a potentially huge market. There is a good choice of species to farm but black soldier fly seems to be the front runner at the moment. The challenge is to transform waste into protein and black soldier fly appear to be an efficient way to do this.

Another challenge is scale; how to move from small holdings to big business. Feed is another problem; what is available, is it a reliable, economic and sustainable source? A major hurdle was altering public perception. More research into the safety of insects as feed and food is required, though a change in the law relating to feeding insects to livestock was expected very soon. He then invited everyone to join Woven, a network of expertise to support the emerging industry.

Sarah Beynon

from the Bug Farm & Grub Kitchen

Sarah discussed how Grub Kitchen had gone about introducing insects to their menu. Changing consumer attitudes were one of their priorities. Insects as food and feed can be introduced to the public by education via entertainment. If it's fun, a positive outcome is more likely. They experimented with a range of taste and flavour combinations, the food must taste good to be popular. They expected many single visits as people explore the novelty of insects as food, but to their delight there are lots of return customers because the food tastes really good. Grub Kitchen offers different inclusion rates of insect material for customers to try, so customers can try lower rates first then progress to meatier versions. The meals are no more expensive than the average farm cafe and so remain affordable. As Sarah is involved in the media she has noticed a recent shift in attitude with less emphasis on gimmick and more interest in this as a serious topic. Sarah's final point was that if we eat less meat this will allow

farmers to produce smaller herds of livestock thus using less land, which allows for an increase in the area of land available for conservation.

Rachel O'Connor

Associate, Michelmores (Bristol).
Insects in animal feed & the law

In the 21st century farmers are looking to diversify their business and insect farming is being explored by many. In 2007, FAO predicted that poultry production would increase by 85% before 2020. So the poultry industry is looking for a source high quality protein to use as feed as it currently imports soya and fish meal which is not a sustainable source. As a result of the BSE crisis, the use of bone meal in animal feed as supplement has been banned so farmers are searching for alternatives and insect protein appears to be a viable option. 33% of agricultural land is used to farm crops to feed to livestock, so if we use alternative feeds we can we take back some of this land to grow crops for human consumption.

The main barrier in both EU & UK law is the lack of legislation. The EEC is currently waiting for science to inform them on policy regarding rearing, slaughter, processing and food safety. The cornerstone of the current legislation is the protection of human health via the Precautionary Principle – there has to be clear proof that the product offers no threat to human health. In the UK, the main barrier to the use of insects as feed is the prohibition of processed animal products in feed. This legislation is one consequence of the BSE crisis but was not intended to deal with insects. A current exception is for the use of non-ruminant products in aquaculture. Another barrier is the slaughter house provision, which states that all animals must be slaughtered in a recognised slaughter house; a provision that clearly did not have insects in mind.

The European Food Safety Authority (EFSA) are waiting for the results of further research before a full risk assessment regarding the safety of

insects as feed and food can be made. Once this has been completed, EU legislation can be formulated. Brexit will certainly impact the development of legislation dealing with insects as food and feed. Post-Brexit EU laws won't apply, but because of the volume of existing legislation EU law will have to be adopted wholesale and then modified individually over time. As the EU is a large proportion the UK's market, UK law will have to harmonise with EU law, thus UK legislation regarding insects as food and feed will coevolve alongside EU legislation.

Francesca Lotta

Associate, Two Birds (Rome).
Insects as human food

The same legislative problems apply to insects as food for humans as apply to insects as feed (see previous talk). In the UK, no insect species have been approved although the Food Standards Agency (FSA) recognises that several species of insect are currently being sold as food in the UK. The approach to insects as food varies across Europe with some countries banning insects entirely while others allow selected species to be sold.

Authorisation will only apply to approved species, i.e. each species requires separate authorisation. In Belgium, three species have been authorised as novel foods. This requires proof that there is no risk to human health and no nutritional disadvantage. Product labelling must state the presences of any allergens plus cooking and eating instructions and nutritional information must conform with EU law.

Jo Wise

Monkfield Nutrition, Cambridge.
(<http://www.monkfieldnutrition.co.uk/>)

Monkfield were the first UK breeder of crickets and locusts and now produce 4 million insects per week. The main species supplied are: (a) *Acheta domesticus*, which was the core insect for insect farms, but in 2004 the adenovirus wiped out most populations across Europe and then in 2012 it decimated stocks in the USA; (b) *Gryllus bimaculatus* has replaced *A. domesticus* as it is large, has a good growth rate and reproduces well. Another is *Gryllodes sigillatus* which reproduces well but has a slower growth rate; (c) *Locusta migratoria* requires large amounts of grass and

bran and has to be fed on hydroponically-grown wheat in winter; (d) *Schistocerca gregaria* has become more popular as it's a more colourful locust. This species is fed on brassicas and is a voracious feeder. The cost of brassica feed is £0.5 million per year.

Monkfield sell 1 tonne of mealworms per week, but these are imported from eastern Europe, as they can produce them at a lower cost than is possible in the UK. Monkfield also farm small quantities of Morio worm, wax worms and black soldier fly.

The main challenges to producing insects for feed are lack of legislation, and the cost. Monkfield are currently relocating to a purpose-built site which will be more efficient. The principal cost is heating, so a biomass boiler has been installed at the new site. Cooling systems have also been installed as an insurance. Cooling is not often required unless temperatures rise above a critical level, at which point mass fatalities occur. If temperatures fall the only effect is a decline in growth rates but usually there are no fatalities.

Automation will help to lower production costs, but not every part of the process can be automated so its effects will be limited. One of the most expensive resources are the egg boxes used for rearing crickets. Many alternatives have been tried but paper egg boxes have proved to be best. Further research into alternatives would be welcome. The egg boxes are obtained second-hand from poultry farmers to reduce cost, but future legislation may require new ones to be used which would increase costs. Labour is difficult to obtain and Monkfield rely heavily on European labour, so Brexit may have a serious effect on the business. Currently, cricket flour cannot compete with fish and soya as animal feed but black soldier fly may be able to if an economically-viable food source can be found.

Freezing is currently considered the most efficient and humane method of killing insects but research is required to investigate this, and provide either proof that this is so or a viable alternative.

The food conversion rate is currently 1.75 / 1kg, but better yields could be possible.

There were then a series of short presentations from people within the industry.

Marion Peters

Dutch Insect Farmers Association &
The International Insect Centre (IIC).
(<http://www.insectcentre.com/>)

They were concerned about what we will eat in 2025, and so set up the Centre to offer entrepreneurs the opportunity to conduct research on topics related to their business model or for students to undertake research in this area as part of their studies. They have links to developing countries and are working with many entrepreneurs in the businesses. They link student research projects with new players in the business that require help.

Gary Dow

Davidson Animal Feed
(<http://www.davidsonfeeds.co.uk/>)

They recognise that soya and fish meal are increasing in cost. The major cost is transport. When their soya is shipped from south America, the ship is at anchor for two months, then one month to load it, followed by one month to travel, so it's expensive to transport. An alternative protein source closer to home is being sought. Davidson are keen to work with others to eliminate these costs and thus make feed sustainable. If anyone has any ideas please talk to them.

Alexander Lamond

Bug Bake. Insect-based dog treats

There are 8.5 million dogs in the UK, and we spend £400 million on dog treats each year. Dogs are an ideal market as they have a broad range of tastes and have no 'yuck factor' to overcome. For more info go to <https://www.bugbakes.co.uk>.

Shami Radia

Eat Grub (<http://www.eatgrub.co.uk/>)

The company began with pop-up restaurants that were sponsored by Chang beer, then launched an energy bar with The Economist. These bars are now stocked by the retail chains Budgens and Ocado. They are currently exploring new markets.

Archie Murchie

Agrifood and Biosciences Institute,
Northern Ireland.
(<https://www.afbini.gov.uk/>)

Black soldier fly is being widely considered as a species suitable for farming as animal feed. It is a non-native species in Northern Ireland, so

before it could be farmed a pest risk analysis had to be undertaken. It's a sub-tropical species and therefore would have difficulty establishing in a temperate climate. It feeds on decaying organic material so should it become established it would colonise habitats such as dung heaps which have a low conservation value. This and the absence of any known pathogen transmission indicates that black soldier fly poses no threat to livestock, crops or the environment.

Mike Copland

Wyebugs. A biocontrol company

Mike raised the opportunity for insect rearing companies to obtain facilities at the old Wye college site, where there are glass houses and rearing facilities available at low rents and no business rates. More details from: <http://www.wyebugs.co.uk/>.

Chris Palgrave

Veterinary surgeon and senior lecturer in veterinary pathology at University of Surrey

Chris discussed the range of skills available in the veterinary world and how they could be transferable to insect farming. As a practicing vet and a member of the Invertebrate Veterinary Society, he would be happy to work with the industry on aspects of insect health.

Discussion session

A number of issues were raised in the meeting that need to be considered by the insect farming industry. Eight key issues were drawn out and discussed in detail by groups during the afternoon, and each group identified the top priorities that needed addressing. (See Table 1.)

Conclusion

Over the last five years, focus has shifted from the notion of insects as a temporary novelty to a genuine opportunity to diversify our food supply chains. This has been reflected in pending revisions to European and UK legislation, and increasing engagement from current food supply industries. By 2018, insects will be permitted in aquaculture for the first time, and novel food legislation will be ready to assess insects for human consumption. This workshop

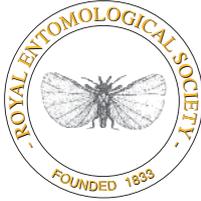
Marketing and Awareness	Raise the profile of insects as food with children, and to farm insects in the UK to ensure low food miles.
Food safety	Establish protocols and documentation for insect production.
Legislation (human consumption)	Create consortia to apply for novel food authorisation.
Legislation (livestock feed)	Begin discussion with government to gain clarity.
Insect farming resources	Maintain network to connect entrepreneurs, experienced insect farmers, and investors.
Economics and technology	Draw together our collective expertise and experience of insect farming and make it available for start-ups. Establish an open innovation approach to involving other such as engineers to assist in building solutions to the challenges of large scale farming of insects.
Insect feed substrate	Improve access to existing research and improve communication across interested parties.
Research and development	Identify the research needs and establish ongoing research themes.

Table 1. Key issues and top priorities generated by the SIG discussion session.

highlighted the need for ongoing research in this area, as there is still much to discover about how best to safely produce insects at a scale sufficient to compete with existing products. Collaboration will be important, and there will be a vital role for the government and NGOs to engage with the innovators and early adopters who aim to lead the UK into this new era of farming diversification.

The results of the discussion and conclusion are taken from an article by Mark Ramsden previously published on the ADAS website and are reproduced here with their permission.

The next meeting of the Entomophagy SIG will be on April 4th at the Royal Agricultural University, Cirencester. Details available from psmithers@plymouth.ac.uk



SCHEDULE OF NEW FELLOWS AND MEMBERS

as at 4th October 2017



New Honorary Fellows

None

New Fellows (1st Announcement)

Ms Samantha Fay Pickles

Upgrade to Fellowship (1st Announcement)

None

New Fellows (2nd Announcement and Election)

Dr Firake Dnyaneshwar Madhukar (as at 13.9.17)

Dr Malaiyappan Raja

Dr Samuel John William

Dr Timothy Cockerill

Dr Casper Nyamukondiwa

Professor Arthur Gary Appel

Dr Mark John Ingraham Paine

Professor Michael Robert John Boots

Upgrade to Fellowship (2nd Announcement and Election)

None

New Members Admitted

Mr Devon Andrew Petrie (as at 13.9.17)

Dr Christopher James Palgrave (as at 13.9.17)

Mr Michael Adrian Holland

Ms Edie Jolley

Dr Rebijith Kayattukandy Balan

New Student Members Admitted

Miss Cintia Cansado-Utrilla

Mr Harrison Lambert

Re-Instatements to Fellowship

Dr Waqas Wakil

Re-Instatements to Membership

None

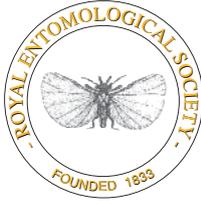
Re-Instatements to Student Membership

None

Deaths

Professor J Pettersson, Hon. Fellow, 2011, Sweden

Dr R W Crosskey, 1951, UK



SCHEDULE OF NEW FELLOWS AND MEMBERS

as at 6th December 2017



New Honorary Fellows

None

New Fellows (1st Announcement)

Dr Krishna Kumar

Upgrade to Fellowship (1st Announcement)

None

New Fellows (2nd Announcement and Election)

Ms Samantha Fay Pickles

Upgrade to Fellowship (2nd Announcement and Election)

None

New Members Admitted

Dr Max Blake

New Student Members Admitted

Miss Veronica Wignall

Mr Charles Griffiths

Miss Amy Withers

Miss Megan Jane Lewis

Mr Eric Dexheimer

Ms Susan Isobel Hammond

Mr Warren James Minns

Miss Kelly Jowett

Miss Laura James

Miss Claire Elizabeth Allison

Ms Brinna Ellen Louisa Barlow

Re-Instatements to Fellowship

None

Re-Instatements to Membership

Dr Assam Gulzar

Re-Instatements to Student Membership

None

Deaths

Dr I W B Nye, 1956, UK

In the last edition of *Antenna* the Schedule of Fellows and Members reported that Professor M.P. Pener had passed away, an announcement that transpires is untrue as Professor Pener is alive and well. The announcement was published in good faith on receiving news of his death from the Hebrew University of Jerusalem.

We wish the Professor continuing good health.

ENTO 18

THE GOOD AND THE BAD AND THE UGLY



Edge Hill University National Science Meeting

Wed 29th - Friday 31st Aug 2018

Exploring the importance of lesser studied insects

Advancement in entomology is frequently driven by a variety of factors beyond scientific exploration and interest, from ease of sampling and identification or the favouring of more 'charismatic microfauna' to difficulties in obtaining resources required for specialised field or laboratory techniques or funding bias. This conference seeks to address this by providing a platform for areas of entomology that are often understudied.

Plenary Speakers

Professor Stefan Scheu – Georg August University Göttingen

The Good – Belowground goodies: Ecology and evolution of soil microarthropods

Professor Lin Field – Rothamsted Research

The Bad – Aphids as vectors of crop diseases

Professor Richard Wall – Bristol University

The Bad – Ticks and tick-borne disease

Dr Jason Dombroskie – Cornell University Insect collection

The Ugly – Yes that's nice...but look at this! Challenges of generating interest in and relevance to the non-charismatic microfauna

Proposed sessions:

- Agriculture and Forest Entomology
- Ecological Entomology
- Insect Conservation and Diversity
- Insect Molecular Biology
- Medical and Veterinary Entomology
- Physiological Entomology
- Systematic Entomology
- Outreach and Citizen Science
- Open Sessions

Submissions on any topic are welcome including more popular areas of entomology!

Further information on registration, and abstract submission can be found at www.royensoc.co.uk. **Meeting convenors:** Dr Anne Oxbrough, anne.oxbrough@edgehill.ac.uk; Dr Clare Strode, clare.strode@edgehill.ac.uk

Book Reviews

A Naturalist's Guide to the Butterflies of India, Pakistan, Nepal, Bhutan, Bangladesh and Sri Lanka

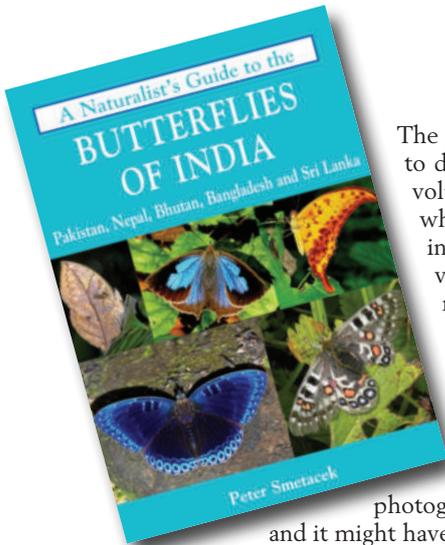
by Peter Smetacek

John Beaufoy Publishing, Oxford

ISBN 978-1-909612-79-2

176pp., size smaller than A5

£9.99



The geographical scope of this book – the whole of the Indian subcontinent – is enormous and to deal comprehensively with the butterflies occurring in the region would take several thick volumes. India alone has approaching 1,400 butterfly species; this guide depicts 279 for the whole region. To prepare a field guide to include the butterflies most likely to be encountered in this vast region is frankly impossible in a small, thin volume. As a guide to enable a casual visitor to identify a reasonable percentage of butterflies seen on a visit to any part of the region, any small book is therefore more-or-less doomed to failure before it gets off the ground.

But that doesn't matter ... and in fact it describes itself as a naturalist's guide, not a field guide. What this professionally-produced little book does do – successfully – is present an overview of the huge diversity of butterflies in a remarkable region which supports habitats from coastal beaches to mountains over 4,000m elevation and from plains and deserts to tropical evergreen, deciduous and montane forest. Inclusion of almost 1,000

photographs necessitates individual pictures being smaller than might be useful for identification, and it might have been better to include fewer pictures in a larger format. But as expected in this digital age, the standard of photography is high, and the compressed text is well written and informative. In fact, there is literally more useful text to be found here than in several well-known large format butterfly books published over the last few decades. It also does include many of the large papilionid butterflies likely to be seen.

Take this book at face value. It is a very nice picture book accurately depicting a good range of the variety of species found to occur across the author's region, offered at a reasonable price.

John Tennent

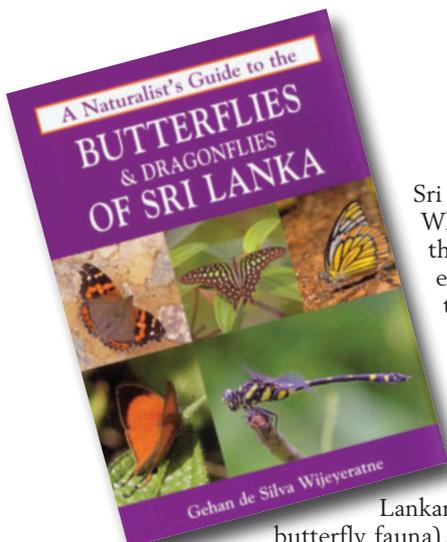
Butterflies and dragonflies of Sri Lanka

by Gehan de Siolva Wijeyeratne

John Beaufoy Publishing, Oxford

176 pp

£9.99



Sri Lanka is one of the top destinations for many people considering a tropical wildlife holiday. While many of those people may concentrate on the fabulous birds and mammals on offer in that country, others (especially those reading these pages) might have an eye for insects, especially the butterflies and dragonflies. A new, profusely-illustrated field guide is now available to 148 species of the butterflies and 78 species of the dragonflies that observant visitors are most likely to encounter on their visit to the island. This book is so compact (18x12.5 cm) that it easily fits into the pocket or backpack and so would not over-encumber even those with only a passing interest in these insects and is at such an affordable price that it should not provoke any second thoughts about purchasing it.

The focus of the first 108 pages of the book is on Sri Lankan butterflies. A short opening section deals briefly with the general life cycles, biology, behaviour and status of the Sri Lankan butterfly species. This is followed by accounts of the 148 species (about 60% of the total butterfly fauna), which the author suggests are most likely to be seen by the casual observer. Each species account comprises one or two good quality photographs of a living specimen in a typical pose, together with a brief résumé of key diagnostic features allowing identification of each sex, typical flight mode, Sri Lankan distribution and larval food plants. A list of all 245 species known from Sri Lanka is provided at the end of the butterfly section and those species covered in the book are highlighted. Hesperids and lycaenids can be particularly difficult to identify, especially in the field, and the attention of users is drawn to this difficulty with some useful tables comparing critical features to aid correct identification. Only 39 of the 83 species of lycaenids and 19 of the 47 species of hesperids are illustrated so it may be possible to identify accurately only the most distinctive species using this book.

The dragonfly section of the book follows the same format as the butterfly part, except notes on habitat replace the food plant entry. As before, about 60% of the total Sri Lankan dragonfly fauna is covered. All but four of the libellulid species are included, which is appropriate as libellulids usually take the least effort to find as they occur, sometimes in large numbers, at open standing waters and large rivers, often in areas impacted by human activities. Less well-covered are the gomphids and platystictids, which are more typical of forest streams, and so are less-likely to be encountered by non-specialist wildlife enthusiasts or casual observers. There is some advice on photographing dragonflies (but not on butterflies), which implies that dragonflies are more likely to be identified from photographs back at the hotel rather than in the field, but the same is probably true of many of the butterflies encountered. I think that using the guide to identify photographs of these insects, rather than for identification of specimens in the field is probably the best way to use this book, especially for observers new to this fauna. This may also reduce the risk of misidentifying species not covered in the book.

The front inside cover includes a useful map showing the main roads and locations of the larger national parks, while the back inside cover has a map showing the top 16 wildlife viewing sites in the country in relation to four broad climatic zones. This may be useful when planning an itinerary.

This is a neat little book, which I will certainly take with me when I visit Sri Lanka, as it serves as an excellent introduction to the identification of the commoner butterflies and dragonflies of that country.

Steve Brooks

Field Guide to Butterflies of The Philippines

by Peter B. Hardy & James M. Lawrence

Siri Scientific Press, 2017; in English.

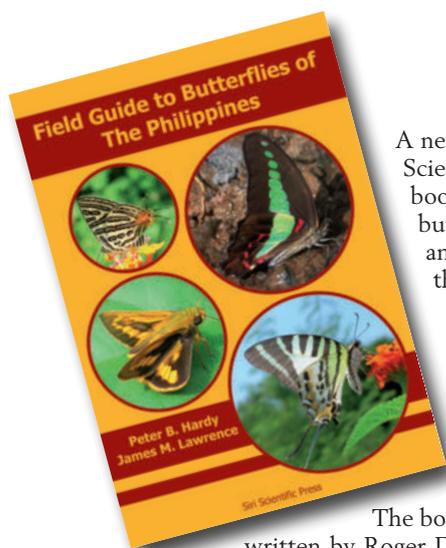
Obtainable from Siri Scientific Press www.siriscientificpress.co.uk

ISBN 978-0-9957496-0-3

448 pages, 1280 colour photographs (157 colour plates),

24 x 16.5 cm. Soft-back.

£45 plus p/p.



A new superb book devoted to the butterflies of the Philippines has just been published by Siri Scientific Press (Manchester), and it is my pleasure to introduce it to the readers of *Antenna*. The book is a unique edition, containing 1,280 colour photographs and documenting all the 947 butterfly species known from the Philippines. Of these photographs, 1,080 were taken in nature and depict live specimens; an additional 176 photos were taken from specimens deposited in the Manchester Museum's Lepidoptera collection.

The book was written by two professional entomologists: Peter B. Hardy, a retired civil servant from Cheshire with a passion for Lepidoptera who is the sole author of *Butterflies of Greater Manchester* and (co)author of some 50 papers on butterfly ecology and diversity, and Dr James M. Lawrence of the University of Stellenbosch in South Africa who is the author of *Field Guide to Butterflies of Seychelles* and some 30 papers devoted to ecology and conservation of invertebrates. The work is primarily based on 13 research trips to the Philippines undertaken by Peter Hardy.

The book is arranged in the typical way for a natural history field-guide and consists of a 'Foreword' written by Roger Dennis (p. 4), 'Acknowledgements' (p. 6–7), 'Introduction' (p. 9–19), section on 'Butterfly Biology' containing brief general information about butterfly taxonomy, life cycles and intraspecific variation (p. 20–27), 'Species Accounts' (p. 28–267), 'References' (p. 265–266), colour 'Plates' (p. 268–424), and 'Index' to species/genus names, including English common names (p. 425–448).

The main sections of the book are the 'Species Accounts' and 'Plates'. Each species account is numbered and contains a reference to a colour plate, in which all individual photographs are also numbered by the same number as that of the species account. Such cross-referencing makes a very easy search for the information relating to each image. Species accounts are standardized and include the following sub-sections, depending on available information: Latin and English common names, reference to the figure plate(s), a list of all subspecies included in each name and their distribution across the Philippines, all the recorded/known host plants, and a reference to conservation status of the listed species (common, local, rare, etc.). In my opinion, this kind of 'information pack' is exactly what is needed in a field guide that is meant to be used in the field. However, I feel it would also be useful to include in each species account references to further available information about the species. This would generate a much more comprehensive reference list and, more importantly, one specific to the Philippines.

Overall, the book makes a very good impression with regard to its carefully selected content and quality, being printed on high grade glossy paper, and I wish to congratulate the authors and publisher on the production of an excellent guide. The book constitutes a reliable visual guide to butterflies of the Philippines and will be useful both for beginners and for experienced entomologists. Moreover, it is safe to assume that the audience of this richly illustrated book will potentially be very broad and include not only entomologists, but also wildlife photographers and interested eco-tourists. Indeed, the book is good value for money. I highly recommend this book to both amateur and professional entomologists alike.

Dmitri V. Logunov
Curator of Arthropods
The Manchester Museum

Solitary Bees

by Ted Benton

Naturalists' Handbooks 33

Pelagic Publishing

202 pages

£19.99



After a gap of some hundred years since the publication of Edward Saunders' *Hymenoptera Aculeata* in 1896, broken by Edward Steps' 1932 general introduction, there is now a relative glut of books about bees. Many of these have concerned themselves with the bumblebees, but now there is a change of emphasis towards the 'other bees' – termed here 'solitary bees' – a not exactly true description, but, as explained in the introductory chapter, a good enough working one. The author is similarly explicit where he has made working 'short-cuts' elsewhere to help his argument flow.

Benton's strength throughout is in good quality personal observation, related to sound scientific evidence concerning behaviour and autecology. There are few authors so adept at gripping the attention through some quite difficult patterns of thought. The chapters on *Bee lives*; *Cuckoos in the nest* and *Bees and flowers* give anyone something to work at – including source references. The book is worth its modest cost for these chapters alone.

The Conservation of Solitary Bees is clearly a personal viewpoint, but a fairly broad one and a good introduction, certainly better than many that are popularly shouted about by those who are more interested in merely gaining our attention than giving serious consideration to the complex issues involved.

He is on less sure ground where he moves into taxonomic description and, unfortunately, it shows. The listing of the characters for the genera, when he has a perfectly workable key to genera at the end, is at best fairly useless and, coming where it does early in the book, runs the risk of making an impenetrable block to further reading, which is a pity. There are also some errors of fact: all female bees have stings – that is a defining feature of the aculeates as a group – and it is the old queen honeybee who leaves with a swarm, not the new one. The standard of editing throughout is not always consistent with some paragraphs re-appearing almost verbatim – it is very easy to do this when writing at reasonable length about something fairly complex.

The book closes, apart from the keys to genera, with seven pages of *Approaches to practical work* – this is 'Benton the observer', a fitting, if perhaps easily lost, summary of what Ted is particularly good at – read it!

Mike Edwards

The Asian hornet – threats, biology and expansion

by Stephen J Martin

Published by the International Bee Research Association / Northern Bee Books

September 2017. Paperback: 104 pp.

ISBN 978-0-86098-281-4



Whilst we wait in dreaded anticipation for the Asian Hornet to overwhelm us, just as we waited for *Varroa* that never seemed to arrive. The inevitability of this hornet being amongst us that is preceded with a bevy of horror stories.

The Asian Hornet is a new invasive to the UK and this book is perfectly timed for the beekeeping market that is bracing itself for the onslaught. The author is Professor Stephen Martin of the University of Salford who has specialised in honeybees and hornets throughout much of the world, particularly Japan where he worked for seven years, so he knows a great deal about the Giant Asian hornet and hornets in general. The book is jointly published by The International Bee Research Association (IBRA) and Northern Bee Books.

The book is an introduction to wasps and hornets, where at the present time there is no other book on the subject. There is a lot in the book about hornet species in general. Hornet biology is explained and shown to be significantly different from honeybee biology. So what we learn from the biology of other hornet species can be applied to our latest invasive – the Asian Hornet.

There are five sections of the book, General Information on hornets and yellow-jackets, Hornet & Yellow-Jacket Invasions, Hornet Life Cycle, Hornet Predator & Pests, Hornets as pests, food & Control Methods and More Information.

The Asian hornet is a social wasp and belongs to the *Vespa* genus of which there are 23 species living in temperate and tropical areas. Other social wasps include the *Vespula* species and *Dolichovespula* species of wasps, also living in temperate climates, where they tend to be called 'wasps' rather than 'yellow-jackets', which is more how they are referred to in North America, and in this book.

Focusing on the Asian Hornet, we are told about the 13 subspecies that occur in Asia and how just one of these, *V. velutina nigrithorax* invaded France, as well as South Korea at roughly the same time. Lessons from South Korea are mixed with lessons from France where it has rapidly spread from its arrival in 2004. The book has plenty of colour and black and white photographs of nest diversity amongst different hornet species, of brood, of parasites and of mass attacks by the Giant Japanese hornets. The Asian hornet species (three species) are demonstrated to be 'almost exclusively' living in Japanese cities now, they being just part of the natural biodiversity in the Japanese countryside. But when they arrived in Europe there were no natural defences from honeybees, or other insects, so insect biodiversity is under threat. The Asian Hornet will have easy pickings of native insects.

The author makes the point that '*the natural history of hornets makes their eradication impossible*', which may worry a lot of people. The outbreaks in Scotland and in England in 2016 and 2017 are mentioned, but we are only at the beginning of a long experience with this invasive, and there are so many unknowns on ecology and behaviour. If we knew more, we would be better informed on control.

The book is written in an accessible and logical manner, 'generalised' to make it 'more accessible to non-specialists'. Those wanting more information are recommended to read the more scientific books or peer-reviewed papers listed at the end. The book will be of interest to entomologists, ecologists, students and naturalists, and should be included in bee association libraries.

John Feltwell

Leaf Beetles

by David Hubble

Naturalists Handbooks 34

Pelagic Publishing

ISBN 1-78427-150-3

£19.99



The Naturalist handbooks offer a complete introduction to specific groups that are either taxonomically- or habitat-based, thereby providing an over view of the groups biology and a key that enables non-experts to identify the species involved. *Leaf Beetles* is an excellent addition to this extremely useful series.

The book opens with an introduction that defines the taxonomic basis of the group known as Leaf Beetles, details the families and genera than it comprises, and offers an introduction to their morphology plus a brief evolutionary history of the group. Chapter two explores the groups life history and reproduction, while chapter three examines their role as pest species, their potential as bio control agents and indicators of habitat quality. It also examines the conservation of the less common species within the group. Chapter four outlines the natural enemies of the leaf beetles, from predators and parasites to fungi, microsporidians and bacteria. It examines the array of defences that leaf beetles have at their disposal, ranging from the chemical and structural to behavioural responses. Chapter five explores the UK distribution of the group, providing distribution maps, a written about of its distribution and biology plus a photograph of a pinned specimen. Chapter six is a detailed key to the sub families and then species of UK leaf beetles, which is annotated with a series of clear line drawings. It also contains checklist of UK species with common names where they occur. Chapter seven offers advice on field work, maintaining a collection, rearing specimens, dissecting genitalia, a plug for the Chrysomelid recording scheme, and an outline of population estimation. It also lists the leaf beetles associated with common plants and trees. Chapter eight supplies a list of useful societies and suppliers, while chapter nine has the references and notes on further reading.

Leaf Beetles maintains the integrity of this important series with an introductory overview of this commonly encountered group that will be useful to a wide spectrum of biologists, from students to ecological consultants. Just like its predecessors, this book will encourage a new generation of naturalists to delve into the biology and ecology of these beautiful and fascinating beetles and add to our knowledge of the UK fauna. If you want to get to know the UK's leaf beetles this is the book you need.

Peter Smithers

Field Guide to the Robberflies of the Netherlands and Belgium

by Reinoud van den Broke & Andre Schulten

Jeugdbondsuitgeverij (JUB)

ISBN 978-90-5107-054-5

£15.99



The book opens with an introduction that outlines the history and diversity of the group, with drawings comparing the size range and photographs of the various morphologies. There is a section on how to tell Asilidae from other dipteran families and a clear indication of the geographical range covered by the book, an area that includes the British Isles.

The next chapter details the life history of the Asilidae, which is illustrated with a series of excellent photographs. This is followed by a habitat guide which features a shot of a habitat along with photographs of the species likely to be found in it. A section on the morphology of the group follows which is illustrated with clear, concise drawings. There then follows a systematic list of species from the region. The guide to families is the weak point of the book, as each of the eight families are described and illustrated with photographs but I feel that without a key to guide them, beginners could make errors at this point. However, once one has arrived at a family the keys to species are superbly illustrated with a mix of drawings and photographs. A series of species accounts follow the family key which offer, field characters, a detailed description of the species, notes on similar species, flight period, behaviour, habitat and distribution. The book closes with a bibliography, tables of flight periods and distribution. An index of scientific names plus the common names in English, Dutch, German and Danish.

While beginners may find assigning a specimen to family an initial challenge, once they are sure of the families the concise keys to genera and species will enable rapid and accurate identifications. This field guide is superbly illustrated and will almost certainly become the standard work on this family for northern Europe. The arrival of a clear user-friendly key is bound to stimulate a fresh wave of interest in this fascinating group of flies.

Peter Smithers

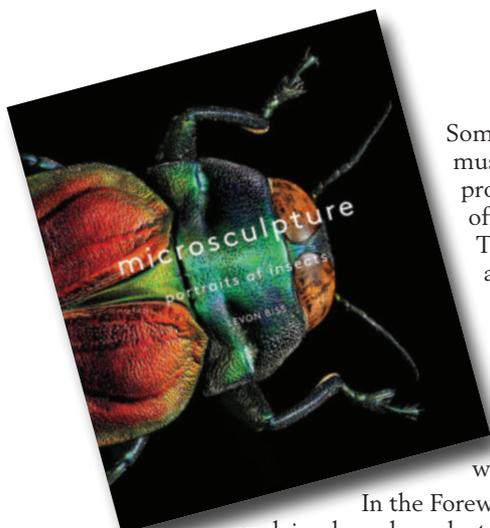
Microsculpture Portraits of Insects

by Levon Bliss

Published by Abrams

ISBN 978-1-4197-2695-8

£30.00



Some readers may recall my review of the exhibition of the same name at the Oxford museum of Natural History back in 2016 in *Antenna* 40(4), an exhibition of staggering proportions and exquisite detail. While the exhibition is now touring Europe, the book offers an opportunity to view these images at a reduced scale in the comfort of your home. The book measures 31cm x 26cm, thus offering images that still allow the viewer to appreciate the complex detail they possess. Most of the images of the 36 species appear as a single page but eight of them spill across a double page spread, offering a hint of the exhibition's visual impact. The detail is supplied by a series of close-ups of visually interesting parts of each insect presented as a montage that follows each image of the whole insect. Intensely lit and presented on a black background, the images have a slightly unreal quality that adds a dramatic edge. Stunning, beautiful and arresting, these images are ambassadors, introducing the complexity and diversity of the insect world to a wider audience.

In the Foreword, James Hogan (Curator of Entomology at the Oxford Museum of Natural History) explains how he selected the 36 specimens from the vast number available in the Museum's collection. Meanwhile, at the end of the book Levon Bliss reveals how he created the photographs, compiling each one from up to 8,000 separate images.

There were two things I found frustrating. On the page depicting the stalk-eyed fly, the text box overlays the close up of the antenna obscuring most of the image, and on the following page, which displays images of an Orthopteran of the family Chorotypidae, it is labelled as a stalk-eyed fly.

These concerns aside, *Microsculpture* is a book that celebrates the intense and often bizarre beauty of the insect microcosm. It is the ideal gift for anyone with an interest in the natural world. Obtain a copy and be amazed.

Peter Smithers

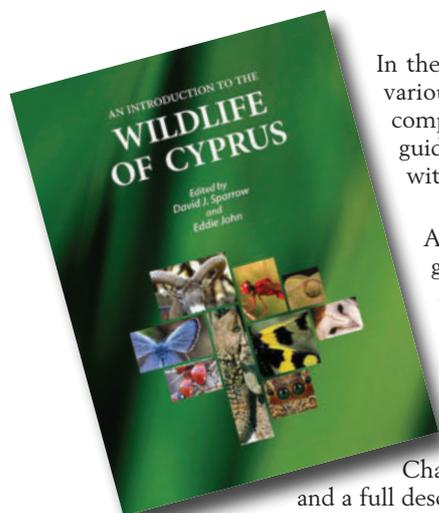
An Introduction to the Wildlife of Cyprus

Edited by David J. Sparrow & Eddie John

Published by Terracypria

ISBN 978-9963-601-45-5

£83.99



In the preface the editors state that this book offer no more than a general introduction to the various faunal orders of Cyprus. A claim of the utmost modesty, as this is one of the most comprehensive general introductions to a fauna that *Antenna* has encountered. It is not a field guide as at 5.5cm thick and weighing in at 2.3 kg it's a bulky item to carry around but it brims with useful information.

The book is divided into thirty chapters which are subdivided into four sections. Section one, An Introduction to Cyprus. This comprises four chapters dealing with the geography, climate geology and habitats of the island. Section two, introduction to the animal kingdom. This section has two chapters that offer an introduction to classification and an overview of the islands faunal diversity with notes on its history. Section three documents what is known of the invertebrate fauna in seventeen chapters, while section four documents the vertebrates in six chapters.

As always, knowledge of faunal groups is patchy, which the editors freely acknowledge.

Popular groups are well documented while less popular groups are less well known.

Chapters such as the Odonata offer a full and detailed account of the group, with photographs and a full description of each species plus notes on their distribution, habitat, behaviour and flight season.

The Orthoptera are also fully covered with an illustrated key to species plus photographs and notes on each of these. The mantids are also well-documented with photographs, drawings of critical features and descriptions for each of the eight species. For other groups such as the Dictyopteran, Phasmida and Dermaptera, a brief introduction is all that is available. The Hemiptera chapter deals with the common families with notes and photographs of some commonly encountered species, although the Neuropteroid orders have only a brief introduction. The Lepidoptera are a popular group and are subsequently well-documented, all forty nine species of the butterflies are illustrated with notes on distribution, flight period, habitats, key features and similar species. While the more diverse moths (750 species) for very practical reasons have notes and photographs of each of the superfamilies recoded from the island. The Coleoptera chapter faced an impossible task with 1,750 species recorded from Cyprus so it offers an introduction to a handful of common families. The chapters on Diptera and Hymenoptera take a similar approach. The Arachnid chapter deals with the spiders on a family basis, scorpions on a species basis (as there are only three species) and a brief introduction to harvestmen, pseudoscorpions, solifuges and mites. The remaining invertebrate groups also receive brief overviews. The chapters on amphibians, reptiles and mammals offer accounts of each of the species found on Cyprus with photographs and detailed notes, while the bird chapter, faced with 395 species recorded from Cyprus, offers a check list with notes on their breeding or migrant status. This chapter also details of selected endemic species and those of general interest.

To take on the cataloging of an entire country's fauna is a herculean task but David Sparrow and Eddie John have pulled together an authoritative team who have produced a comprehensive overview of the fauna of Cyprus as it stands in the early 21st century. An overview that highlights the gaps in our knowledge of this fauna, but also supplies a wealth of information where it is available.

The team are to be congratulated on an excellent review of the Island's fauna which will stimulate further work and introduce future generations of naturalists to the diverse fauna of Cyprus.

Peter Smithers

Insects. Their Natural History and Diversity

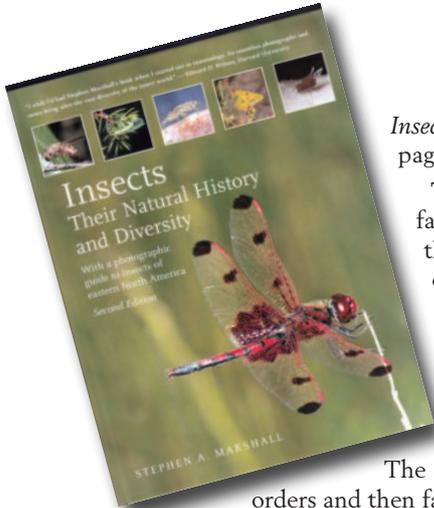
(2nd edition)

by Stephen Marshall

Published by Firefly Books

ISBN 978-1-77085-962-3

£54.99



Insects is a monster of a book which is as lavish as it is heavy. At just over three kilograms and 735 pages, it is the largest guide to insects I have yet encountered.

There is a short introduction that gives an overview of insect morphology along with an insect family tree. It then cuts straight to the chase with the following twelve chapters dealing with the insect orders. Small orders are grouped into single chapters while larger orders have a chapter to themselves.

Each chapter begins with an exploration of the biology of the families within it, and is followed by a series of small photographs (9 per page) depicting the variation within each family, plus images of representative larvae. The penultimate chapter is an overview of the terrestrial Myriopods, Crustacea and Arachnida which is followed by a section on sampling invertebrates, making a collection and how to photograph them.

The main strength of this book is the fifty five pages of simple-to-use keys (28 of them) to the orders and then families of insects, plus two novel keys to “Invertebrates that can bite, sting or make you itch” and “Invertebrates found in houses”. These keys are a simple but effective compromise, allowing identification using the macro features of the insects. These take the reader to a suite of images depicting members of the family which can then be used to confirm the identification.

In the preface the author states that they will work 95% of the time and where they don't, details of more technical keys are appended in the selected references. Stephen Marshall also explains that while the book focuses on the insect fauna of the north eastern USA it has been written so that it will be helpful in many parts of the world. My personal impression is that it would certainly work in northern Europe.

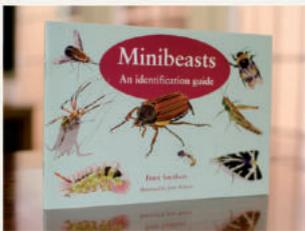
Insects is a field guide on a gargantuan scale. It is a compendium of everything required to identify an invertebrate to one of the major taxonomic groups. While it is too large to take into the field, it is a wonderful resource to have at a field station or base camp. For students beginning a course in entomology, this book would be invaluable as an introduction to the vast diversity of terrestrial invertebrates.

While this book is of great practical value to students, it also offers a pictorial insight into insect diversity that can be appreciated by non-biologists. The 4,000 plus photographs provide a clear indication of the overwhelming numbers that entomologists deal with on a regular basis and provide an insight into the diversity of forms that can be found within this group. *Insects* ensures that an appreciation of the vast diversity of the insects is now within the grasp of anyone with the time and patience to stop and look.

Peter Smithers

ROYAL ENTOMOLOGICAL SOCIETY ONLINE SHOP

THE PLACE FOR ALL GIFTS INSECT-RELATED...

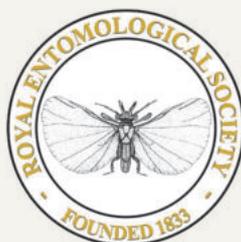


IMAGES © RES AND LEIGH HOWELLS

From Annual Membership Renewal to casual clothing, rare watercolour greetings cards to notebooks, colouring books to playing cards, and even ladybird USB drives! There are many insect-related gifts to check out on the Royal Entomological Society's online shop.

Take a look on www.royensoc.co.uk/shop and see what you can find to take your insect interest to a whole new level. Visit today!

The RES Handbooks are also available online at:
www.royensoc.co.uk/publications/handbooks
to receive your membership discount you need to be logged into the website.



Royal Entomological Society
www.royensoc.co.uk/shop



MARSH

Christian Trust



RES MARSH AWARD FOR EARLY CAREER ENTOMOLOGIST



Marsh Award for Early Career Entomologist recognises an individual who has made an early career contribution to Entomological Science, with a single or on-going impact to the field. It commends their dedication to the field, hard work and creativity.

Award Criteria

For an early career contribution to Entomological Science 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

£1,250 and Certificate.

Eligibility

Any person whose work, or contribution, meets the Criteria. There are no geographic restrictions.

Cycle

Annual; nominations accepted until 31st December in any year, winner announced early in following year.

Adjudication

By a panel consisting of, the President, two senior Fellows and the Chairman or representative of the Marsh Christian Trust.

Entry

By letter of nomination from a Fellow of the Society, or, a person of standing in the field of entomological science. Additional letters of support welcome. The nomination should give as full a profile of the nominee as is possible with special emphasis on relevance to the Award Criteria. All entries to:

**The Registrar, Royal Entomological Society, The Mansion House,
Chiswell Green Lane, St Albans AL2 3NS**

It is a condition of entry that the winner of the Award shall attend the annual Ento (or other nominated) meeting to receive it, at the Society's expense.

Further information

Websites www.marshchristiantrust.org/Early_Career_Entomologist
www.royensoc.co.uk/awards/Marsh_award.htm

2017 WINNER: JOHN SIMAIKA

With an already deep affinity for the protection of the environment, and a broad interest in the biological sciences, John studied at the University



of Victoria, Canada, graduating with a B.Sc. in Biology (Honours) and Anthropology (Major). He continued his studies at Stellenbosch University, South Africa, with his M.Sc. (Entomology) focused on dragonflies as model organisms for developing and testing methods in freshwater conservation. For his MSc, he worked on developing and testing the Dragonfly Biotic Index (DBI) a rapid assessment index for South African streams, work which he continued for his PhD research. The remainder of John's Ph.D. focused on conservation planning. The spatial planning work concerned reserve selection using South African aquatic macroinvertebrates and habitat suitability modeling under projected future climate change scenarios in South Africa, and analysis of the representativeness of the continental African network of protected areas of aquatic biodiversity.



MARSH
Christian Trust



RES MARSH AWARD FOR INSECT CONSERVATION



The Award recognises an outstanding contribution to the field of insect conservation and is run in partnership with the Royal Entomological Society. The Award has been running since 2002 and is awarded annually.

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

£1,250 and Certificate.

Eligibility

Any person whose contribution to Insect Conservation meets the Criteria.

Cycle

Annual, nominations accepted until 31st December, winners announced in following year.

Adjudication

Shortlisting by RES Conservation Committee, final selection by Honorary Officers, Chair of Conservation Committee and M.C.T. representative.

Entry

Written nominations giving full outline of the reasons for the nomination and personal profile of the nominee, giving as much information as possible, to be sent to:

**Chair of the Conservation Committee c/o Royal Entomological Society,
The Mansion House, Chiswell Green Lane, St Albans AL2 3NS.**

It is a condition of entry that the winner of the Award shall attend the annual Ento (or other nominated) meeting to receive it, at the Society's expense.

Further information

Websites www.marshchristiantrust.org/Insect_Conservation
www.royensoc.co.uk/awards/Marsh_award.htm

2017 WINNER: DR MIKE MORRIS

for his outstanding
contribution to Insect
Conservation on the basis of
lifetime achievement



After 3 years as the V H Blackman Research Scholar in East Malling Research Station, Mike joined the Nature Conservancy's new research lab at Monks Wood (later NERC's Institute of Terrestrial Ecology), where he spent 15 years (1961-76) on research into conservation ecology, notably devising innovative field experiments to explore how different types of grassland management can restore and maintain distinctive species-rich-assemblages of insects, especially on lowland calcareous soils. For the rest of his career – 1976 to retirement in 1994 at the then obligatory age in government service of 60 – Mike Morris was Head of Furzebrook Research Station and ultimately Acting Director of ITE, as well as ITE's Head of Invertebrate Ecology since 1976.

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

2018

Mar 7 **Verrall Lecture by Dr Amoret P. Whitaker, University of Winchester**

Fabulous Fleas

Venue: Natural History Museum

Convenor: Dr Archie K. Murchie

Due to their parasitic lifestyle, the much maligned flea has always had a close association with humans. However, it has also been celebrated in poetry, art and entertainment. This talk will consider some of the many ways in which this fascinating insect has been portrayed - including their use in flea circuses, as curiosities and as love tokens.

Mar 14 **Insect Behaviour SIG**

Venue: Rothamsted Research, Harpenden

Convenors: Jozsef Vuts (jozsef.vuts@rothamsted.ac.uk) and
Jason Lim (jason.lim@rothamsted.ac.uk)

Mar **Joint Insect Endosymbiont and Insect Infection and Immunity SIGs**

21-22 Venue: University of Liverpool

Convenors: Ailsa McLean (ailsa.mclean@zoo.ox.ac.uk), and
Greg Hurst (G.Hurst@liverpool.ac.uk)

The Wednesday meeting will focus on specificity of symbiotic interactions, from functional aspects through to evolutionary ecology. The Thursday meeting will include immunity, defence, vector biology, evolution, biochemistry and ecology.

Invited speakers:

Prof Martin Kaltenpoth (21st March) – “*Symbiont-provided defense and nutrition in herbivorous beetles.*”

Dr Lena Wilfert (22nd March) – “*Man-made epidemics: the evolutionary ecology of multi-host bee pathogens.*”

Both meetings will be small and informal, and short talks or posters are welcome from everyone at any career level. We would love people to attend both meetings, as that way we can gain insights from each other.

Please register for both events separately at: <https://www.royensoc.co.uk/events>

The cost for each separate event is £10 for members, £15 for non-members, which covers lunch and two tea breaks.

Please send abstracts for both symposia to symbiont2018@gmail.com, by no later than 23:59 on Monday 5th February. Please specify if you would like to present a talk or poster and for which symposium. Please note that the poster session for both symposia will be held on Wednesday early evening.

Apr 4 **Entomophagy SIG**

Venue: Royal Agricultural University, Cirencester

Convenor: Peter Smithers (p.smithers@plymouth.ac.uk)

A day of presentations and discussions around the production and use of insects as food and feed in the UK. Further details from: p.smithers@plymouth.ac.uk

Apr 6 South-West Regional Meeting – 6pm

Venue: Seminar Room G14, Life Sciences Building, University of Bristol

Convenor: Peter Smithers (p.smithers@plymouth.ac.uk)

Tim Bray (Bristol Zoo) – *Lazy Lycidae: Tropical forest beetle assemblages and fine scale speciation.*

Josh Phangurha – *The biology of spider webs.*

Lucia Chmurova – *Farming Lepidoptera in Madagascar.*

Further details from: p.smithers@plymouth.ac.uk

Apr 11 Electronic & Computing Technology SIG

Venue: The Mansion House, St Albans

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

Jun National Insect Week 2018

18-24 <http://www.nationalinsectweek.co.uk/>

Jun 27 Insect Conservation SIG, joint meeting with the Swallowtail and Birdwing Butterfly Trust

Ecology and Conservation of the British Swallowtail

Venue: Wheatfen Broad Nature Reserve, Ted Ellis Trust, Surlingham

Convenor: Alan Stewart (a.j.a.stewart@sussex.ac.uk)

Aug Ento'18 Annual Science Meeting

29-31 *The good, the bad and the ugly - exploring the importance of lesser studied insects*

Venue: Edge Hill University, Ormskirk

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

Clare Strode (clare.strode@edgehill.ac.uk)

Plenary speakers:

Professor Stefan Scheu - Georg August University Göttingen

"The Good - Belowground goodies: Ecology and evolution of soil microarthropods"

Professor Richard Wall - Bristol University

"The Bad - Ticks and tick-borne disease"

Dr Jason Dombroskie - Cornell University Insect Collection

"The Ugly - Yes that's nice...but look at this! Challenges of generating interest in and relevance to the non-charismatic microfauna"

For more information visit: <https://www.royensoc.co.uk/meeting/ento-18>

Other Meetings

2018

Mar 13 Aberdeen Entomological Club seminar

"Rare invertebrates in the Cairngorms project: one year on", speaker Gabrielle Flinn (RSPB)

Venues: Macaulay B, James Hutton Institute, Craigiebuckler, Aberdeen; and screened live to New Seminar Room, James Hutton Institute, Invergowrie, Dundee.

Convenors: Jenni Stockan (jenni.stockan@hutton.ac.uk) and Jennifer Slater (Jennifer.Slater@hutton.ac.uk)

Apr 10 Aberdeen Entomological Club seminar

"Fleas", speaker Norman DeFoe

Venues: Macaulay B, James Hutton Institute, Craigiebuckler, Aberdeen; and screened live to New Seminar Room, James Hutton Institute, Invergowrie, Dundee.

Convenors: Jenni Stockan (jenni.stockan@hutton.ac.uk) and Jennifer Slater (Jennifer.Slater@hutton.ac.uk)

Jul 2-6 European Congress of Entomology

Venue: Expo Convention Centre, Naples, Italy

2020

Jul 19-24 XXVII International Congress of Entomology (ICE2020)

Entomology for our planet

Venue: Helsinki, Finland



Ensure you have the skills and knowledge to pursue a career in conservation management or ecological consultancy.

- Career orientated programme which includes a placement with a conservation organisation or consultancy
- Teaches essential field skills including species identification, survey work and habitat assessment for plants, invertebrates and vertebrates
- Incorporates relevant professional skills and knowledge including GIS, legislation and management planning
- Undertake over 25 days of field work including a residential trip at no extra cost
- Study full-time one year or on a part-time basis

We also offer a Masters by Research on ecology and conservation topics aligning your own research interests with current staff, as well as undergraduate programmes in Biology, Ecology & Conservation, Genetics, Human Biology and Biotechnology.

For more information please contact course leader
Anne Oxbrough on: 01695 584149
or email anne.oxbrough@edgehill.ac.uk

edgehill.ac.uk/biology

MSc Conservation
Management



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

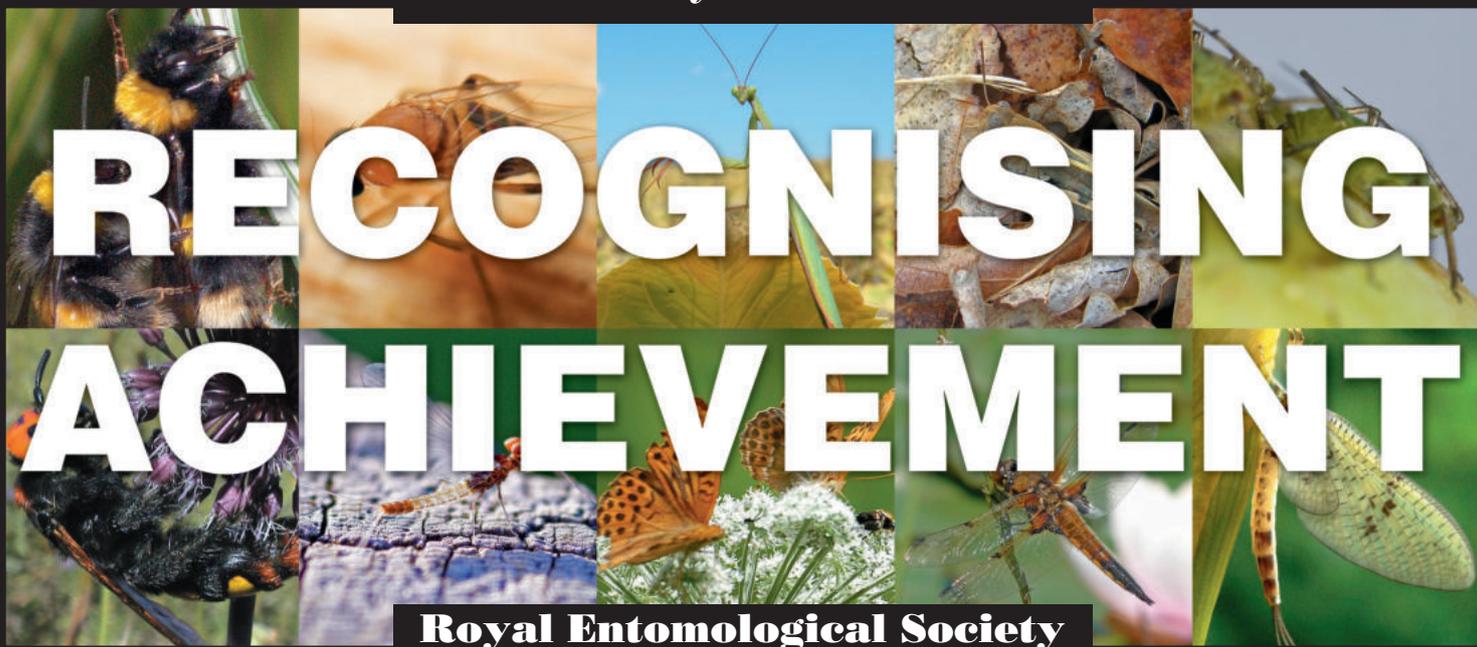
Editor: David George (Stockbridge Technology Centre)

Editor: Richard Harrington (Rothamsted Research)

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

Consulting Editor: Prof Jim Hardie (RES)

Assistant Editor: Adam Hart (University of Gloucestershire), Peter Smithers (University of Plymouth)



**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**

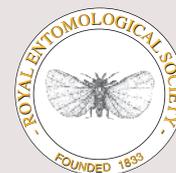
Award Criteria: ORF: Grants to support activities which further the Society's aims. This may range from, help to purchase equipment, to help in funding expeditions/meetings. CPF: Grants to assist applicants who are participating in a meeting or conference in some way, e.g. presenting a paper/poster.

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



Royal Entomological Society
www.royensoc.co.uk

The Mansion House, Chiswell Green Lane, St. Albans, Herts AL2 3NS, UK
Tel: +44 (0)1727 899387 • Fax: +44 (0)1727 894797
E-mail: info@royensoc.co.uk

RES STUDENT AWARD 2018

Write an entomological article and WIN!



www.royensoc.co.uk

REQUIREMENT

Write an article about any Entomological topic that would be of interest to the general public. The article must be easy to read and written in a popular style. It should be no more than 800 words in length.

WHO CAN ENTER?

The competition is open to all undergraduates and postgraduates, on both full and part-time study.

PRIZES

First Prize: A £400 cheque and your article submitted for inclusion in *Antenna*.

Second Prize: A £300 cheque and your article submitted for inclusion in *Antenna*.

Third Prize: A £200 cheque and your article submitted for inclusion in *Antenna*.

ENTRIES

You can send electronically via e-mail to: kirsty@royensoc.co.uk

Alternatively, complete the attached entry form, and submit it with five copies of your entry to:

The Registrar,
Royal Entomological Society,
The Mansion House,
Chiswell Green Lane,
St Albans, Herts
AL2 3NS

For further information telephone:
01727 899387

Please include:

- Your name and address (including postcode)
- Your e-mail address
- The name and address (including postcode) of your academic institution
- Evidence of your student status

THE JUDGES

The judges panel will be made up of three Fellows of the Royal Entomological Society. The judges decision is final.

CLOSING DATE

The closing date for entries is 31 December 2018. The winner will be announced in the Spring 2019 edition of *Antenna* and on our website.

PLEASE CUT AND RETURN THIS PORTION WITH YOUR ENTRY

Article title: _____

Student name: _____

Address: _____

Telephone: _____

E-mail: _____

Name of academic institution:

