

# Antenna



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## Mimicry and gene flow among butterfly species: reply to Brower & Garzón-Orduña



## EnTeam: North Carolina Museum of Natural Sciences



## Saving the apollo and their allies



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## Antenna

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**Index**

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## Editorial



There are a lot of butterflies in this issue, for which we make no apology. The Swallowtail and Birdwing Butterfly Trust reports on its online conference on the ecology and conservation of apollo butterflies, and there is a response to Brower & Garzón-Orduña's article from our previous issue, which questioned the evolutionary mechanism of mimicry in *Heliconius* spp. If the genetics of these butterflies is a contested topic, understanding them can be important. I am reminded of an advert that appeared in the *Bulletin of the Amateur Entomologists' Society* in 1952, submitted by someone wishing to communicate with another enthusiast about the breeding of *Papilio dardanus*. The surprising outcome of a response to that advert – by Sir Cyril Clarke, who would later become President of the RES – was a treatment for Rhesus-haemolytic disease of the newborn, based on an understanding of the genetics of these butterflies (Clarke, 1967). This was followed by the establishment of a medical genetics research centre in Liverpool.

Ants can also be found in this issue. We welcome back EnTeam, after a five-year absence, which features the work of the ‘Ant Lab’ at the North Carolina Museum of Natural Sciences (although more than ant research goes on there, as might be imagined). If you'd like your team's work in a UK or non-UK lab to be featured, please get in touch.

Jenny Turner has enthusiastically picked up the baton of the Hon. Fellow interviews, this time collaring Bert Hölldobler. Our insect identification team was again busy in 2024, having dealt with some 2,400 enquiries! One of the species they were able to identify appears on the front cover, and may be the first record of this species in the UK. Emilie Aimé describes the Society's plans for the RES Handbooks, all of which will be eligible for a 50% discount for members.

A variety of meetings is reported on in this issue, and the outreach reports include the results of the annual photo competition; the pictures are always enjoyable to view.

Finally, congratulations to the winners of the RES journals Early Career Entomologist Awards 2021–2023, who are featured in this issue.

Dafydd Lewis

## Reference

Clarke, C. (1967) British Medical Journal 4, 7–12, available online: <https://www.bmj.com/content/bmj/4/5570/7.full.pdf>

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## Antenna

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## Letter from the President

Spring is here! One of the most rewarding aspects of my job is teaching entomology to undergraduate students in the spring semester, just as the northern hemisphere starts to emerge from the long winter. Sharing the wonder of insects with students, from those who can barely stand to be in the same room as a live arthropod to fully-fledged ento-enthusiasts, is endlessly fulfilling. Watching someone go from hesitant curiosity to genuine fascination — whether sparked by the hissing of cockroaches, apparent muddle of a bumble bee nest, or iridescent wings of butterflies — reminds me why insects hold such a special place in teaching biology, and in my heart.

As RES members are well aware, insects offer an astounding diversity of biological stories that are both fascinating and bizarre. Their physiology and ecology provide countless teaching opportunities — often beyond the boundaries of what people expect. They are not simply small, hard-to-identify creatures or limited to the roles of crop pests and pollinators. Insects are masters of survival, and the protagonists of some of the whackiest sex lives you can imagine.

Yet, despite their diversity, with insects making up the majority of animal species on Earth and playing critical roles in ecosystems, economies and culture, they occupy a surprisingly small space in our educational curricula. At primary and secondary school, teaching about insects is often limited to charismatic honey bees and butterflies, or their roles as crop pests. Undergraduate biology degrees might only include a single module on entomology, and specialised master's programmes are still relatively rare. Why is this?

The value of insects has long been recognised — be it as pollinators, decomposers or agricultural adversaries — but they remain an undervalued teaching resource. Part of their charm lies in their accessibility. Insects are everywhere; they can be reared inexpensively and humanely, studied in a classroom or observed in nature. Collections, like the millions of specimens housed at institutions such as the Natural History Museum, provide an unmatched treasure trove for students and researchers alike. And there's always more to discover — new behaviours, new species and new ecological roles — ensuring that entomology remains as exciting for experts as it is for beginners.

Moreover, insects can be more relatable than one might think. Who doesn't smile at the vibrant colours of a jewel beetle, marvel at the complete metamorphosis of a butterfly, or feel peaceful and relaxed on hearing the hum of a bumble bee? Check out Emily Carter and Dave Goulson's beautiful book *Insectarium*,

produced in partnership with the society, and share with friends, family and colleagues — insects really are a gateway to curiosity and discovery of nature for everyone.

Insects provide unique opportunities for hands-on learning, and being a Member or Fellow of the RES provides a community for sharing resources, stories and approaches to teaching. The RES insect garden in London is one opportunity, but the beauty of a worldwide society like ours, is that there are potential connections and networks far beyond this, and we have the prospect of using this to promote entomological teaching and learning far and wide. Please do get in touch and make the most of the society, especially if you are teaching.

Entomology is wonderful to study and teach because it's endless — and endlessly rewarding. So, I urge all of you to go forth and share the joy of insects.

**Jane Stout**

President  
Royal Entomological Society



*Heliconius elevatus*

## OPINION PIECE

### Mimicry and gene flow among butterfly species: reply to Brower & Garzón-Orduña

#### Background

We thank the editors for inviting us to respond to Brower and Garzón-Orduña's (2024) commentary on recent studies of *Heliconius* butterflies, in which the authors once again criticise our findings of introgression (the transfer of genetic material by means of hybridisation among species). They employ the same general arguments against our science that they have made in the last 15 years or so, resulting in at least 7 publications voicing such criticisms. None of these, including the current paper in *Antenna*, provide new data, nor employ re-analyses of existing data. Instead, these critiques exhibit distrust of almost every aspect of our data as well as analyses leading to conclusions of hybridisation or introgression in *Heliconius* butterflies.

#### Critiques by Brower and Garzón-Orduña of other *Heliconius* biologists

As is typical for all Brower's and more recently Brower & Garzón-Orduña's critical papers of the rest of the *Heliconius* community, they detect so many apparent flaws in our work that they are hard to answer in a form readily digestible to the reader. In the current critique, Brower & Garzón-Orduña (hereafter B&G):

- insinuate that we view introgression to be an alternative to mimicry (we don't);

- doubt that hybridisation occurs between species, in spite of hybrid specimens in collections (which existed and were widely recognized as hybrids long before any of us started our research careers);
- postulate that even if they do exist, hybrids between species of *Heliconius* "do not *de facto* imply a viable conduit for interspecific gene flow" (to the contrary, if the hybrid is viable and fertile, and many are, "a viable conduit" does seem a likely implication);
- claim that we "neglect to consider potential alternative explanations" to introgression (but we do: we always test against alternatives);
- assert that "it would be quite remarkable for wing pattern alleles ... to slip across a species boundary..." (but natural selection may use any variation, including introgressed variation, to effect mimicry);
- state that "successfully navigating this gauntlet of selective challenges is quite unlikely" (ditto);
- and propose that if "species are not convergent [due to mimicry], but truly homologous ... then there should be genomic smoking guns that preclude alternative explanations" (those "smoking guns" are precisely what we did find!).

Both Brower & Garzón-Orduña are on the editorial board of *Cladistics*, the only journal to mandate the use of parsimony-based cladistics to the exclusion of today's more widely used numerical taxonomy methods to construct phylogenetic trees, such as model-based likelihood and Bayesian methods. The

current critique of B&G is characterized by appeal to cladistics principles, and much high-flown prose arguing that other *Heliconius* biologists have adopted what they regard as non-scientific approaches to their work.

In our rebuttal of this latest screed, we hope that readers of *Antenna*, who, perhaps surprised by the sudden appearance on their radar of this arcane dispute, might be enabled to appreciate why the B&G allegations are without substance. After 15 years of trying, however, it seems unlikely we'll ever convince Brower himself. Nonetheless, it is important to rebut the misinformation perpetrated by B&G for other readers.

#### Mimicry, and what is homology and what is homoplasy?

Homology and homoplasy are both terms much used in cladistic thinking.

A homologous trait (a homology) is a shared derived character. For example, the pentadactyl limb is a homologous trait among today's amphibia, reptiles, mammals and birds (although digits and sometimes whole limbs have been lost in some clades).

A homoplasious trait (a homoplasy) is a derived character that has been gained independently more than once in a phylogeny. For example, wings in birds, bats, and pterodactyls. But even in this simple case, there are some wrinkles: in all cases, wings have been gained using different modifications of homologous forelimbs of these vertebrates.

Mimicry, convergence of unrelated taxa on the 'same' warning colour pattern, is a trait that almost by definition has evolved as a homoplasy. The first



several pages of B&G apparently seek to educate us on the evolution of mimicry. Contrary to the insinuation that we don't understand mimicry, we are both great supporters of the evolution of mimicry by natural selection, and have written numerous papers on this topic (e.g., Mallet and Joron, 1999; Naisbit *et al.*, 2003; Jay *et al.*, 2018; Page *et al.*, 2024).

B&G claim that “we do not yet understand how mimetic parallelisms occur at the molecular level.” While our knowledge of exactly how genes lead to colour pattern phenotypes is still somewhat incomplete, we do now understand a considerable amount about genomic locations and genes involved in the extraordinary switches in mimicry within and between species of *Heliconius*.

One of us, having crossed subspecies within both *Heliconius melpomene* and *H. erato* with the same mimetic colour patterns (Mallet, 1989) is on record as arguing that “the forewing bands of *H. erato* and *H. melpomene* seem to me to have about as little in common genetically as might possibly be imagined for such nearly identical colour patterns” (Mallet, 1991). The ‘nailhead’ shape of the rays and the hindwing bar shape in the *H. melpomene* lineage found in the upper Amazon mimicry ring (*H. timareta*, *H. melpomene*, and *H. elevatus*, starred in Fig. 1) appear very different developmentally from the ‘needle-like’ rays of *H. erato* (also shown in Fig. 1).

But how wrong this intuition about the morphological genetics was! We soon found by means of genomic mapping that a homologous region of the genome was involved in mimicry switches in three unrelated species, *Heliconius erato*, *H. melpomene*, and *H. numata* (Joron *et al.*, 2006). The effects on colour pattern at this locus on chromosome 15 were at first thought to be caused by *cis*-regulation of a protein-coding gene, *cortex*, but are now known instead to be almost certainly due to an overlapping long non-coding RNA gene, *ivory*, which gives rise to a microRNA (Livraghi *et al.*, 2024; Tian *et al.*, 2024). Similar major loci involved in

*Heliconius* mimicry switches have been documented on chromosomes 18 (the *optix* gene) (Reed *et al.*, 2011) and 10 (the *Wnt-A* gene) (Martin *et al.*, 2012). *Heliconius melpomene* and *H. erato* both show somewhat similar colour pattern switches due to the actions of these same three homologous loci in the genome. More recently, colour pattern switches in other Lepidoptera, for example melanism in the Peppered Moth (Geometridae) (van't Hof *et al.*, 2016), or iridescence of Nymphalidae (Zhang *et al.*, 2017) are also found at the *cortex* and *optix* loci, so that it now appears that these loci are involved in colour patterning across the Lepidoptera. These are local phylogenetic examples of ‘deep homology’, similar to the finding that, for example, the same genes are involved in vertebrate eyes and insect compound eyes (Gehring, 1996), and even more profoundly, the segmentation

patterns and appendages in vertebrates and arthropods (Shubin *et al.*, 1997).

Although homologous loci are involved in mimicry switching in *H. erato* and *H. melpomene*, these unrelated species almost certainly derived their colour patterns independently via divergent gene regulation in each lineage (Van Belleghem *et al.*, 2023), as intuited by B&G. The major differences causing colour pattern switching appear to be inherited in non-coding regions of the genome, presumably regulatory, near the genes cited above. Thus, although the genes are homologous, their regulation causing colour pattern switching is homoplasious as it affects mimicry in the divergent lineages. Thus, a realistic view of homoplasy vs. homology is that it is a continuum rather than a pair of alternatives. How much homology do you need to convert a homoplasy into a homology? It's not clear.



**Fig 1. Dennis-ray mimicry in the upper Amazon.**

Row 1: *H. burneyi huebneri*, *H. aoede auca*, and *H. xanthocles zamora*  
 Row 2: *H. timareta timareta* f. *timareta*, *H. doris doris*, and *H. demeter ucayalensis*  
 Row 3: *H. melpomene malleti*, *H. egeria homogena*, and *H. erato emma*  
 Row 4: *H. elevatus pseudocupidineus*, *Eueides heliconioides eanes*, and *E. tales calathus*  
 Row 5: *Chetone phyleis*, a pericopine moth.  
 The stars indicate the three species that show unusual ‘nailhead’ rays. Specimens figured are from the Neukirchen Collection, McGuire Centre, Florida, from populations in Ecuador and Northern Peru. (Photo from Wallbank *et al.* 2016, © the authors, CC-BY-4.0).

## Hybridisation and introgression between *H. melpomene* and *H. timareta*

We were by ~2006 intrigued by the possibility that the very unusual ‘nailhead’ ray pattern found in non-sister taxa (starred in Fig. 1), might represent a singular apomorphy within the genus, such that it was truly homologous. This might occur if their common ancestor was polymorphic, and the ray pattern survived all the speciation and subspeciation events via incomplete lineage sorting. Or it could be due to introgression among *H. melpomene*, *H. elevatus*, and *H. timareta* from the upper Amazon region.

B&G caution: “the occurrence of hybrid *Heliconius* specimens does not *de facto* imply a viable conduit for interspecific gene flow”. However, all 15 or so species in this subgroup of *Heliconius* are very closely related and interfertile in captivity, and resulting F1 males and some F1 females are fertile (Jiggins *et al.*, 2001; Naisbit *et al.*, 2002; Mallet *et al.*, 2007; Rosser *et al.*, 2021). Occasional hybrids are also found in nature, for example between *H. ethilla* and *H. melpomene* (Ackery and Smiles, 1976; Dasmahapatra *et al.*, 2007). Female F1 individuals are usually sterile, but males can be backcrossed in almost any direction right across the subgroup (Gilbert, 2003; Mallet *et al.*, 2007), so that one can move alleles of colour pattern loci from one end of the *H. melpomene* group to the other (Mallet *et al.*, 2007).

Analyses of genomes of wild-caught individuals of many of these species also demonstrate that B&G are incorrect. The genomes of sympatrically occurring *H. melpomene*, and *H. cydno* or *H. timareta* (Martin *et al.*, 2013), as well of *H. elevatus* and *H. pardalinus* (Rosser *et al.*, 2024) show extensive evidence of interspecific gene flow across their entire genomes (see also below). Reversing the argument of B&G, since rare hybridisation can result over long periods in significant amounts of interspecific genetic interchange, we would further argue that absence of verified hybrids does not *de facto* imply that similar genetic exchange has not occurred.

B&G also argue that mimicry can parsimoniously explain colour pattern similarity, rather than introgression. However, the introgression hypothesis of colour patterns in the rayed mimicry ring requires the help of mimicry for the stability of introgressed variation; introgression and mimicry work together rather than being alternatives. Introgression will provide variation that can be employed in mimicry, rather than causing convergence in spite of mimicry.

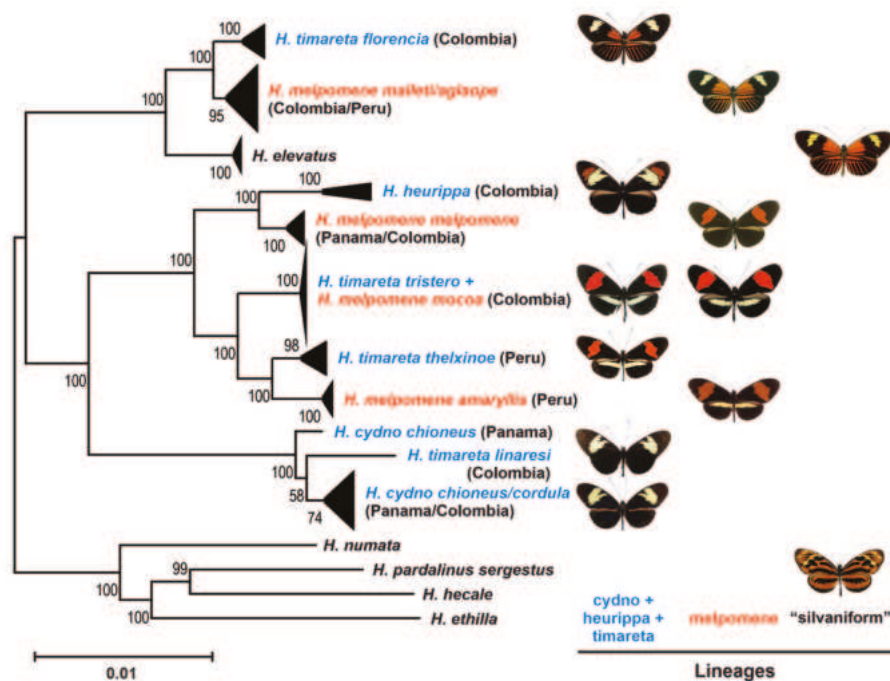
B&G are phylogenetic systematists, but it has long been recognized that a phylogenetic tree (cladogram) of species may differ from the trees (cladograms) of the genes within those species. One source of conflict among the gene trees could be ‘incomplete lineage sorting’ of gene trees due to polymorphisms in the ancestors of the two species. For example, although humans are clearly more closely related to chimpanzees than to gorillas, around 15% of the genes in humans show a closer relationship to gorillas – almost certainly due to incomplete lineage sorting in the common ancestor of all three (Burgess and Yang, 2008).

The other source of gene tree conflict could be that a gene was passed from another species via hybridisation, and is therefore more closely related to the homologous locus in that donor species than is the majority of the genome: this can also yield a different gene tree topology than the species tree topology. The ease of genome sequencing is now demonstrating that such gene flow between species is prevalent across the tree of life, with several excellent non-*Heliconius* examples, for example humans and Neanderthals (Green *et al.*, 2010). We have taken great pains to test evidence for gene flow between species against the null hypothesis (which would include incomplete lineage sorting). Much of this was based on regions of the genome that show highly deviant gene trees compared to the rest of the genome.

B&G question whether *H. heurippa* is a hybrid species. We agree that it is not; it's essentially just a geographic subspecies of a much more widespread species

(including *H. timareta* to the south of its range) (Edelman and Mallet, 2021; Rosser *et al.*, 2024). However, there is good evidence from gene trees in a colour patterning region that *H. heurippa* got its red forewing band by introgression from *H. melpomene* (Salazar *et al.*, 2010, and see Fig. 2 below), contrary to assertions by B&G.

Contrary to B&G's implications, we do not use introgression “as an *a priori* framework for interpreting the evidence, rather than a hypothesis to be tested by it”. B&G gravely misunderstand the inherent hypothesis-testing frameworks we use. As soon as next-generation sequencing became feasible (*Heliconius* Genome Consortium, 2012), we could readily test whether colour patterns from the rayed *H. timareta florenciana*, and the red-banded ‘postman pattern’ *H. timareta thelxinoe* (then unnamed and labelled “*H. timareta* ssp. nov.”) showed gene tree evidence for gene flow with *H. melpomene*. B&G argue that “homoplastic nucleotide sites abound within every gene ... so far examined”, and that “a parsimonious explanation for homoplasy is simply evolutionary noise”. However, we are not talking about a handful of homoplastic sites here; we are talking about hundreds of sites in our *D*-statistics analyses of colour pattern regions that all point to the same conclusion. This method requires testing for the presence of shared derived substitutions in non-sister species, and comparing with a null distribution of shared derived substitutions expected with what B&G call “random homoplasy,” or incomplete lineage sorting. The hundreds of derived substitutions (ABBA/BABA sites) pointing towards introgression between local pairs of postman *H. melpomene* and *H. timareta*, as well between rayed *H. melpomene* and *H. timareta* (see *Heliconius* Genome Consortium, 2012: their Fig. 4a–c) thus provide highly convincing evidence against the null hypothesis of no introgression. Clearly, introgression produced some of the close similarity in those colour pattern-determining regions of the genome, and not merely completely independent, homoplasious mimicry evolution.



**Fig 2. Phylogenetic analysis of a genomic region near the colour pattern gene, *optix*.** Maximum likelihood analysis of a 21 kb section of the genome (Hmel218003:758703–784954) within the ~50 kb *cis*-regulatory region of *optix* (compare Fig. 4 of *Heliconius* Genome Consortium, 2012). Note the clades containing locally co-occurring races of *H. melpomene* (red) and *H. timareta*/*H. heurippa*/*H. cydno* (blue), and the placement of the ‘silvaniform’ species *H. elevatus* with other co-mimetic taxa of the same ‘rayed’ mimicry ring. Maximum likelihood and parsimony trees of these regions showing the individual branches and accession numbers, as well as a tree based on 10 Mb of chromosome 3 showing species relationships can be seen at [https://github.com/kanchond/Brower\\_rebuttal\\_Antenna\\_2025](https://github.com/kanchond/Brower_rebuttal_Antenna_2025).

It must seem odd to the reader that two cladists, who supposedly believe in maximum parsimony-based tree-building, here oppose a tree-based analysis that demonstrates introgression! ABBA-BABA sites and D-statistics depend strongly on a tree-based approach to polarise derived sites. To demonstrate what we mean, let’s construct a tree from within the *optix cis*-regulatory region (Fig. 2), known to be involved strongly in *H. melpomene* with red patterning elements, particularly the rayed pattern (yellow forewing band, with red forewing ‘dennis’ patch and hindwing rays), and the so-called postman pattern (red forewing band). As is evident from Fig. 2, geographically overlapping subspecies of *H. melpomene* and *H. timareta* up and down the Andes universally share this 20.6 kb region of DNA within an important colour pattern switch locus. Similar evidence is shown for a 50 kb region of this same switch locus, albeit with fewer pairs of sympatric taxa (*Heliconius* Genome Consortium, 2012), their Fig. 4).

Thus, although it seems to B&G “that it would be quite remarkable for wing pattern alleles to defy selection for both mate preference and mimicry, and slip across a species boundary even once,” on the basis of homology of these regulatory regions between local colour pattern races of *H. melpomene* and *H. timareta*, we can indeed declare an even more remarkable result: “perhaps five or six independent introgression events” have taken place in different locations. Note that the ‘postman-patterned’ *H. timareta tristero* in Mocoa, Colombia, and the postman-patterned *H. timareta thelxinoe* from near Tarapoto, Peru, both apparently obtained their similar colour patterns not from one another, but from the local *H. melpomene* postman subspecies that they currently mimic in sympatry. This should not be a surprise, however, as we know from at least two of these overlap zones that hybrids are rather common in nature: for *H. timareta thelxinoe* and *H. melpomene amaryllis* in Peru, 0.6% of specimens are putative F1 hybrids

(Mérot *et al.*, 2013), and there is evidence on many chromosomes across the genome for low rates of introgression (*Heliconius* Genome Consortium 2012): their Fig. 3b; see also (Martin *et al.*, 2013)); for *H. timareta florenciae* and local *H. melpomene malleti* in Colombia, 3.5% are putative hybrids (Giraldo *et al.*, 2008). Given that hybridisation is ongoing, the phylogenetic evidence that a locus involved in assortative mating was introgressed across the *H. melpomene*/*H. timareta* species boundary (Rossi *et al.*, 2024) also seems much more likely to us than to B&G.

### The hybrid species status of *Heliconius elevatus*

B&G then attempt to cast doubt on our result showing hybrid speciation of *H. elevatus* (Rosser *et al.*, 2024). Given B&G’s scatter-gun criticisms of the possibility of hybridisation, in the interests of brevity, we focus on their major points. Our data show that *H. elevatus* is indeed a hybrid between a *H. pardalinus*-like ancestral species with a small, ~1% genomic contribution from *H. melpomene*. Since all three species are stably sympatric across a huge area of the southern and western Amazon rainforest, in spite of occasional hybridisation, all three are also clearly species in their own right (Rosser *et al.*, 2024). Critically for the demonstration of hybrid speciation, this small contribution from *H. melpomene* is non-randomly distributed across the genome of *H. elevatus* and associated with multiple traits involved in pre- and postzygotic reproductive isolation. This includes not just colour patterns, but also male sex pheromones, mate preference, host plant preference, wing shape and flight characteristics.

B&G go on to say “scrutiny of Rosser *et al.*’s Fig. 1c and Suppl. Fig. 2 shows that for 97% of the genome windows, Amazonian *H. pardalinus* and *H. elevatus* races are more closely related to one another than they are to either *H. pardalinus sergestus* from the Huallaga Valley in Peru, or *H. elevatus bari/tumatumari* from the Guianas (where *H. pardalinus* does not occur).” B&G did not really have to ‘scrutinise’ our

figures very carefully, because those were indeed our own conclusions in the published paper! Although *H. elevatus* and *H. pardalinus* overlap stably in sympatry, they do still hybridise occasionally (Mallet *et al.*, 2007). Since Amazonian populations of the species have continued to exchange genes, the genomes of some individuals contain long runs of ancestry heterozygosity with the other species. *Heliconius elevatus* and *H. pardalinus* even share local fluctuations in SNP allele frequencies, as shown by  $f_4$  statistics (Rosser *et al.*, 2024: their Figs. 2a,b and Extended Data Fig. 3).

B&G’s next criticism is: “implausibly, Rosser *et al.*’s Fig. 1e implies that introgression occurred between distantly allopatric populations of *H. pardalinus* and *H. melpomene* to produce the Guianan *H. elevatus bari*.” However, we used the allopatric populations of both *H. pardalinus* in the Andes, and *H. elevatus* in the Guianas to avoid interference from the abundant ongoing gene flow among Amazonian *H. pardalinus* and *H. elevatus*. But the evidence of the *melpomene/pardalinus* hybrid status is similar whether we use sympatric or allopatric populations (*Heliconius* Genome

Consortium, 2012), presumably because it clearly happened ~200,000 years ago (Rosser *et al.*, 2024). As B&G state in passing, this is comparable to the age of the split between *H. melpomene* and *H. timareta*/*H. cydno*, as well as the splits between the component subspecies of *H. melpomene*, and so much geographic redistribution is likely since then.

### Summary and conclusion

Once again, Brower and Garzón-Orduña criticize the majority of their fellow students of the butterfly genus *Heliconius*, especially the current authors. Once again, they fail to provide any new data or even reanalyses of the copious data we have painstakingly collected. Instead, they rely on their instinct that our conclusions are wrong. We wonder whether B&G’s extreme scepticism towards any suggestion that hybridisation or introgression has any evolutionary importance perhaps stems from a strong prior belief as parsimony-promoting cladists: that evolution of species is tree-like rather than net-like.

In the course of their argument, B&G accuse us of being unscientific by accepting our preferred hypothesis too easily:

“evidence that is consistent with a hypothesis does not necessarily refute alternative hypotheses, and science does not proceed by ‘confirming’ one’s preferred theory.” Thank you, B&G, for letting us know about the proper way to do science! – except that we didn’t do what B&G said we did. We refuted alternative hypotheses via statistical tests.

B&G also reiterate a theme they have used earlier, by complaining about “the vastness of genomic data sets.” To our knowledge neither B nor G has ever generated or analysed any genomic dataset. Nonetheless, B&G accuse us, who do use and generate genomic datasets, of “pareidolia”, a word neither of us had previously heard of. After a quick visit to Wikipedia, we find that they think we have a psychological problem and that we erroneously perceive patterns in random data from our results. As we point out, our results are all tree based (e.g., Fig. 2) – do B&G, as cladists, seriously doubt the evidence from these well-supported trees we have found in the genome proving introgression?

Correspondence on this interesting debate is now closed

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# Featured Insect

## The necrophagous dung beetle *Canthon cyanellus*



*Canthon cyanellus* (male, emitting pheromones) (Photo: Dr. Alfonso Díaz Rojas)

**Mario Favila**  
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### A fascinating life

Living off dead bodies is a challenging yet fascinating way of life. Carrion is a temporary resource, rapidly losing its nutritional qualities. Consequently, a crucial trait of necrophagous animals is their ability to locate carcasses quickly. This capability is exemplified by the necrophagous beetle *Canthon cyanellus*, which belongs to the so-called dung beetles and is an insect inhabiting the tropical forests of the Americas. What is truly amazing is that these beetles form pair bonds for reproduction, a behaviour that surprisingly mirrors aspects of human relationships.

### Life on the edge: finding and securing resources

*Canthon cyanellus* detects the scent of a recently deceased small- to medium-sized animal with remarkable efficiency. Males and females meet at the food source and identify each other through chemical signals emitted by their cuticular compounds. While this interaction facilitates mate recognition, it does not guarantee pair bonding. Females are particularly selective, often rejecting potential partners. Competition is fierce at the food

source. The first-come, first-served rule applies strictly to dung beetles, with individuals of the same sex—especially males—engaging in intense battles over food balls. Theft of both food and mates is commonplace. Males exhibit unique behaviour to attract females: standing on their heads and rubbing their abdomens with their hind legs. This action releases pheromones from specialised glands in the abdominal sternites, signalling readiness to mate.

### The cooperative struggle: rolling and nesting

Once paired, the male and female roll a food ball to a suitable nesting site. The journey is fraught with challenges, including theft by competitors and attacks by predators like birds and ants, but *C. cyanellus* have a pair of pygidial glands that produce defensive compounds, repelling them. Upon reaching a secure location, the pair begins to make a superficial nesting place. The female divides the food ball into several brood balls, which will nourish the larvae. However, reproduction has its complications. Females possess a spermatheca, an internal structure capable of storing sperm from multiple males, resulting in intense sperm competition. To enhance their

chances of fertilisation, males adopt a strategy of repeated mating, thereby increasing the likelihood that their sperm will successfully fertilise the eggs.

### Chemical defences: protecting the offspring

During nesting, the offspring face threats, such as fungal infestations that can render the food of the brood balls unviable. *C. cyanellus* parents protect their progeny by coating brood balls with antifungal and antibacterial compounds derived from their exocrine glands and gut microbiome that avoid fungal and bacterial growth on the food. These substances have proven effective against various strains of pathogenic fungi, including those that pose significant challenges to agriculture.

### A future in dung beetle compounds

As pathogenic fungi increasingly resist existing antifungal agents, the chemical arsenal of dung beetles like *C. cyanellus* offers a promising avenue for scientific research. These natural compounds could inspire innovative solutions to pressing agricultural problems, underscoring these remarkable insects' ecological and biotechnological importance.

# Insects in the News

October to  
December 2024

Richard Harrington  
with the help of material from  
Stuart Reynolds, Hugh Loxdale,  
Linda Essex, Dafydd Lewis and  
Jes Bartlett



It's summer in Australia and if you live near Sydney, you may well have been deafened by cicadas. "It's been a phenomenal year for Greengrocer Cicada" (*Cyclochila australasiae*) according to Prof. David Emery as reported in *The Guardian*. They are said to be one of the loudest insects in the world. They have a yellow form known as the Yellow Monday. Also abundant have been Double Drummers (*Thopha saccata*), Black Princes (*Psaltoda plaga*), Razor Grinders (*Henicopsaltria eydouxii*), Redeyes (*Psaltoda moerens*) and Cherrynoses (*Macrotristria angularis*). Ripper names, mates.

There's been a good run of paleo stories. Sticking for a moment with cicadas, a paper by Ed Jarzembowski in *Science Advances*, featured in *Apple News*, explains that giant cicadas of the Palaeontinidae evolved increasingly powerful and efficient wings when birds first appeared, presumably in a predator-prey arms race, or should that be wings race? *Apple News* also informed us that a team from the Chinese Academy of Sciences has revealed that the fireflies *Flammarionella hehaikuni* and *Protoluciola albertalleni* glowed when dinosaurs ruled Earth. They had different types of lantern, showing that by 100 MYA bioluminescence was well developed and diverse. *The National Tribune* reported that Australian researchers have

named a 16-million-year-old sawfly fossil, *Baladi warru*, which will help explain the evolution and distribution of the group. *The New York Times* told how Michele Francis of Stellenbosch University has determined by carbon dating that a termite mound along the banks of the Buffels River on the west coast of South Africa has been occupied for 34,000 years. From oldest to biggest, and *The Independent* says that scientists from Université Claude Bernard, Lyon, have reconstructed the head of possibly the largest bug ever to live, a 50 kg, 2.6 m arthropleuran with "the body of a millipede and head of a centipede".

Scientists at ICIPE, Kenya, have found that larvae of the Alphitobius Darkling Beetle (*Alphitobius diaperinus*) host bacteria that can break down plastic. *The Conversation* says that "this raises the possibility of isolating the bacteria, and the enzymes they produce, to create microbial solutions that will address plastic waste on a large scale". Also involving Kenya, *The Guardian* reports that Black Soldier Fly (*Hermetia illucens*) larvae are being used to break down food waste, the resulting frass being used as a fertiliser for land-based crops, and the protein-rich bodies to feed livestock and fish. Another larval microbe might also prove beneficial to humans according

to *The Independent*. The Cordyceps fungus, which infects lepidopterous larvae, could lead to a game-changing cancer drug, say scientists from Nottingham University. The chemical cordycepin can disrupt cell growth signals. Handle with care, though; this is the 'zombie fungus' from the American post-apocalyptic drama series *The Last of Us*.

Honey bees are struggling to get a decent night's sleep under city lights, says *The Daily Telegraph*. According to researchers at the University of California, San Diego, well-lit urban spaces disrupt the body clocks of pollinators and result in a less effective 'waggle dance'. I don't read it of course, but *The Oldie* magazine included an article by veteran broadcaster and environmentalist John Humphrys criticising the collapse of wildflower meadows and concomitant loss of bees. Felicity Muth of UC Davis has, says *Earth.com*, found that caffeine amps up the flower-visiting rate of bumble bees, and that some plants produce nectar laced with the drug. In *The Guardian* there was a bit of a hoo-ha over Defra's authorisation to use neonicotinoids in sugar beet. There are arguments on both sides which I won't delve into here. Help may be at hand, though. *Reuters* reported that Colombian scientists have developed a novel food supplement based on





Early Palaeontinidae, *Sinopalaeocossus fangi*, from the Middle Jurassic Daohugou Konservat-Lagerstätte, China (NIGP150277, deposited at Nanjing Institute of Geology and Palaeontology, CAS).

flavonoids to protect bees' brains from pesticides. It's not just pesticides that can harm bees. *The Independent* cited research from the University of Freiburg showing that they are also victims of nanoplastics and microplastics. Did you know that the Irish are smaller and hairier than other Europeans? The honey bee, that is. This honey bee ecotype is under threat of extinction according to scientists at the University of Galway, as reported in *The Irish Times*.

*The Conversation* reports a complex mathematical study from a Rothamsted colleague. Although male midges (*Chironomus riparius* in this case) move around in swarms, they do so in a way that ensures they keep their distance from each other. Staying evenly spaced means that there is less competition between males when females enter the swarm to mate, meaning that as a group they expend less energy and have more overall mating success.

Birds benefit from insects as food, of course. But on Nightingale Island, Tristan da Cunha, invasive scale insects are causing problems for Wilkins' Bunting (*Nesospiza wilkinsi*) by covering its food plant, Island Cape Myrtle (*Phyllica arborea*), in a honeydew on which sooty moulds grow. Release of a chalcidoid wasp, *Microterys nietneri*, that parasitises the scale, has helped save the birds from extinction, according to *The Guardian*.

"Insects have made life hell for oligarch's daughter who finds

them in her wine and eating her designer clothes." Oh dear! Our friends are getting a bad name again. This story ran in *The Daily Telegraph* and referred to a £36 million Victorian mansion in Notting Hill. The owners are suing the property developer (who apparently was a champion rower) for fraudulent misrepresentation. I wonder whether he's up the creek without a paddle. The moths were apparently attracted to the "trendy" wool insulation. What I want to know is what species they were.

Other news in brief. Two clearwing moths new to science and now named *Carmenta brachyclados* hitched a ride to Wales in a photographer's boot bag (*BBC*). Hawaii has introduced rules aimed at stopping the spread of Coconut Rhinoceros Beetle (*Oryctes rhinoceros*) (*The Guardian*). A tenfold increase since the early 2000s of a parasite is reducing the ability of Monarch (*Danaus plexippus*) butterflies to achieve their southward migration (*Phys.org*). The Horehound Plume Moth (*Wheeleria spilodactylus*) is thriving on Llandudno's Great Orme after an absence of more than 100 years (*North Wales Live*). The Great Silver Water Beetle (*Hydrophilus piceus*) has turned up in Dorset for the first time since 1821 (*The Daily Telegraph*). The Plane Lace Bug (*Corythucha ciliata*) from North America is posing a threat to the plane trees that line London's streets and parks (*The Daily Telegraph*).

Spread of the bee-killing Yellow-legged Hornet (*Vespa velutina*) in the UK has been halted by rapid nest eradication responses by the government's National Bee Unit (*The Guardian*). The position, shape and connections of every single one of the 130,000 brain cells in *Drosophila melanogaster* have been identified and will open up avenues for understanding human brains (*BBC*). Malaria cases in Britain are at a two-decade high (*The Daily Telegraph*). Eighteen species of insect from 12 families in three orders found in 19 illegally killed rhinoceroses in South Africa show the potential for forensic detection of poachers (*MSN*, citing a paper from our very own *Medical and Veterinary Entomology*).

It was nice to see the RES, and David Simcox in particular, mentioned in *The Observer*. The Large Blue (*Phengaris arion*) conservation project features as one of the paper's top five conservation success stories. The paper recommends a visit to Daneway Banks.

Let's end with a happy story involving a young entomologist and return to where we began – cicadas. *The Guardian* ran a piece on a 12-year-old Slovenian girl, Kristina Kenda, who hopes to save a project aimed at reintroducing the New Forest Cicada (*Cicadetta montana*) to, you guessed, the New Forest. British conservationists failed to find the cicadas in Slovenia, but Kristina has put traps out and will alert the team if any are found.

# EnTeam

## Ant Lab, North Carolina Museum of Natural Sciences, United States

Claire Price

Harper Adams University

After five years of absence from the magazine following the COVID-19 pandemic, the series of EnTeam articles is attempting a comeback with this introduction of an overseas entomological team. We are hoping that this will lead to more articles showcasing non-UK teams in the future, as even though this interview was conducted on Microsoft Teams and did not allow a proper visit, I still managed to get a good insight into what kind of research is taking place there. So, if any non-UK entomologists reading this article are interested in having their research featured in *Antenna*, please do get in touch!

Based at the Evolutionary Biology and Behaviour Research Lab in the North Carolina Museum of Natural Sciences (United States), better known as Ant Lab, this team is led by Dr Adrian Smith, who has a joint appointment with North Carolina State University (NCSU). Research here focuses on the behaviour, communication and natural history of insects and arthropods, and is conducted by Adrian himself alongside students from NCSU completing research projects as part of their degree.

The museum does not have an insect collection so the staff's

role there is research-based, together with some public-facing duties. Indeed, one of the particularities of this lab is that one of the walls is entirely made of glass from floor-to-ceiling, so the research team working there is on display at all times during opening hours – Adrian mentioned that even sitting in his office at the back of the lab talking to me on his computer, visitors craning their necks could potentially see him! With this set-up, museum visitors can watch the researchers do their work, and even come in to watch more closely and ask questions during special events when parts of the



Adrian Smith (Photo: Megan May).





Selena Ruzi (Photo: Adrian Smith).

lab are open to the public. The team members also have access to a lecture theatre in the museum where they can give short talks about their current research, which take place frequently.

When he is not giving talks, Adrian works on his own research projects. He started his research career working on ants with Walter R. Tschinkel, Emeritus Professor of Biological Science at Florida State University, for about three and a half years, all the way through his degree. Before this opportunity came up, Adrian confesses that he had no idea that a career studying insects was a possibility as he had never met an entomologist before. This is something that I (and a lot of other people I suspect) can relate to, having myself only discovered entomological research during my biology undergraduate studies. Adrian's interest in entomology grew from this first experience, realising what working with insects entails and why people would work with insects in the first place. After his first degree he continued to work on ants as a postgraduate conducting behavioural studies, saying that he was interested in understanding what they are doing and why. "There are so many different questions and answers, it is quite a diverse group of insects and there are so many

interesting adaptations and behaviours you can study" he concludes.

An integral part of Adrian's research involves capturing videos of the organisms he studies, which he uses to extract illustrative figures and include as supplementary material in his published work. Adrian also uses these data to produce videos for his YouTube channel, Ant Lab. It started more than a decade ago as a platform for Adrian to publish video summaries of scientific articles that he or his colleagues have published and that would be tied to institutional press releases. Since then, it has grown into a way of educating members of the public about insect and arthropod biology in a more engaging and accessible way than a peer-reviewed paper can. Latest videos include slow-motion capture of the jumping and flying behaviour of a wide variety of orders and species. Students will sometimes help with the filming, but the editing, post-production, writing of the script and publishing will be done by Adrian himself.

A recent study subject for Adrian that is very different from ants is the globular springtail, which he started studying out of curiosity before the COVID-19 pandemic. During lockdown working from home, he had the opportunity to collect them from

his own back garden and tackle the physical challenge of filming them, which he discovered when looking at the literature, had never been done before. "It was just a process of discovery, of what these things are, as springtails were totally outside of my expertise. The challenge of filming them was exciting and interesting. There are very few papers that attempt to even visualise what those organisms are doing, because they are so small and so fast. It's on such a hugely different scale than what is easy for us to see and to describe". The lack of knowledge of springtail biology in the literature motivated Adrian to keep working with them and publish his findings, both as a story to tell about our local biodiversity during public-facing talks at the museum, and a story that can be a scientifically useful scholarly contribution. "Springtails really hit that sweet spot for me. It was so great to work on them, they checked all the boxes for the type of science I want to do". In a video he posted on his YouTube channel and a peer-reviewed paper published earlier this year, Adrian describes the jumping behaviour of the globular springtail *Dicyrtomina minuta*, which uses its furca, a serrated jumping appendage located under its abdomen, to propel itself off the ground at record

speed when scared off (1.7 milliseconds, or about 100x faster than the blink of an eye). Although being about 1 mm tall when resting on their legs, they can jump up to 60 mm in the air while constantly doing backflips. In a majority of cases, upon landing, springtails are able to quickly get themselves back onto their feet by using a colophore, a sticky two-part appendage also located under their abdomen and usually retracted inside their body, that they use to catch the surface as they first touch the ground to avoid bouncing back up into the air (Smith & Harrison, 2024; Smith, 2024).

Besides his own work, Adrian is an advisor on various student and post-doctoral projects. Current research includes the work of Dr Selena Ruzi, who has a PhD in ant ecology and is now working on a social science post-doctoral project. For the last two years, with help from Adrian and another researcher, she created a set of science story videos about a fictional new species of ant. This was followed by a series of surveys for members of the public to fill out to give their opinions on how they perceived the science being communicated, or the communicators themselves depending on how close to the research they were: a scientist presenting their own research, a

third-party summarising the research, or an infographic video without a presenter. She found that people evaluated the presenter as being more trustworthy and having more expertise when they were describing their own research instead of acting as a third-party, and that seeing a scientist onscreen made the research more human compared to a video without a presenter. With these findings, she and her co-authors are hoping to find effective science communication methods to increase the trust of the audience in the science presented in the video (Ruzi *et al.*, 2021). The publication of two additional peer-reviewed papers is currently underway.

Nicolás Galvez, a long-term undergraduate research student, is working on a behavioural and bio-mechanics project on cockroaches, looking at how they jump when faced with different obstacles such as gaps using a fluttery flight. Cockroaches are well-known pest insects of homes that we all dread seeing crawling across the floor of our house. However, this is not their only way of moving around! This project came about when Adrian discovered a 2012 peer-reviewed paper describing for the first time a South African species of wingless jumping cockroaches, *Saltoblattella montistabularis*,

which possesses grasshopper-like hindlegs enabling it to jump (Picker *et al.*, 2012). The article states that no other species of cockroach are known to use this mode of locomotion. This inspired Adrian and Nicolás to film other species of cockroach, and they were able to show that common pest species such as the German Cockroach (*Blattella germanica*), the Smokybrown Cockroach (*Periplaneta fuliginosa*) and the American Cockroach (*Periplaneta americana*) are all able to jump across gaps in a different way from *S. montistabularis*, being that the middle legs are the ones that initially power the jump instead of the hindlegs, which are dragged up and forward as the jumping motion has already started, sometimes using their wings to help. This unique footage can be seen in a video available on the Ant Lab channel (Smith, 2022).

Finally, a graduate student, Henry Adamson, recently started a descriptive behavioural project on Psyllids, also known as jumping plant lice, with ecology and predator-prey components. He will be investigating escape behaviour across different species when faced with a predator, and whether laboratory observations are comparable to how they would behave in the wild.

I want to thank Adrian for taking the time to talk to me about the research his students and himself are conducting at the museum. Make sure to check out his YouTube channel @AntLab to see fascinating videos of insects and other arthropods in action!



Henry Adamson (Photo: Adrian Smith).

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# External Meeting



*Parnassius apollo* (Photo: Martin Partridge)

## Saving the apollos and their allies: An online conference

**N. Mark Collins and  
Martin G. Partridge**

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In June 2024, we organised an online conference to draw international attention to the lesser-known swallowtail butterflies in the monotypic subfamily Baroniinae (*Baronia* of Mexico) and the eight genera belonging to the subfamily Parnassiinae (apollos and their allies) (SBBT, 2024). This was a challenging topic to choose, with researchers and conservationists relatively few and far between. Nevertheless, in addition to a welcome presentation and an introductory overview, nine international video presentations were secured in time for *World Swallowtail Day* on 8<sup>th</sup> June and launched on the Swallowtail and Birdwing Butterfly Trust's (SBBT) YouTube channel. This article summarises the presentations to build interest in the ecology and conservation of these often-threatened butterflies and to draw attention to the excellent research being conducted around the globe.

The conference followed a pioneering online event held in 2021, where 15 speakers shared their firsthand experiences in grassroots swallowtail conservation and research – protecting habitats and food plants, preventing commercial exploitation, planning conservation strategies, advocating for change, and educating young people. Most species discussed in that first event belonged to the subfamily Papilioninae, from the tribes Leptocircini and Troidini, which includes *Parides* and the birdwings, and their allies, and the Papilionini, the so-called 'true' swallowtails in the much-divided genus *Papilio*. The talks remain available online and are summarised in an earlier report in *Antenna* (Collins, 2021).

Many rare papilionids are confined to small islands where agriculture and deforestation threaten tiny areas of remaining habitat (Collins & Morris, 1985). As

we shall see from the data gathered during this conference, the Parnassiinae are not denizens of islands, at least not islands surrounded by sea, but they often do inhabit the equivalent of islands, confined to isolated forests, valleys or mountains surrounded by vast continents in the northern hemisphere. This makes them vulnerable to the localised floods, droughts, landslides and forest fires that all too often result from climate change. Over time, many will be forced to retreat, together with their foodplants, to more northerly latitudes or higher altitudes, assuming suitable habitat is available for them.

Commercial collecting has long been another problem for the apollos and their allies, and it remains so today despite the work of the Convention on International Trade in Endangered Species (CITES), which listed *Parnassius apollo* in Appendix II as long ago as 1977. Many



*Parnassius stubbendorfi* (Photo: Mike Friel)

parnassians sell for significant sums on the international market – money that would generally be better spent on research and conservation.

Below are short summaries of the presentations, but they are no substitute for the talks themselves, which are of excellent quality. Many of them discuss poorly studied species and habitats, often in rugged, hard-to-reach locations. They are a tribute to the perseverance and conscientiousness of our swallowtail conservation and research community and show us the way forward for future research and action.

### **Diversity and geography of the apollos and their allies, by Dr Dick Vane-Wright, University of Kent and the Natural History Museum London, UK**

This talk provides an overview of the evolutionary history and global distribution of the Papilionidae. The speaker relates how this family, which originated in the mid-Cretaceous, some 100 million years ago, shows an overall latitudinal diversity pattern, with species richness highest near the equator and declining at higher latitudes, both north and south of the Equator (Scriber, 1973). Dick discusses the

significance of butterfly–plant relations, questioning if butterflies coevolved with flowering plants or merely radiated onto them as a pre-existing resource (Condamine *et al.*, 2018). He highlights the challenge of extinction in a biogeographical context, stressing the importance of conservation and the need to prevent the loss of these ecologically important insects through human activities. He introduces the subfamilies Baroniinae (now only represented by the monotypic Mexican endemic, *Baronia*) (Marino *et al.*, 2023) and the Parnassiinae, which are entirely confined to the Northern Hemisphere. The latter comprise the numerous apollos (genus *Parnassius*) found in temperate North America and Eurasia, and seven much smaller, exclusively Old World genera: the western *Zerynthia*, *Archon*, *Allancastris* and *Hypermnestra*, and the eastern *Sericinus*, *Luehdorfia* and *Bhutanitis*.

### **Phylogenomics of Parnassiinae, by Noémie Hévin, CNRS, Montpellier, France**

The speaker focuses on her research on the phylogenomics and diversification of the Parnassiinae, particularly exploring their evolutionary history

using genomic data. The subfamily includes eight genera and upwards of 70 species (Nazari *et al.*, 2007), with *Parnassius* being the most diverse. In most cases, the larvae are specialists on toxic host plants, particularly *Aristolochia* and other genera in the Aristolochiaceae, but *Hypermnestra* favours the Zygophyllaceae, while *Parnassius* species feed on Papaveraceae and Crassulaceae. Parnassiines are remarkable for their adaptation to high-altitude environments, particularly around the Tibetan plateau and the Himalayas. Hévin's study focuses on reconstructing a comprehensive phylogeny of these butterflies using both short-read Illumina and long-read Nanopore sequencing methods. So far, her team has collected 400 specimens and sequenced five high-quality reference genomes and 140 short-read genomes. Preliminary phylogenetic trees, based on mitochondrial and nuclear genomes, offer some insights into species relationships and possible cryptic species within the group. The study aims to refine the understanding of species boundaries and contribute to conservation efforts, particularly as some species face clear threats from climate change.

**Population dynamics of alpine *Parnassius smintheus* butterflies, by Prof. Jens Roland, University of Alberta, Canada**

Prof. Roland presents his long-term study on the population dynamics of Alpine *Parnassius smintheus* butterflies in the Rocky Mountains of Canada, focusing on habitat fragmentation and climate change impacts (Roland & Matter, 2007). The research, spanning 29 years, in collaboration with Drs Steve Matter (University of Cincinnati) and Nusha Keyghobadi (Western University), has involved over 24,000 individual butterflies from 21 subpopulations. Roland highlighted how rising treelines due to climate warming reduce connectivity among butterfly populations, limiting dispersal and gene flow. Mark-recapture methods revealed that forests hinder movement more than do open meadows, potentially increasing the risk of local extinctions due to reduced recolonisation. Additionally, he explored the influence of weather, particularly winter conditions, on population change. Using models and machine learning, his team found that November temperatures and winter snowfall are key survival indicators. A seven-year experiment confirmed that snow cover influences egg survival, significantly impacting populations (Roland & Matter, 2016). Overall, Roland's findings emphasise the critical role of habitat connectivity and winter weather in butterfly population dynamics amidst a changing alpine environment.

**Metapopulation context in Apollo butterfly conservation – a case from the Pieniny National Park, by Pawel Adamski, Institute of Nature Conservation, Poland**

The speaker discusses his 50-year project to restore Apollo butterfly populations in Poland's Pieniny National Park. He highlights the importance of metapopulation dynamics for this species, which thrives in mountainous habitats. Due to climate change and land-use shifts, suitable areas for the butterflies have drastically shrunk in size and become fragmented. By the early 1990s, the population dwindled to just 30 individuals. A restoration programme began in



*Bhutanitis lidderdalii* (Photo: Sonam Dorji)

1992, aiming to restore Apollo populations to levels seen in the 1950s and 1960s. The effort involved improving habitat structure and reintroducing interpopulation movement to maintain genetic diversity and dispersal (Adamski & Witkowski, 2007). Key challenges included reversing behavioural changes that reduced migration tendencies. The project saw success by introducing individuals from other viable populations, which re-established migration behaviour. The author emphasises that conservation efforts must consider both habitat restoration and behavioural mechanisms if species like the Apollo butterfly are to thrive (Adamski & Ćmiel, 2022).

**Challenges and limitations in managing the Apollo butterfly in Mediterranean habitats, by Joaquin Baxeras, University of Valencia, Spain**

The speaker discusses the conservation of *Parnassius*

*apollo*, the Apollo butterfly, in Mediterranean habitats, particularly at high altitudes around Valencia in Spain. This butterfly has been protected since the 1930s and is classified as vulnerable in regional and international conservation assessments. The presentation highlights the distribution, biology and conservation challenges faced by the species, emphasising threats such as habitat loss, pollution and climate change, which impact its food plants and reproductive cycles. Conservation efforts, including population monitoring and reintroduction programmes, have been implemented to restore populations. The speaker concludes by stressing the need for ongoing research and habitat management to support the butterfly's recovery and lifecycle, highlighting the importance of nectar availability and the removal of competing vegetation (Nakonieczny *et al.*, 2007).

**On the Edge: *Archon*, *Allancastria* and *Zerynthia* in Eastern Europe, by Dr Michael de Courcy Williams, Independent Entomologist, Greece**

The speaker focuses on the diversity and ecology of three butterfly genera: *Archon*, the False Apollo, and *Allancastria* and *Zerynthia*, the festoons, all of which have striking colour patterns, and many of which are narrowly endemic, with limited geographical distribution across Europe and the Middle East (von Stetten & Bozano, 2021). The talk explores their evolutionary relationships through phylogenetic analysis based on genetic sequencing. Dr de Courcy Williams also delves into their ecological significance, particularly their reliance on *Aristolochia* plants as food sources. He describes the unique pollination mechanism of these foodplants, which attract specific fly species using mimics of alarm pheromones produced by insects attacked by other insect

predators (Oelschlägel *et al.*, 2014). The talk concludes by addressing conservation concerns, particularly the threats posed by habitat loss due to wildfires, exemplified by the devastating fire in Greece in 2023, which severely impacted the habitats and populations of *Archon apollinus*, *Allancastria cerysi* and *Zerynthia polyzena*.

***Bhutanitis* in China – conservation and challenges, by Dr Shao-Ji Hu, Yunnan University, China**

The butterfly genus *Bhutanitis* demonstrates and exemplifies Sino-Himalayan biodiversity, being distributed across China, India, Bhutan, Nepal and Thailand, with distinct populations affected by habitat degradation and extinction events, such as the 1983 forest fire in Thailand (von Stetten & Bozano, 2021). Four species exist in China, with their habitats primarily in medium and low-altitude evergreen forests (Wu and Hsu, 2017). Despite their national protection since 1989, illegal collecting and habitat loss due to agriculture and construction pose significant threats. Climate change exacerbates these issues, isolating populations and limiting genetic diversity (Hu *et al.*, 2019). Although conservation efforts have improved the appreciation of *Bhutanitis*, challenges remain,

including the need for further research on genetic diversity, human impact, and ecological resilience to climate change (Wang *et al.*, 2020). Effective conservation strategies must involve local communities and address sustainable collection practices to protect these vulnerable species from ongoing threats.

**The Ecology and Conservation of *Parnassius*, *Luehdorfia* and *Sericinus* in Japan, by Motoki Saito, Butterfly Society of Japan**

The speaker, a TV journalist and long-term butterfly enthusiast, discusses the ecology and conservation of Japanese parnassiine butterflies, focusing on the genera *Parnassius*, *Luehdorfia* and *Sericinus* (Park *et al.*, 2023). He provides a brief overview of Japan's diverse butterfly species, highlighting the country's rich biodiversity due to its varying climate. He details the three *Parnassius* species (Nagata, 2024), emphasising their unique wing patterns and their abundance, requiring no conservation efforts. Saito introduces *Luehdorfia* and its two species, *L. japonica*, endemic to Honshu, Japan, and *L. puziloi*, introduced from Korea. Neither species is considered to be threatened. He focuses on two species that are in less happy circumstances, *Parnassius*



*Sericinus montella* (Photo: Mike Friel)

*eversmanni* and *Luehdorfia japonica*, detailing their limited distributions, life cycles, and threats from climate change and deer overpopulation (Suzuki *et al.*, 2023). Saito stresses the urgent need for comprehensive conservation efforts to protect these butterflies, citing habitat loss and ecological challenges. He concludes by inviting further engagement and exploration of Japan's extraordinary butterfly diversity.

***Baronia brevicornis*: ecology and conservation, by Prof. Jorge Contreras Garduño, ENES Morelia, UNAM, Mexico**

This talk focuses on research into *Baronia brevicornis*, an endangered butterfly inhabiting tropical dry forests in Mexico. The speaker highlights its intriguing biology, including colour variation in males and females, and its larvae, which feed on *Pithecellobium dulce* (Fabaceae). The pupae remain underground for up to two years, although fewer butterflies emerge in the second year compared to the first year (Galicía-Mendoza *et al.* 2021). The research examines *Baronia*'s immune memory, a phenomenon previously thought to exist only in vertebrates, showing that butterflies with immune memory had higher survival rates when challenged with pathogens. The study also monitored *Baronia* populations, finding that precipitation, not temperature, significantly affects butterfly emergence, with optimal emergence rates between 120

and 140 mm of rainfall. The talk also discusses yearly morph variation and ongoing conservation efforts. The speaker acknowledges the support of local communities, who have embraced the conservation of *Baronia* and assisted in long-term monitoring efforts. Future research will continue to explore immune responses and environmental factors influencing the butterfly's distribution.

**Conclusion**

The subject matter of the papers presented at this SBBT online conference extends across the entire range of the papilionid subfamilies Baroniinae and Parnassiinae, which are found only in the northern hemisphere. Life strategies for these species emphasise narrow foodplant and habitat preferences that can be very vulnerable to short-term change, such as climate warming and the consequences in terms of fire, drought, flood and ecological displacement. Fragmentation and isolation of habitats impact the genetic mixing required for healthy metapopulations and can even lead to altered behavioural traits, such as weakened ability to migrate, that render species more vulnerable to unpredictable change.

Engagement with local communities is a frequent theme, emphasising the importance of community involvement and education in building a strong base for conservation action, political support, national and international regulation, and the

prevention of unsustainable exploitation by unscrupulous collectors.

The success or failure of governments and civil society to safeguard the planet will decide the fate of many species, including our own. Describing the predicament of swallowtails, searching for solutions, and understanding and monitoring their interactions with the changing environment can help reveal and illustrate the bigger picture and the risks we face. Forty years ago, nobody saw climate change coming with such force. Who can predict where we, or these lovely butterflies, will be in another forty years?

**Acknowledgements**

In 1985, the Red Data Book *Threatened Swallowtail Butterflies of the World* (Collins & Morris, 1985) evaluated all 573 species of Papilionidae known at that time, found that one in ten was at risk, and followed up with an action plan (New & Collins, 1991). It was not until 2017 that the Swallowtail & Birdwing Butterfly Trust (SBBT) was formed to build networks of people and projects to promote a global movement for the protection of these beautiful insects. The trustees organised this second online conference voluntarily without external financial support. We thank all conference contributors for their dedication and determination to conserve butterflies such as these, often under very difficult and demanding conditions.

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# Society News



Planthopper nymph with the 'fibre optic' tail. (Photo: Weixiang Lee)

## Calling all insect researchers: Share your experience on ethical applications

The Royal Entomological Society is conducting a landmark survey to better understand current practices, challenges and experiences of UK researchers towards insect ethics applications.

Whether you currently submit ethics applications, voluntarily engage in the process, or do not submit applications at all, we want to hear from you.

Your insights are essential in identifying challenges and knowledge gaps and improving the support and resources available for the entomological research community.

The questionnaire explores:

- Current rates of ethics applications within the community
- Experiences with ethics applications (mandatory or voluntary)
- Attitudes toward ethical considerations in insect research
- Resources to help support researchers, students and their work

The survey takes approximately **15–35 minutes** to complete, and all responses are anonymous.

By sharing your experiences, you will contribute to a clearer understanding of current practices and help inform resources to better support researchers in navigating ethical considerations. Keep an eye out for these resources in future *Antenna* issues.

**Access the survey:**



<https://www.royensoc.co.uk/news/res-welfare-survey-2025/>



Winner of the 2012 RES photography competition: Hairy-footed Flower Bee, *Anthophora plumipes*, looking through the keyhole. (Photo: Anthony Cooper)

Deadline to participate: 1<sup>st</sup> April 2025.

For more information on the Royal Entomological Society's position on the ethical treatment of insects, please see our ethics statement (*Antenna* **48**(4), page 184).

**Thank you for contributing to this vital research.**



# News from Council

## Council Meeting

Council met online on 4<sup>th</sup> December (chaired by Past President Jane Hill, as the President was unavailable). New trustee, Hayley Jones, was welcomed.

## CEO's Report

CEO, Simon Ward, reported on his productive participation in the meeting of the African Association of Insect Scientists, held in Zambia, where he gave a presentation on the RES Grand Challenges in Entomology initiative as well as manning a stand promoting the Society. Simon updated trustees on progress with grant applications, partnerships and business development. A new children's book series to be published by DK is progressing well.

## 2025–2028 Strategic Implementation Plan

Following earlier discussions with trustees, ambitious initiatives were tabled by Simon under the following headline priorities:

- i) Support and advance the study and practice of insect science
- ii) Increase public understanding of insect science
- iii) Empower and support the entomological community
- iv) Focus on the Grand Challenges in Entomology

These initiatives will be refined before the next council meeting.

## ICE 2033

Simon updated trustees on the Society's bid to host ICE2033. He presented a paper describing the process for selecting the host city. It was suggested that bids from cities are presented and shortlisted by a panel who will then visit the sites before making a final selection. Trustees agreed the process and timeline for determining the host city and agreed to the formation of a panel. Trustees were invited to nominate themselves or others to be part of the panel.

## Health & Safety Statement and Policy

The updated Health & Safety Statement, which is refreshed annually, was tabled. There were no material changes from the previous year, and it was approved by trustees.

## Membership Subscription Fees

Director of Communications & Engagement, Luke Tilley, outlined proposed changes to RES membership pricing, including strategic alterations to improve engagement and accessibility. Council approved the changes, which will come into effect in January 2025.

## Committee and Finance Reports

Reports were tabled from the Publications, Meetings, EDI, Membership and Finance Committees. Director of Finance, Steven Lee, led trustees through the latest management accounts and risk register.

## HONOURS FOR THREE RES FELLOWS



It is a pleasure to report that **Professor Lin Field Hon. FRES**, who was RES President from 2008 to 2010, received a CBE in the King's New Year's Honours 'For services to protecting crops and the environment'. You can read about her work by looking at the Honorary Fellow Interview in *Antenna* 44(2) 76–79 (2020).



**Professor Rosemary Collier FRES** was awarded an OBE for her pioneering work in horticultural science. Rosemary has been involved with the RES for over forty years and is based at Warwick University.



**Laurence Mound Hon. FRES**, a globally renowned thripsologist, was appointed Officer of the Order of Australia in the Australia Day Honours in January, for services to entomology. The citation notes his contributions to the study of plant-feeding insects, including describing over 640 thrips species and 90 genera. Before moving to Australia, Laurence headed the Department of Entomology at the Natural History Museum, London, between 1981 and 1992. He helped organise the International Congresses of Entomology from 1976 to 1992.



# Library and Publications

## Royal Entomological Society Obligations Book (1833)

### Rose Pearson

RES Librarian and Archivist

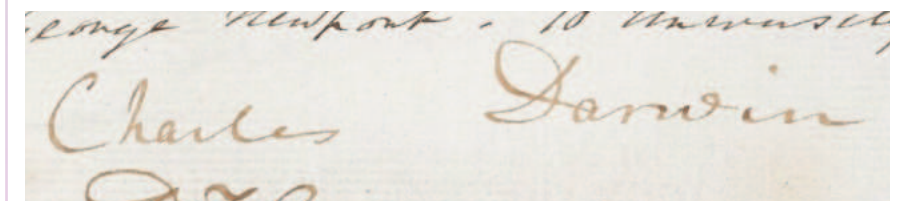
One item in our collections which offers a real sense of the history of the RES as a continually evolving entomological organisation is The Obligations Book, which was first signed by the founders of the Society in 1833 and remains a working document, still signed by Fellows today. The book was crafted to the highest standards of its time, with Morocco gilt binding and a rich blue watered silk lining. As they sign the book, Fellows read the 'Obligation' which gives the book its name, promising to attend meetings regularly, promote the aims of the Society, and abide by its rules.

One of the first pages includes an 1835 painting by John Obidiah Westwood (President, 1852–1853) who also illustrated a number of noteworthy early entomological works. The piece, titled 'Strength, Beauty and Vitality' depicts a Stag Beetle (*Lucanus cervus*), two butterflies – the Silver-studded Blue (*Plebejus argus*) and the Small Copper (*Lycaena phlaeas*) – and a honey bee (*Apis mellifera*). It also includes the twisted-winged fly *Stylops melittae*, which was depicted in the RES logo. Above the illustration is a stamped Royal Coat of arms and two signatures: those of Victoria, Duchess of Kent, and her daughter Princess Victoria, who was later to become Queen. Founding President J.R. Children personally assured the royals that "the same generous loyalty to rank and sex which is the grand characteristic of the economy of the hive, will ever be pre-eminent among the members of the Entomological Society".

Recognisable signatures from the early years include that of



'Strength, Beauty and Vitality' by J.O. Westwood, and two royal signatures.



Signature of Charles Darwin.





Queen Elizabeth II signs the book in 1985, observed by RES President Richard Southwood. Inset: 1985 illustration by Brian Hargreaves, featuring a variety of insects.

Charles Darwin (Vice-President, 1838). Unusually for learned societies at the time, women were eligible to be members on the same basis as men, and this page also includes the signature of our second female member, and the first woman member to sign the book. Mrs F.W. Hope (née Ellen Meredith), together with her husband, the then President, the Rev. F.W. Hope, built up a substantial collection of insects which today forms the basis of the Hope Entomological Collections in the Oxford University Museum of Natural History. Another notable signature is that of Alfred Russel Wallace (President, 1870–1871).

150 years after the first illustration, the themes of strength, beauty and vitality were echoed in two further illustrations

by RES Fellow and illustrator Brian Hargreaves. In addition to a beetle, the Garden Chafer (*Phyllopertha horticola*), a Dark Green Fritillary butterfly (*Speyeria aglaja*), a Buff-tailed Bumblebee (*Bombus terrestris*) and the twisted-wing fly *Stylops melittae*, the first illustration includes a 2-spot Ladybird (*Adalia bipunctata*), a Hummingbird Hawk-moth (*Macroglossum stellatarum*) and a Vapourer Moth caterpillar (*Orgyia antiqua*) as well as a Great Green Bush-cricket (*Tettigonia viridissima*); the second, smaller illustration features a Painted Lady butterfly (*Vanessa cardui*). That the Bumblebee is a queen is apt, as this page was also signed by Queen Elizabeth II, on Thursday 30<sup>th</sup> May 1985 at 'A reception to commemorate the Centenary of

the Granting of the Royal Charter' held at London Zoo.

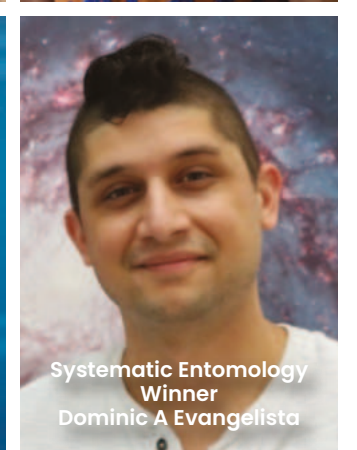
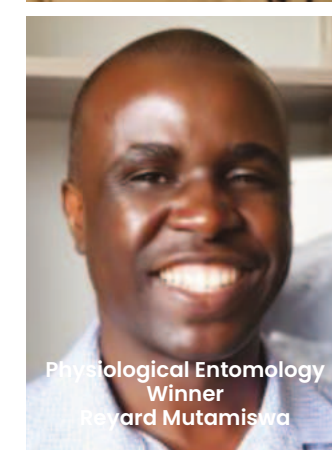
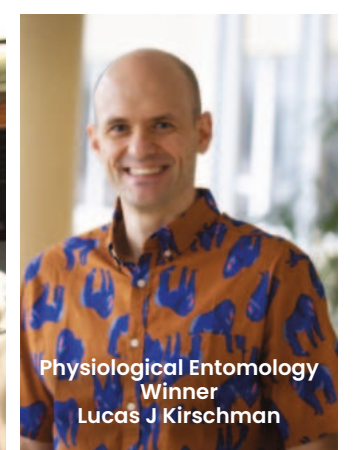
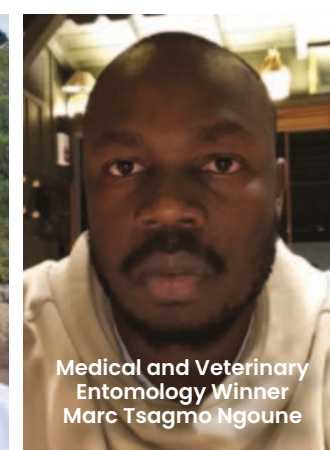
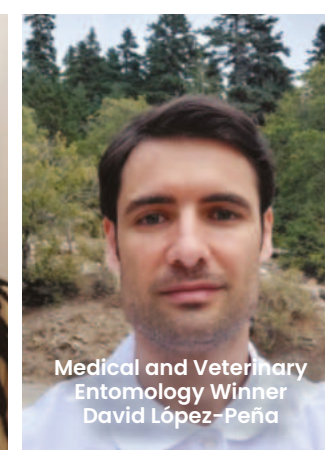
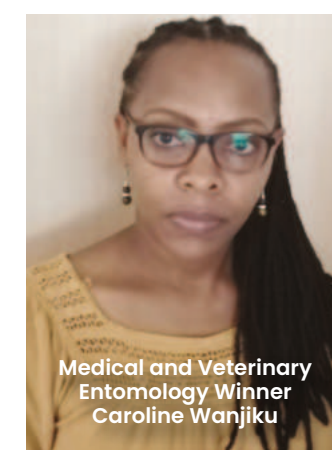
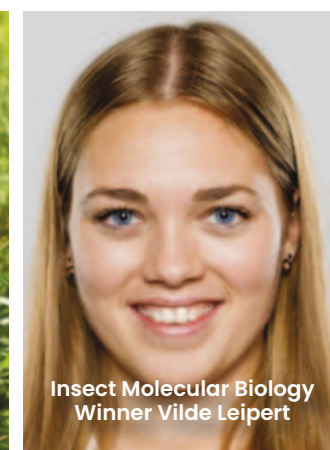
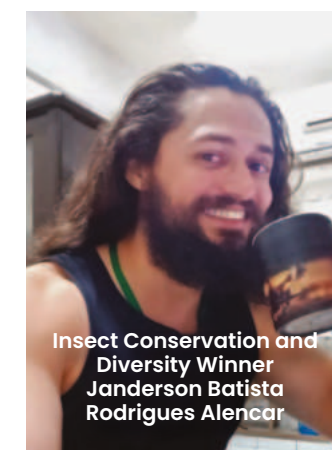
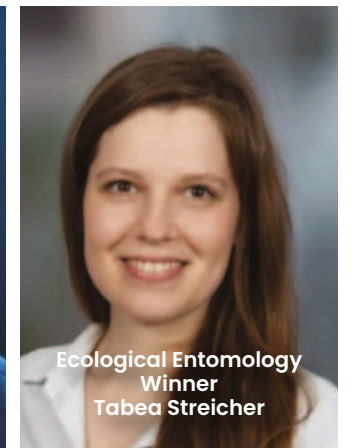
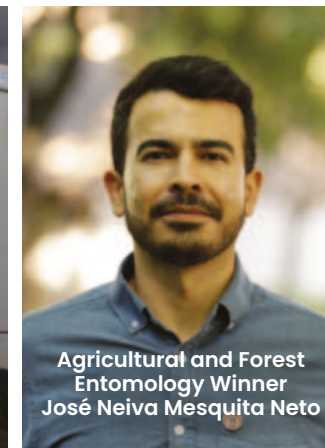
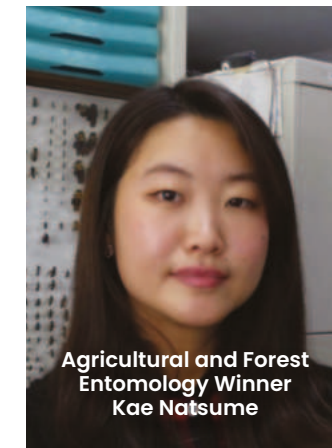
The book continues to be signed by Fellows to this day, who read a modified form of the Obligation before they sign. Recent signees include current President Jane Stout, who signed the book at Ento 2024 in Liverpool.

To help preserve the book and make it more accessible, it was recently digitised by Wiley Digital Archives and is available to view as part of their Environmental Science and History Collection.

If you would like to view the book, or if you are a Fellow who would like to sign the book, contact the Librarian at [library@royensoc.co.uk](mailto:library@royensoc.co.uk).

Thank you to Richard Harrington, Dave Simcox and Jim Hardie for help with the identification of the insects in the illustrations.

## RES Journals Early Career Entomologist Awards 2021-2023



The RES journals are delighted to announce the winners of the Royal Entomological Society Journal [Awards](#), given to the best articles led by an early career entomologist and published between 2021 and 2023. The winning researchers quite literally span the globe, representing countries from Japan to Canada, Norway to Brazil, India to Cameroon, and Germany to South Africa. It's fantastic to see that global insect science is thriving and our early career community is engaging in interesting and exciting research. Winners receive a cash prize, a year's free membership and a talk at Ento.

As well as the winning articles, Highly commended awards were given to Yevhen Suprunenko, Ana Laura Pietrantuono, Bin Jiang, Danielle Rutkowski, Cigdem Ün, Shao Xiong Chui, Kieran M. Boyd, Ellen Welti, Mahtab Yazdani, Mara Urdapilleta, Oswald Yedjinnavenan Djihinto and Ayumi Kudo.

See more information about all the [winners](#) and a [virtual collection](#).



[Winners](#)



[Virtual collection](#)

#### Agricultural and Forest Entomology



#### **Kae Natsume: 2022 winner for [Ants are effective pollinators of common buckwheat \*Fagopyrum esculentum\*](#)**

Kae is working towards completing her PhD at the University of Tokyo focusing on the capacity of ecosystems to sustain our livelihoods, such as pollination service to crops. She has been investigating whether diverse wild insect species provide complementary services for buckwheat and has found ants can make a significant contribution to buckwheat pollination in central Japan. Her paper illustrates that, although all types of pollinators are important, ants are still important pollinators in small-scale agricultural landscapes, along with other services they might provide such as pest control. The judges felt the paper was exceptionally well written and presented: the figures were particularly good examples of how to show results clearly; the findings were succinctly presented and discussed in the context of the vital role that pollinators play in food security.

#### **José Neiva Mesquita Neto: 2023 winner for [Native bees with floral sonication behaviour can achieve high-performance pollination of highbush blueberry in Chile](#)**

José is a South American scientist with a background in pollination ecology, and is currently Assistant Professor at the Universidad Católica del Maule (Chile). His research has focused on the study of pollination of native and cultivated plants. The winning article demonstrates for the first time that

native Chilean insects can effectively pollinate crops, specifically Chilean bees using buzz pollination on highbush blueberry flowers. Remarkably, some native bees outperformed managed honey bees, transferring 5.8 times more pollen, and revealing the previously unrecognised role of Chilean pollinators in improving yields for a globally significant crop. The judging panel noted that the paper is very well written and the figures, including one illustrating some of the study species, are a great example of how to draw the reader into finding out more about insect science.

#### Ecological Entomology



#### **Erez Buyukyilmaz: 2022 winner for [Developmental temperature predicts body size, flight, and pollen load in a widespread butterfly](#)**

Erez graduated with honours in biology from The University of British Columbia in 2021 and is currently working on crop pests in the private sector. In a novel approach, this paper demonstrated that butterflies reared in warmer temperatures were smaller and flew for a shorter time and distance. Smaller butterflies captured in the field also carried less pollen. Based on these conclusions, climate change could have profound impacts on butterfly and plant interactions. Judges called the paper "ambitious" and noted how it combined both lab and field components to test the direct effects of climate warming on the butterfly *Pieris rapae*, suggesting it likely has important implications for pollination services.

#### **Tabea Streicher: 2023 winner for [Experimental viral spillover can harm \*Bombus terrestris\* workers under field conditions](#)**

Tabea is a biologist at Baden-Württemberg's State Institute of Bee Research, at the University of Hohenheim, and works on bee health and resilience in the face of longstanding and novel environmental challenges. This paper addresses a timely and important ecological question: whether pathogen spillover from farmed honey bees is a risk to wild bees. Understanding this risk is vital, given the decline in wild pollinators in recent years. The study shows that although deformed wing virus (DWV) can cause disease in *B. terrestris*, the individual risks from DWV spillover during foraging on virus-contaminated flowers appear limited. The judging panel said the paper is clear and well written and covered an interesting and impactful question that furthers our understanding of pathogen spillover and pollinator decline.

#### Insect Conservation and Diversity



#### **Janderson Batista Rodrigues Alencar: 2022 winner for [Windthrows promote higher diversity of saproxylic beetles \(Coleoptera: Passalidae\) in a Central Amazon forest](#)**

Janderson holds a PhD in Entomology from the Instituto Nacional de Pesquisas da Amazônia (INPA). His research focuses on ecological communities, particularly the evolutionary and ecological outcomes for Amazonian insects. The winning paper investigates how windthrows in the Central Amazon affect saproxylic beetles and underlines the critical role of natural events in sustaining biodiversity within

tropical forests, crucial research given the expectation that climate change will increase extreme weather events. Judges awarded the prize for the study's experimental design, impressive sample sizes generated under challenging field conditions, exceptional taxonomic resolution, robust statistical analyses, and a well-written and thoughtful discussion about the factors that promote and maintain species diversity.

#### **Lindsey Kemmerling: 2023 winner for [Butterfly biodiversity increases with prairie strips and conservation management in row crop agriculture](#)**

Lindsey is currently a postdoctoral researcher at the University of Minnesota, and is interested in research that has application to support biodiversity and advance social equity. The research leading to this award tested how restoring habitat in row-crop agriculture using 'prairie strips' in conjunction with other conservation management practices can mitigate the loss of butterfly biodiversity, demonstrating that there is an urgent need to transform agricultural landscapes into multifunctional systems that meet human needs while mitigating biodiversity loss. The judges were impressed with the experimental study, and strong applied conservation angle, adding that it had a strong statistical analysis. The work also demonstrated the value of long term ecological research sites, especially in providing new experimental contexts for future research.

#### Insect Molecular Biology



#### **Vilde Leipert: 2022 winner for [Resolving the zinc binding capacity of honey bee vitellogenin and locating its putative binding sites](#)**

Vilde is a postdoctoral researcher at the Norwegian University of Life Sciences (NMBU), currently on a research stay at University College London (UCL). This research is an interdisciplinary approach to reveal a new outlook on how a protein works: vitellogenin (Vg). In honey bees, Vg is essential for reproduction, disease defence, lifespan regulation and nutrition and although it can be traced back 700 million years to the beginning of multicellular animal life, its molecular mechanisms remain poorly understood. The paper used artificial intelligence to predict protein structure alongside experimental data, unveiling new insights into Vg's diverse roles. The judges commented that the study stood out because of the elegant computational analyses of sequence data and protein structures combined with experimental data and the significant contributions of the first author as an early career researcher in this work.

#### **Jianfeng Qiu: 2023 winner for [Circadian clock regulates developmental time through ecdysone and juvenile hormones in \*Bombyx mori\*](#)**

Jianfeng Qiu is a teacher at Fujian Agriculture and Forestry University, Fuzhou, China. He and his coauthors evaluated hormonal biosynthesis and signalling after knocking out the core clock gene *Cryptochrome 1* (*Cry1<sup>-/-</sup>*) in the biological clock system of *Bombyx mori*. The results of this research provide important insights into the molecular mechanisms by which the circadian clock regulates

animal development by maintaining hormonal homeostasis. The judges selected the paper because the authors conducted a thorough study including gene expression analyses, hormone titre measurements, dissections of brain corpora allata complexes, and immunohistochemistry to observe hormones. They further noted that this study advances our understanding of how the circadian clock regulates the coordinated release of hormones during development.

#### Medical and Veterinary Entomology



#### **Caroline Wanjiku: 2021 winner for [Plant sugar feeding patterns of wild-caught \*Aedes aegypti\* from dengue endemic and non-endemic areas of Kenya](#)**

Caroline is currently a postdoctoral researcher at the KEMRI-Wellcome Trust Research Programme (KWTRP), Kilifi Kenya. This study used DNA barcoding to understand mosquito sugar feeding behaviours in arbovirus vectors of Kenya and found that *Ae. aegypti* feeds on diverse plants; sex and seasonality influences feeding rates; and that plant feeding results in the acquisition of a variety of important sugars. The judges noted that it "filled an important gap by exploring plant sugar composition in both male and female mosquitoes and across wet and dry seasons. The high diversity of sugars and host plant species found in mosquitoes has implications for the use of novel vector control tools. We chose this study because of the strong study design, the comprehensive methods employed and the author's ability to put the results into the broader context."

#### **David López-Peña: 2022 winner for [Environmental drivers of breeding sites in blackfly species of medical and veterinary importance in eastern Spain](#)**

David completed a PhD on simuliids of the rivers of the Valencian Autonomous Region at the University of Valencia. His postdoctoral research has focused on haematophagous adults, and the bioecology, distribution and diversity of pre-imaginal stages of blackfly. This study sampled six blackfly species of medical and veterinary importance in Spanish streams, evaluating the effect of biotic, abiotic, meteorological, and landscape variables on the distribution and abundance. These findings provide valuable insights for pest control strategies and emphasise the need for seasonal monitoring to better understand blackfly life cycles and ecological interactions. The judges chose this study because of the huge amount of data enabling appropriate and complex statistical analyses to determine the variables relevant to each species, adding that the paper was also very well written and the data presented with great care and finesse.

#### **Jean Marc Tsagmo Ngonne: 2023 winner for [Protein abundance in the midgut of wild tsetse flies \(\*Glossina palpalis palpalis\*\) naturally infected by \*Trypanosoma congolense\* s.l.](#)**

Jean Marc is a vector biologist/parasitologist by training, specialising in neglected tropical diseases, particularly host-parasite-symbiont interactions. His research career began in Cameroon, where he started



as an entomologist identifying and characterising the populations of mosquito vectors of malaria in different regions of the country. His research in the winning paper is an alternative approach to control Tsetse Flies' vector competence by describing factors involved in the transmission of African trypanosomes. The judges chose this study of field-collected flies for several reasons: the manuscript was very well written and engaging, with well presented data, and the topic of the research is extremely important given the severity of the disease and the instability of livestock farming in the areas where it is prevalent.

#### Physiological Entomology: How Insects Work - Linking Genotype to Phenotype



**Lucas J. Kirschman: 2022 winner for Immune function does not trade-off with reproductive effort in a semelparous wolf spider with parental care**

Lucas is an Assistant Professor in the Department of Biology at Southeast Missouri State University and is an ecological immunologist and physiological ecologist. His work has examined how environmental stressors, resource subsidies, and development influence these trade-offs in wild animal populations and laboratory models. This study provides insights into the relationship between reproductive effort and immune function in semelparous organisms. The judges awarded the prize to this article because it thoroughly investigated trade-offs between immune response and reproductive effort in *Tigrosa georgicola* (a semelparous wolf spider that provides parental care) and addressed a significant gap in the ecoimmunology of this species. It was selected because of its excellent writing style, convincing study design and carefully conducted methodology.

**Reyard Mutamiswa: 2023 winner for Thermal stress exposure of pupal Oriental Fruit Fly has strong and trait-specific consequences in adult flies**

Reyard is currently a Senior Lecturer in Entomology in the Department of Zoology and Entomology at Rhodes University, South Africa. His research interests lie in a range of themes surrounding terrestrial insects and their environmental adaptations to changing climates, including eco-physiology, tri-trophic interactions, invasive species, and sustainable pest management. This study documents the effects of juvenile thermal stress on adult Oriental Fruit Fly (*Bactrocera dorsalis*) fitness, a critical invasive pest affecting global agriculture, the results of which show they may have limited potential to shift ranges or thrive under heat stress. Judges said that the authors "nicely demonstrate that mild heat stress during the pupal stage compromises longevity and thermal tolerance in the adult stage. We selected this paper because of its unique approach to studying the consequences of thermal stress across developmental transitions, as well as its relevance to timely topics such as climate-induced range shifts and invasion biology."

#### Systematic Entomology



**Dominic A Evangelista: 2021 winner for Assessing support for Blaberoidea phylogeny suggests optimal locus quality**

Dominic is an evolutionary biologist interested in how biodiversity originates through evolutionary

processes, specialising in cockroach systematics and biodiversity, their importance in tropical ecosystems, and molecular tools for biodiversity monitoring. This study aimed to address the relationships among the families of Blaberoidea with genome-scale data, using a technique that targets hundreds of genes and sequences them all at once. The empirical results supported the creation of a new subfamily and a new tribe of cockroaches, in addition to resolving many relationships between the families. The judges called this phylogenomic study "impressive", noting its robust evolutionary hypothesis and how it went far beyond a standard set of modern phylogenomic analyses and provided insights into desirable properties of loci for phylogenomic inference that could be useful for studies beyond this particular taxonomic group.

**Mukta Joshi: 2022 winner for Delimiting continuity: Comparison of target enrichment and double digest restriction-site associated DNA sequencing for delineating admixing parapatric *Melitaea* butterflies**

Mukta's academic journey began in India and has been driven by a deep fascination for biodiversity and the evolutionary processes that generate and maintain it. Her doctoral research at the University of Oulu focused on resolving taxonomic challenges in different groups of butterflies and moths, employing genomic approaches to investigate species boundaries and relationships. This study focuses on the issue of delimitation of parapatric species by comparing two original genomic-scale datasets, a ddRAD and a target enrichment dataset, in their usefulness to resolve the relationships of two parapatric *Melitaea* butterfly species. The judges were delighted to award the prize for the article's carefully enacted methodology, insightful results and recommendations for the delimitation of species in parapatry, as well as its excellent writing style.

**Víctor Noguerales: 2023 winner for Image-based taxonomic classification of bulk insect biodiversity samples using deep learning and domain adaptation**

Víctor is particularly interested in grasshoppers and beetles from mountain and island ecosystems and is currently at the University of La Laguna (Tenerife) as a 'Viera & Clavijo' researcher, having studied and conducted internships in Spain, the U.K and U.S.A. He believes that "the increasing availability of global collections of standardised images and refined AI methods will facilitate the rapid and effective characterisation and monitoring of insect communities facing global change." Indeed, this research integrated high-resolution images and machine learning to assess the efficiency of domain adaptation to the family-level identification of beetle specimens from bulk insect samples from unknown communities. The judges chose the article due to its innovative study design and methodology, and its contributions to the field of biodiversity research.



## RES Insect Identification Handbooks – expanding our reach

Emilie Aimé

Director of Publishing

The RES Handbooks (<https://www.royensoc.co.uk/publications/handbooks/>) are an established, well-respected series of insect identification guides which have been published since 1949. We have recently partnered with CABI as our publisher, and we have some exciting plans for the future of the series. We are keen to ensure that the handbooks continue to serve our community and all insect taxonomists.

#### Expanded scope

Our handbooks have always offered authoritative identification keys across insect taxa, but have traditionally been restricted to groups found in the UK, hence the name *RES Handbooks for the Identification of British Insects*. After discussion with our editorial board and the RES Publications Committee we have decided to remove the geographic restriction on the series, and have therefore renamed the series *RES Insect Identification Handbooks*. We will continue to publish a broad range of UK taxa and will focus on non-UK groups of societal importance.

#### Call for proposals

We welcome proposals for new handbooks (or updates of old ones, as needed). We're keen to see some more international proposals, particularly for medically, economically or agriculturally important groups. You can submit a proposal via the proposal form on our website: <https://www.royensoc.co.uk/handbook-proposal-form/>.

#### Editorial Board

Our longstanding series editor Andrew Polaszek has recently stepped down. Andy has been instrumental in moving the series forward over the years, including expanding the scope as detailed above, and on behalf of the RES we would like to thank him hugely for all his hard work. Beulah Garner has stepped in as interim series editor, and we are currently advertising for a new editor. Once the new editor is in post we will be looking to expand our editorial board to cover more of the UK and, for the first time, to welcome taxonomists from around the world.

#### CABI Partnership

Our partnership with CABI means that the majority of our recently published handbooks are now for sale via their website. This has many advantages. As a small organisation the RES is not well placed to conduct large scale international sales. Holding stock was becoming unmanageable and shipping, particularly internationally, was becoming more and more difficult. Working with CABI means we can use their large international distribution network, which is very reliable. We also benefit from CABI's international sales team and dedicated marketing staff, which should increase our reach.

CABI have also supported us to give new homes to a lot of excess handbook stock that was no longer selling, via a books charity. This has freed up a huge amount of space at the RES offices.

CABI have digitised many of our recent titles at no cost to the RES and these are now available as eBooks. What's more, all future handbooks will be available as both print and eBooks, making them more accessible than ever. All RES books and eBooks for sale via CABI are available to RES members with a 50% discount. 30% discounts are also available for members of AES and BENHS.

#### In the pipeline

We have several great books in the works and are in discussion with many more potential authors. All future books will be published by CABI. The first edition will always be a hardback, available to all but marketed primarily to libraries around the world. For this reason first editions will generally be more expensive than handbooks have been previously. However, importantly there will always be a second, paperback edition, published 6 months after the first edition, priced at 50% of the first hardback edition. The RES Member and Fellow discount will apply to all editions of the book.

Our interim handbooks editor Beulah Garner says: "I am excited about the future direction of the RES Handbooks. The addition of fully searchable eBooks will be very useful for many of our users and a global scope will allow us to support researchers around the world with insect identification".



# Illustrating Insects

Emily Carter

My fascination with the natural world began in childhood growing up in the English countryside, where my first drawing was of a spider, at age two. Afternoons spent observing butterflies, shield bugs and woodlice captured in jam jars began a lifelong passion for drawing insects. Equipped with a small microscope I spent hours examining their patterns and symmetry, which is particularly appealing to me as an artist. These formative experiences laid the foundation for my lifelong passion for insects, which now informs my practice as an artist and designer, and is woven into every one of my designs.

My most recent work, *Insectarium*, is a tribute to the often-overlooked world of insects. This book was a two year labour of love, and consisted of endless late nights of accuracy revisions and redrawing. This collection of illustrations seeks to celebrate their beauty and intricacy, as well as inspiring others to recognise their ecological importance. My approach to illustrating insects is not just technical but also personal, reflecting a continuous admiration for their complexity and a desire to convey their misunderstood nature to a wider audience.

Among the selection of insect species I have illustrated over the

years, moths, butterflies, and beetles remain particular favourites. Moths, frequently overshadowed by butterflies, possess a subtlety that is fascinating to me as a creative artist. The variety of different UK tiger moths and hawk-moths has drawn my creative attention, having seen many of them in the garden growing up as well as in London, where I recently saw a Lime Hawk-moth in the middle of Hammersmith.

Butterflies never cease to amaze me with their colour and patterns which I often can't believe are so beautiful. My UK favourites are the Peacock butterfly and the Small Tortoiseshell, which I used to draw (and catch in a butterfly net to inspect more closely) endlessly as a child. Beetles, with



their remarkable diversity, are equally appealing to me as an artist. I had the pleasure of seeing a Stag Beetle for the first time last year, again in London of all places.

In all the years I have been drawing insects and creating designs, I have never run out of species to draw, and I discover something new every time I start my research for a new design or collection. In terms of design process, each illustration begins with meticulous research. Understanding the anatomy, behaviour and habitat of each insect is important to ensure scientific accuracy while allowing for artistic interpretation. My work often involves studying preserved specimens, photographic references and field sketches to capture the behaviours of each insect.

My artistic process remains rooted in traditional techniques. I begin with fineline pen sketches which form the foundation of each piece, before layering



details such as wing veins, textures and leg hairs.

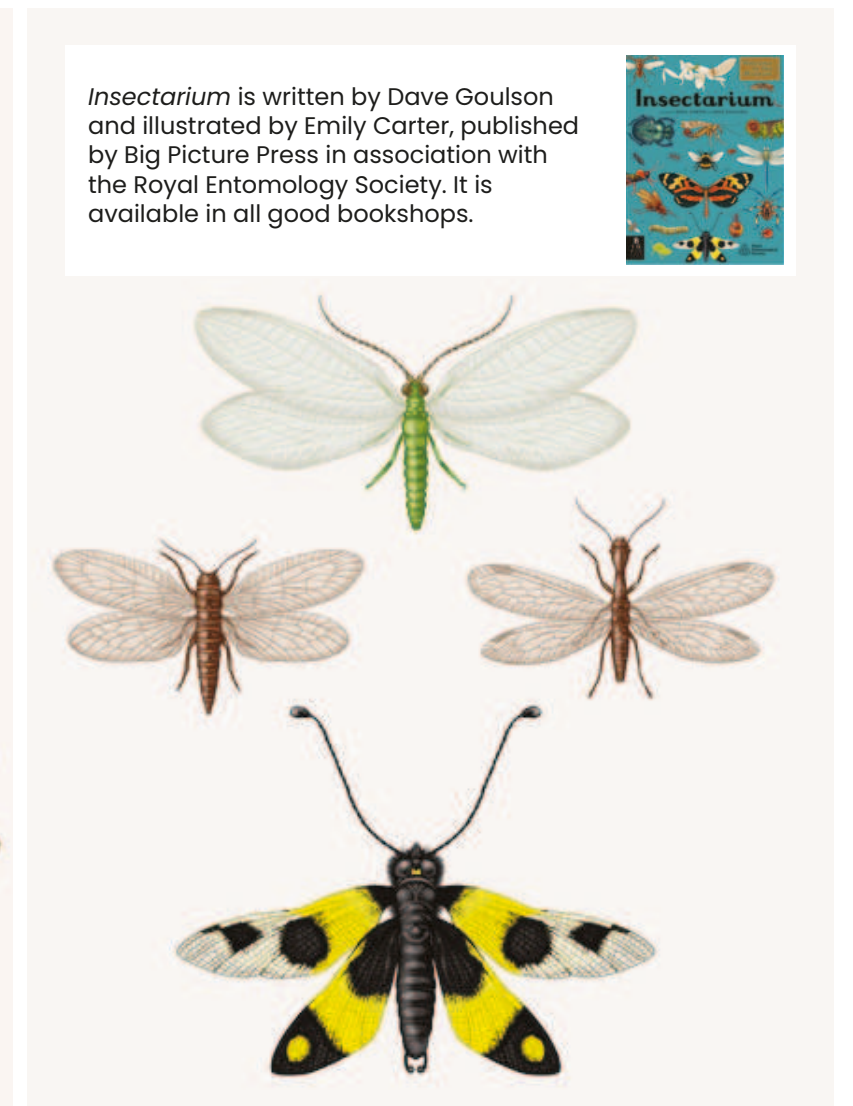
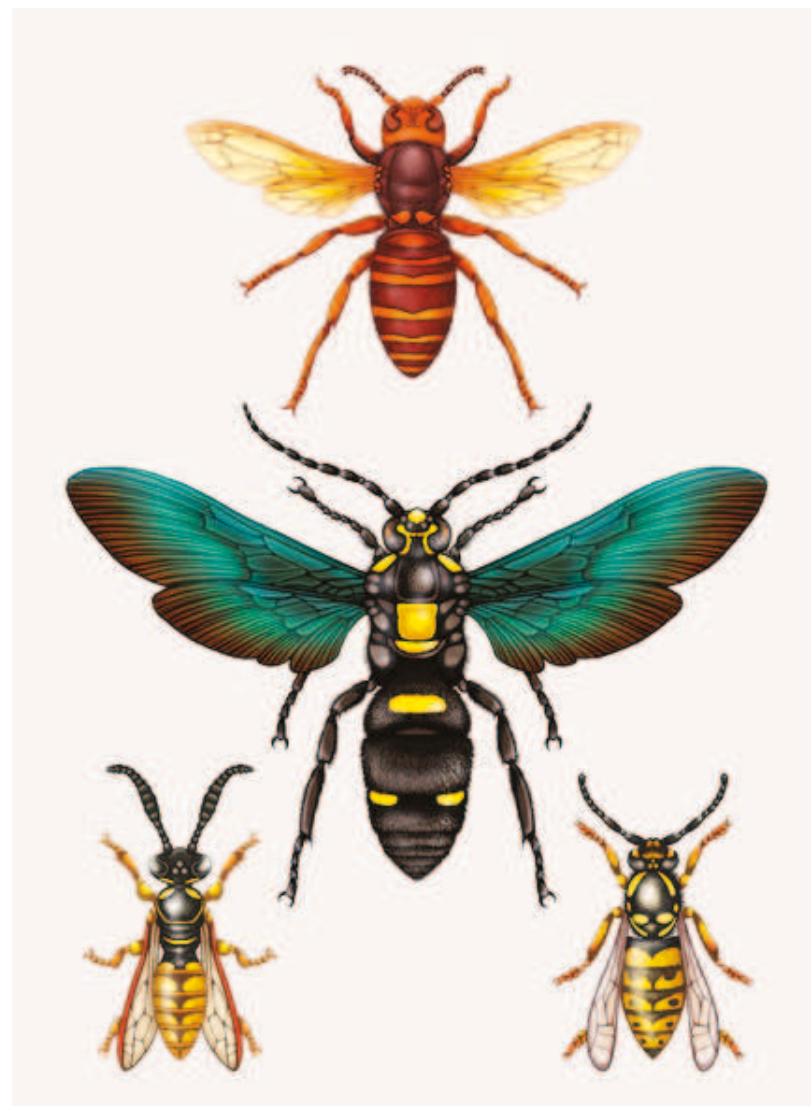
Insects are incredible creations of evolution, yet they are often misunderstood or overlooked. Through my illustrations I aim to challenge this perception, fostering a greater appreciation for their ecological importance and aesthetic beauty.

*Insectarium* represents more than a collection of illustrations; it is a celebration of the natural world and its ecosystems. My

hope is that readers will come away with a deeper understanding of these extraordinary creatures and feel inspired to observe and be more aware of the insects around them.

My fascination with insects is both a professional and personal endeavour, a means of honouring the complexity and beauty of the natural world that first captivated me as a child, and will continue to do so for many years to come.

*Insectarium* is written by Dave Goulson and illustrated by Emily Carter, published by Big Picture Press in association with the Royal Entomology Society. It is available in all good bookshops.



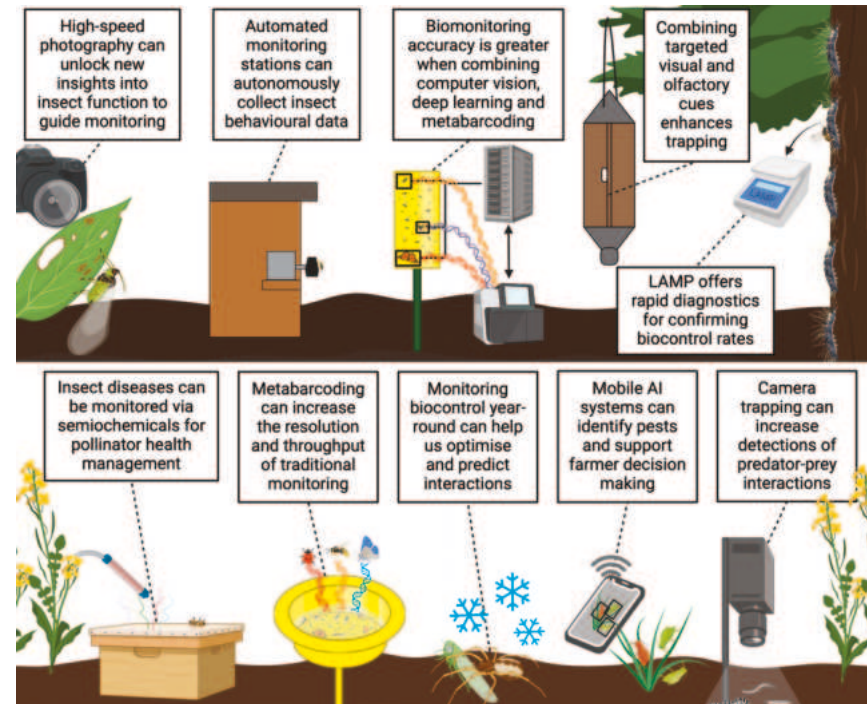
## Agricultural and Forest Entomology Special Issue

### Advances in insect biomonitoring for agriculture and forestry

Jordan Cuff and Allan Watt

Biomonitoring is crucial for maintaining biodiversity and optimising provision of ecosystem services (e.g., pollination) and minimising disservices (e.g., herbivory by crop pests). Such monitoring has traditionally been focused on specific contexts (e.g., agriculture) or taxa (e.g., aphids), often dictated by the economic importance of those systems or taxa. This means that production systems such as agriculture and forestry have often been at the forefront of biomonitoring innovation. Classical biomonitoring methods rely, however, on a massive investment of time and expertise in manual processing and morphological identification. This can introduce biases due to some groups being difficult to differentiate morphologically. Many of the methods used focus on active (often flying) invertebrates, or those active in the daytime. Given these biases and the necessary time investment required for processing and identification, the grand challenges that entomology faces, from species loss and land use change to food insecurity and climate change, may be insurmountable with conventional monitoring. Luckily, new technologies and techniques are paving the way toward a future in which biomonitoring is rapid, scalable and highly accurate.

To highlight and celebrate these ongoing advances, *Agricultural and Forest Entomology* has run a special issue focused on advances in insect biomonitoring for agriculture and forestry. Ten articles spanning this broad remit have demonstrated how new technologies will massively enhance our biomonitoring capacity, and they highlight some of the conceptual changes needed to meet many of the challenges ahead. From disease monitoring of pollinators via semiochemicals, to molecular detection of biocontrol and



analysis of whole communities, the articles use and review some cutting-edge technologies that are set to become mainstays of biomonitoring. Artificial intelligence was particularly well-represented, from farmer decision support systems, through automated monitoring stations, to community identification and ecological network construction. A novel application of high-speed photography revealed new insights into the flight mechanics of aphids, which could inform future monitoring, and the increasing accuracy of insect camera trapping is set to enhance our understanding of in-field predator-prey dynamics. The integration of both visual and olfactory components to monitoring have enhanced trapping efficiencies, and the integration of recent methods paves the way toward year-round monitoring of biocontrol interactions.

Together, the articles in the special issue not only provide a glimpse into the future of biomonitoring, but also

demonstrate that these advances will span many areas of research, and that the greatest advances will come from integrating different methods. Continued improvements to technology and novel ways of integrating different data types will lead to exciting advances, but these advances will evidently not replace traditional morphological monitoring, and many new approaches will even continue to depend on it. Establishing standardised long-term monitoring schemes integrated with these new techniques, and preserving the expertise necessary to operate them, will be key for the future of biomonitoring.



## Meetings

### Monthly Online Meetings

### Agricultural and Forest Entomology

13<sup>th</sup> November 2024

### Special Issue: Advances in Insect Biomonitoring for Agriculture and Forestry

Talks by Gaëtan Seimandi-Corda (INRAE, France), Daniel Leybourne (University of Liverpool, UK) and Andrés Martínez (INTA-CONICET, Argentina)

Chaired by Sam Cook (Rothamsted Research)

#### Report by Richard Harrington

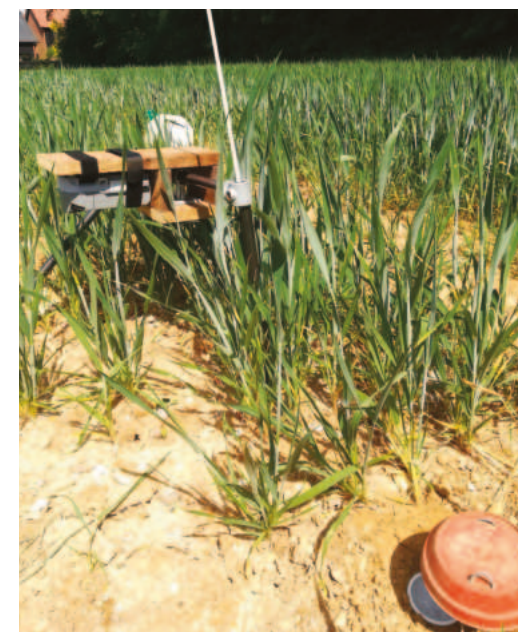
An introduction to this special issue is provided by Jordan Cuff and Allan Watt on page 30. This online meeting gave the 37 listeners the opportunity to hear more details on three of the papers.

Gaëtan talked about work done for the EU EcoStack project (<https://ecostack-h2020.eu/>) while he was based at Rothamsted Research and working with Sam. His aim is to provide a better understanding of predator-prey interactions by using camera trapping. There are several published studies on this,

but most involve expensive surveillance cameras and are hence limited in scope by financial constraints. For large-scale studies, cheaper cameras are required and Gaëtan is developing a flexible and adaptable system based on the Raspberry Pi computer. Manual processing of images is time-consuming. Gaëtan is circumventing this by reducing the quantity of images by removing those showing nothing of interest, achieved by automatic selection of images triggered by detection of

movement and by using deep learning or background subtraction techniques to identify organisms of interest. The use of camera traps can change our view of insect predation by recording unexpected events, by providing new information on behaviour and by linking cameras with other sensors such as temperature sensors. Ultimately this should result in better models to predict the effectiveness of biocontrol.

Daniel asked whether Artificial Intelligence can be integrated into pest monitoring schemes. He is



Camera trap by a pitfall trap to identify predators of sentinel prey (Photo: Gaëtan Seimandi-Corda)



*Sirex noctilio* female ovipositing (Photo: Andres Martinez)



working mainly on cereal systems. He pointed out that IPM is often only used for a single pest species and that a more holistic approach is needed. Computer vision can support the detection phase of an IPM programme by identifying pests, quantifying their abundance in relation to control thresholds, integrating such information into decision models and providing contextual information to support management. A successful system must be based on accurate models, be adaptable to real-world field conditions, be user friendly, device-driven, low cost, mobile and deployable. Daniel showed an example whereby aphids were detected

with 73% accuracy, and he is optimistic that the answer to his question is 'yes'.

Andrés is investigating the relevance of integrating multiple sensory modalities into devices capturing the global wood wasp pest, *Sirex noctilio* (Siricidae). This horntail is native to Europe, Asia and North Africa and can cause up to 80% mortality in pine trees in one season during a bad outbreak. It arrived in Argentina in the 1980s. Monitoring is an important component of management, and Andrés is hoping to design a trap that is sensitive enough to allow detection at sufficiently low densities to trigger timely control. The current standard trap is a 'black trap' containing turpentine,

which includes alpha- and beta-pinenes to which the wasp is attracted. The wasp may also be attracted to visual cues, for example the colours of bark or the yellows of the male abdomen or senescing pine needles. Andrés measured the reflectance spectra of such natural objects and then found commercial paints to match. Traps using these colours were tested in the field with promising results. Further research is needed to assess the best combinations of visual and chemical cues.

Many thanks to the speakers and to the attendees for their company and questions. There is much more to be discovered in the special issue, of course.

pollinators, insects as food and feed, and integrated pest management.

On the penultimate day there was an excursion to two nearby farms, where there were demonstrations of successful integrated pest management. It was interesting to see various techniques such as push/pull planting, pheromone traps and biopesticides in place that were having real benefit to the quality

of the crops and increasing yield. Meeting the farmers who were applying the research and producing the positive outcomes was inspirational.

During the week there were also opportunities to have discussions about how the RES could support the Southern African Entomological Society and AAIS, with the next International Congress of Entomology taking place in Cape Town in 2028.

It was a privilege to be able to attend this conference and to be welcomed so warmly. The conference facilitated discussion and collaboration, pushing the science forward. The student awards that were presented at the end demonstrated the high quality of insect scientists at the start of their career.

The next AAIS conference will take place in Nigeria in 2026.

## African Association of Insect Scientists Conference 2024

**Simon Ward**  
Chief Executive Officer

Whilst based in the UK, the RES has around a third of the membership from elsewhere, and there are submissions to our journals from all over the globe. The RES is keen to build collaborations and support the entomological community, so in November I travelled to Lusaka in Zambia to attend the biennial conference of the African Association of Insect Scientists (AAIS). This was the sapphire jubilee (65 years) of the AAIS and a great opportunity to celebrate the occasion.

I was able to meet delegates from several African countries, including students, early and mid-career scientists and senior academics. It was also a great opportunity to connect with scientists based at ICIPE and other organisations from the applied sector. We had a stand to provide information on available support and to promote our journal portfolio.

The conference took place over five days, each starting with one of a diverse range of plenary lectures. I was invited to deliver one of these, introducing the work of the Society and the Grand Challenges in Entomology paper that was published in *Insect Conservation and Diversity* in 2023. Following the plenary lectures there was a range of symposia, including sessions on



Moses Musonda (RES Trustee) and Simon Ward represented the society.

## An Afternoon at the Museum

### Northern England Regional Meeting

Saturday 2<sup>nd</sup> November 2024

Report by Barbara Tigar, Northern England Regional Rep

Email: [diana.arzuzabuelvas@manchester.ac.uk](mailto:diana.arzuzabuelvas@manchester.ac.uk)

Like other regional meetings of the Society, 'An Afternoon at the Museum' was an event of general interest to entomologists, and was designed to provide a relaxed environment where they could enjoy activities and discussions about insects and entomology and make new connections. It was held jointly with Manchester Museum (part of Manchester University) and hosted by me and Diana Arzuzas Buelvas. Diana is the Curator of Entomology, and has responsibility for the museum's nationally important insect collection as well as global insect collections of international significance. The museum generously provided their Kanaris conference suite for the event which, in combination with the entomology collection, made this

an ideal venue for an entomological gathering. Twenty-two people attended, slightly more than half being RES members, covering different backgrounds, career stages and specialist interests.

Dr Dmitri Logunov, Honorary Research Associate and former Curator of Arthropods at Manchester Museum, gave a personal insight into the entomology collection entitled 'Opening a Treasure Trove of Bugs', with lavishly illustrated slides. He explained that the museum started in the 19<sup>th</sup> Century then moved to the building in Oxford Road in 1888 where it was set up as "a resource for research learning and public enjoyment". He described how the museum staff responsible for

entomology had made important contributions to expanding and curating the collection as well as through publications in the scientific literature. I will mention just a few by name starting with Assistant Keeper John Ray Hardy, 1909–1918, who established the nucleus of the collection and acquired the C.H. Shill Collection of World Lepidoptera. He was followed by Keeper Harry Britten, 1919–1938, who built up most of the British specimens. The role became known as Curator in 2003 when Dmitri was in post, and the current Curator, Diana Arzuzas Buelvas, was appointed in 2023, becoming the first female Curator.

Dmitri explained that the collection houses about three million insects, of which about a third are British species, and our major insect orders are well represented. For example, it houses 92% of British coleopteran species including 45 personal Coleoptera collections, such as the Robert Lloyd tortoise beetle collection (Cassidae). It also has historic collections of Lepidoptera such as Sidebottom's, Walsingham's Microlepidoptera and Longsdon's collection of Papilionoidea. It also has C.W.H. Pugh's collection of Diptera and a considerable collection of scientifically important entomological archive material and books. Dmitri's finishing remarks focused on encouraging the audience to consider using



Visitors to the collection with Phil Rispin (1st left), Diana Arzuza Buelvas (3rd from the left). (Photo: Chris Devenish and Diana Arzuza Buelvas)





Nidia Álvarez Armada.



Dmitri Logunov.

the collections and archives for their research, and to consider getting involved by volunteering, and to gain specialist experience such as curatorial, entomological and public engagement skills. He explained some of the challenges of working with the collection, such as evaluating historical material that has been donated from different sources and is poorly curated.

If any readers wish to know more about the collection there is a regular blog <https://entomologymanchester.wordpress.com/> and those interested in accessing the collection, archives or who wish to volunteer should contact Diana at [diana.arzuzabuelvas@manchester.ac.uk](mailto:diana.arzuzabuelvas@manchester.ac.uk).

Dr Nidia Álvarez Armada, a Marie Curie Research Fellow at the University of Manchester and a palaeobiologist specialising in evolution and palaeoenvironments, spoke about her research into the effect of pigments and colour-producing structures on the mechanical properties of insect cuticles and their influence on pigment preservation in the fossil record. Nidia explained various experimental approaches she uses, including using modern day materials to model some of the physical and chemical processes that take place during fossilisation. She presented results from a number of state-of-the-art physical and chemical analyses that she uses to compare modern day material with fossilised insect remains, helping to address her hypotheses about the preservation of insect pigment in the fossil record; see <https://research.manchester.ac.uk>

[k/en/persons/nidia-alvarez-armada](https://research.manchester.ac.uk/en/persons/nidia-alvarez-armada).

After the talks everyone gave a mini-introduction to facilitate conversation during the refreshment break. We went into the Kanaris Foyer to relax and enjoy tea, coffee and cakes from the museum café. This is where the small group size helped to create a friendly, open environment where everyone could mingle and make new entomological connections, reminding me of the atmosphere at the tea and cakes offered before the RES monthly meetings in Queen's Gate, before the Society moved in 2007.

The highlight of the afternoon was a behind the scenes tour with Diana and Phil Rispin (former Curatorial Assistant) to view the collection. After refreshments, the audience was split into two groups which visited the collection in turn, ensuring that everyone had a clear view of the exhibits and could interact with Diana and Phil. This enabled further time for conversations in the Kanaris Foyer, where I enjoyed chatting about opportunities for early career entomologists, such as how to gain meaningful work experience and get involved in public engagement, the benefits of being a Regional Rep and of joining the Society as a student, and higher education in UK. All the delegates had an opportunity to talk to each other, and the early career entomologists were particularly good at networking and gleaning information that would support their ideas concerning career development.

The post-event social at the KroBar pub in Oxford Road allowed new friends to continue their conversations about entomology.

Lively discussion ensued on topics such as why we liked insects (more than other popular taxa and megafauna), entomophagy and the impact of culture on attitudes to its uptake, urban entomology and stored product pests and new approaches to mosquito population genetics.

Feedback from delegates was very positive and included:

"A really good session, benefitted from being a smaller meeting.... I am looking forward to contacting people I met for further collaboration."

"Very friendly and informative. Great meeting room and speakers. Thank you!"

"Really helpful and I look forward to using the collections."

"Thank you to the museum team for an engaging and informed peek at the collection!"

We also had suggestions for field trips and events related to insect conservation and biodiversity. Diana and I are very happy with the outcomes, which benefitted both the RES and the Museum. I would encourage other Regional Reps to consider joint meetings with their regional museums and other places of general entomological interest.

For anyone visiting Manchester, I recommend a trip to the Museum's public galleries, including zoological and botanical exhibits, a live collection of frogs and amphibia, as well as a mineralogy section, some spectacular fossils and more. The Museum is accessible to all and has something to interest all age groups. The website explains how to get there, opening times (from 08.00 on Saturdays!) and temporary exhibits and events and how to book them; see [www.museum.manchester.ac.uk/](http://www.museum.manchester.ac.uk/).

## 45<sup>th</sup> Orthoptera Special Interest Group

Online, 6<sup>th</sup> November 2024

Convenors: Darron Cullen, Judith Marshall and Ed Baker

Report By Richard Harrington



Fig. 1. Bog Bush-cricket (*Metrioptera brachyptera*) (Photo: Sarah Tucker)

Due to be held at the Natural History Museum and online, the in-person component was cancelled because of threatened tube strikes – which were cancelled! It's just not cricket. Nonetheless, an excellent online meeting was enjoyed by 49 delegates.

When monitoring insects, orthopterists have a distinct advantage over most entomologists because many of their quarry are audible and can be detected by what is known as 'passive acoustic monitoring' (PAM). David Bennett (Christian Albrechts Universität zu Kiel) has tested an inexpensive acoustic monitoring unit (AudioMoth) for grasshoppers and crickets in Germany's Schleswig-Holstein province, and has developed an automatic classifier to reduce the workload involved in identifying the source of the signals. He has tested the performance of AudioMoths against more expensive devices (Batlogger 4) and traditional transect methods. AudioMoth detected all but one of the species that were observed in the transects, and at four sites more species were detected than in the transects. There was no initial difference in the performance of AudioMoth and Batloggers but the batteries of AudioMoth lasted considerably longer, leading to improved species detection. The first version of the classifier has 17 species. True positives formed

>80% of the recordings, and false negatives <10%. David plans to improve performance and to add at least 20 more species during the coming year.

Sarah Tucker (University of Hull) is assessing the suitability of acoustic surveying for monitoring Bog Bush-crickets (*Metrioptera brachyptera*) (Fig. 1) in Yorkshire. These insects are understudied and difficult to survey visually. They were detected using acoustic surveying at all nine sites visited that had recent visual records, and they were found to stridulate under a wider set of environmental conditions than expected from published evidence. Sarah emphasised that only males can be detected using acoustic methods and that the absence of a signal does not prove that the insect is not there. She plans to build and test a niche habitat model to increase knowledge of behaviour and abundance (calls of individuals can be isolated from a single recording) and hopes to extend the approach to other bush-crickets.

The structure of the mandibles of the Acrididea is very diverse. Matt Morley (London South Bank University) is studying the median cusp, a structure located between the molar and incisor regions. It is

an understudied feature, and it is not clear whether it is functionally part of the molar or incisor region. Matt has used micro-CT scans to examine it in 75 species (all in different genera) comprising graminivores, forbivores, detrito-bryovores and intermediates. Three categories were revealed. The first is morphologically and physically nearer to the molar region, the second nearer to, and sometimes fully integrated with, the incisor region, and the third intermediate. In graminivores, the median cusp of the left mandible is typically closer to the incisor region, and in forbivores it is typically closer to the molar region. In the right mandible, the opposite applies. The differences are likely related to the relative toughness of grasses compared to forbs. The correlation with diet is stronger than the correlation with phylogeny.

From a detailed look at the mandibles to a detailed look at the ear, this time in scaled katydids. Advanced 3D printing is being used by Md Niamul Islam (University of Lincoln) to create physical models of the auditory system, located on the front legs, from micro-CT scans, to enable understanding of the geometric-based biophysics of hearing. This



Fig. 2. A male *Satizabalus jorgevargasi* showing off the large head and mandibles (Photo: Lewis Holmes)



Fig. 3. Male Dark Bush-cricket from North Yorkshire (Photo: Africa Gomez)

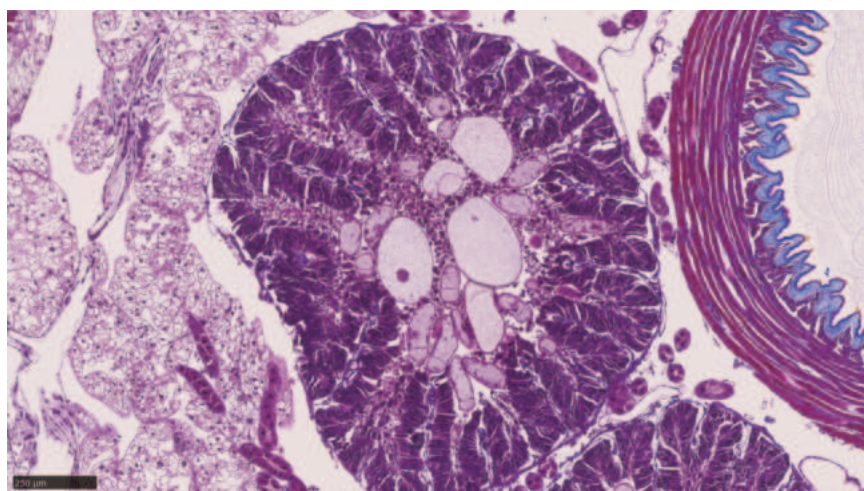


Fig. 4. Gregarine-infested midgut [caeca] of a desert locust (Photo: Ben Kennedy)

has many advantages over using actual insects and facilitates non-invasive examination of fossilised and museum specimens. 3D-printed parts of *Copiphora gorgonensis* revealed that the pinnae cavities resonate to bat calling frequencies, helping the insects to avoid predation. Results from acoustic tracheae models matched predictions from numerical models in relation to increased resonance at certain frequencies. Katydid ears include hard structures such as cuticle and soft structures such as the articulated tympanic membrane. Single-nozzle, multi-material printers have been used to produce models of these structures, with the artificial tympanic membrane showing similar displacement to the real thing.

The bush-cricket *Satizabalus jorgevargasi* (Fig. 2) exhibits male dimorphism in various features, including mandible size and leg colouration, which determine

reproductive tactics. Lewis Holmes (University of Lincoln) would like to know whether diet influences the male morph and hence its reproductive strategy. In an experiment in which the bush-crickets were reared on a high-protein diet, a high-carbohydrate diet or a control diet, those fed on the control diet were dimorphic with respect to head size and colouration, justifying the recognition of dimorphism. The high-protein-fed males had much larger heads and longer mandibles, accompanied by more coloured regions compared to the high-carbohydrate-fed group. Whereas stronger and more colourful males might be expected to be more successful in winning females, the smaller, duller males may be able to fool these stronger males into thinking they are females, and sneak in to mate.

Do Dark Bush-crickets (*Pholidoptera griseoaptera*) (Fig. 3) disperse by oceanic rafting? This is the question asked by

Africa Gómez (University of Hull). The study was sparked by an isolated population of this apterous species found on the tideline in North Yorkshire. How did they get there? Bush-crickets are known to engage in active dispersal by flight, walking and jumping, and are also known to disperse passively on sheep, through human agency on ships, planes and cars, and often on garden plants or hay. The distribution of the Dark Bush-cricket in the British Isles is puzzling. It is common in the south, scattered in the north but found on northern coasts and islands. It exhibits traits favouring oceanic rafting including oviposition in wood or stems (the future rafts), eggs with a dormant stage, flexible development in response to temperature, and habitat generalism such that after rafting, suitable habitat is more likely to be available. Africa and her team tested predictions for several modes of dispersal (active, human-aided and rafting), and the results support long-distance rafting as an explanation for the distribution of Dark Bush-cricket populations in isolated British and Irish populations.

The Desert Locust (*Schistocerca gregaria*) is in much demand as food for the exotic herpetile pet trade. Farmed locusts, however, are prone to infection with intestinal parasites known as gregarines (Fig. 4), especially if the quality of their food is poor. Wild locusts tend not to be heavily parasitised. Benjamin Kennedy (Invertivet Bearded Vets Ltd.), an invertebrate vet, is working on detection of gregarines and on treating infected locusts. Infected locusts had lower weight, softer cuticle, pinkness between the cuticular scutes and were less active than non-infected locusts. Diagnostic tests revealed a parasite burden averaging around 3,000 per gram of homogenised intestines. The agricultural drug diclazuril was found to be a viable treatment candidate when considering efficacy and safety, but colonies often recovered spontaneously with improved nutrition. Diclazuril and other anti-coccidial medications may be viable treatment options for managing gregarine and similar parasite infestations, as in the poultry livestock industry.

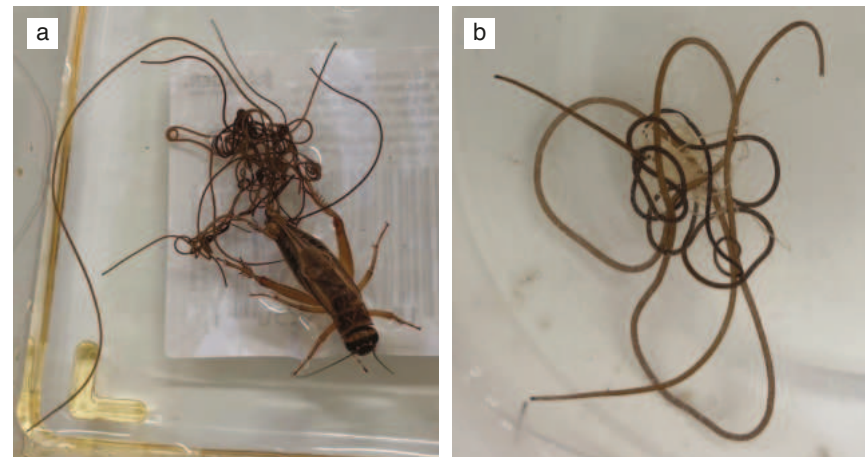


Fig. 5a. *Paragordius varius* emerging from *Acheta domesticus*. Louise Coates; 5b. Male and female *P. varius* with egg string (Photo: Louise Coates)

Another staple of the pet trade, the House Cricket (*Acheta domesticus*), is also afflicted by parasites, this time the Nematomorphs, or horsehair worms. The juveniles are parasitic whilst the adults are free-living in freshwater. Louise Coates (University of Bath) is studying the mechanism by which the adult manipulates host behaviour so that it seeks out and enters water. Dehydration is known to alter insect behaviour, so perhaps the worm mimics dehydration. Experiments using a choice chamber showed that uninfected crickets were not attracted to water, but dehydrated (uninfected) crickets and crickets infected with *Paragordius varius* (Fig. 5a,b) were attracted to water. Louise found that dehydrated crickets prefer to submerge their heads in water whereas parasitised crickets fully enter water. Initial proteomic analysis revealed the presence of proteins associated with oxidative stress in infected and dehydrated crickets, as expected, though the specific proteins did not overlap. Additionally, some of these stress related proteins were significantly differentially abundant in infected crickets (increased in abundance) in comparison to uninfected and post-infected crickets.

What do we want? A brand-new field guide! When do we want it? Now! Thanks to Peter Sutton and many collaborators, the waiting will soon be over. *The Grasshoppers, Crickets and Allied Insects of Great Britain and Ireland* (Fig. 6) is soon to be published by Bloomsbury Wildlife Guides and Peter described the joys, tribulations and sheer quantity of work involved in putting it together. The book is illustrated by the

incomparable drawings of Richard Lewington, together with some high-quality photographs. On the cover is the Large Marsh Grasshopper (*Stethophyma grossum*). During his investigations, Peter was surprised to find a purple male (Fig. 7) of this species in Ireland. Conventional wisdom has it that this is a sex-linked feature of females, so how



Fig. 6. Grasshoppers field guide.



Fig. 7. Large Marsh Grasshopper (*Stethophyma grossum*) purple male (Photo: Peter Sutton)

did it arise and why is it not found in England? There is always more to learn. The book includes regional guides and sections on methodologies, conservation and distribution, including the most up-to-date appraisal of all arrivals in the UK. It is user-friendly, informative and aesthetically pleasing, and I look forward to seeing a full review in *Antenna*!

Luc Willemse (Naturalis) described a range of field guides and courses aimed at stimulating the study of grasshoppers in Europe. He noted that we often have good knowledge on taxonomy, distribution and abundance, but not ecology. The global loss of biodiversity demands more outreach activity to attract and train more specialists. This can be achieved through popular works, online tools, social media, face to face events, etc. Various national field guides exist, but there is none for Spain, Portugal or most of eastern Europe. In the tropics there are many more species and undescribed taxa, but very few collections, libraries and online resources. We should all be thinking about these needs and acting to help where possible.

It can be taken as read that there will be a meeting on 5<sup>th</sup> November 2025. Darron put forward the suggestion of a 'Summer Orthoptera Day' (although the acronym would be best avoided), perhaps in conjunction with the Darwin Tree of Life Initiative at the Sanger Centre, with collecting, a pub dinner and light trapping for katydids. Bring it on!

Many thanks to Darron, Judith and Ed for another fantastic meeting, and to Bianca at the RES for the online technology.

## Forest Invertebrate News

Report by Daegan Inward, Kirsty Godsman, Brenden Beckett, Talor Whitham and Abi Enston, with a news focus on Alder Leaf Beetle: From Red List to Pest, by Danaë Vassiliades



*Agelastica alni* demonstrating their defoliation abilities on hazel (Photo: Daegan Inward)



Gregarious feeding by Alder Leaf Beetle on a mixed species hedgerow (Hampshire, June 2022) (Photo: Daegan Inward)

The Forest Invertebrates SIG held a fascinating online meeting in May 2024, with a diverse mix of people and presentations covering challenges and solutions in invertebrate management and conservation. Presentations ranged from the species to the ecosystem level, and we were delighted to welcome attendees from across Europe and even as far afield as Canada. Many thanks to all our wonderful participants for making the event such a success!

Our news piece this time is from Danaë Vassiliades, former MSc student at Imperial College and the Natural History Museum, who gave an update at the meeting on the changing fortunes of the Alder Leaf Beetle in the UK. Danaë is currently working for Forest Research as a curator of the entomology collections there.

### Alder Leaf Beetle: From Red List to Pest, by Danaë Vassiliades

The Alder Leaf Beetle (*Agelastica alni*) has become a familiar sight for many Britons in the spring and summer months. This striking and attractive blue beetle is often encountered in great numbers, with both adults and larvae feeding primarily on *Alnus* species as well as other Betulaceae. The result is severe and unsightly defoliation, earning the species pest status in some contexts, such as in gardens and parks. This has not, however, always been the case. The beetle has found success here only recently, with

numbers increasing at a rapid rate since its 'rediscovery' in northwest England in 2003. *Agelastica alni* was listed as "very rare" in the 1831 publication *Illustrations of British Entomology*, and with just a few scattered records post-1900 it was perhaps extinct in Britain for much of the 20th century, and was listed as such in the final edition of the Nature Conservancy Council's *British Red Data Book*. Yet, sightings on the citizen science platform iRecord exceed 8,000 over the last 15 years, with a steady year-on-year increase.

In Britain, the current distribution of *A. alni* comprises two distinct populations, which may well merge together over the coming years. From where do these modern 'rebound' populations originate? Are they a proliferation of a small relict population, which had clung on for decades in such small numbers that the species evaded the keen eye of avid coleopterists? It is far more likely that we are looking at one or more reintroduction events from elsewhere in the species' range, perhaps via the plant trade. The explosive proliferation and spread of the beetle since 2003 appears much like an invasive introduction, indeed this pattern of spread closely mirrors the establishment of the invasive Asian Ladybird, *Harmonia axyridis*, in Britain. In view of this similarity, it did seem plausible that the *Agelastica* that have appeared in

the UK since 2003 may be another member of this small genus, namely *Agelastica coerulea*, also hailing from east Asia. However, DNA barcoding carried out (during my MSc studies) on representatives from both contemporary British populations has ruled out such a hypothesis and confirmed that the beetles making a resurgence in Britain are indeed *A. alni*.

Citizen science recording via iRecord has not only helped to track the spread of *A. alni* in the UK, but also uncovered some interesting phenological data. Much of the literature suggests *A. alni* is a spring-breeding, univoltine species, with new adults emerging in late summer before overwintering. The expectation therefore is for springtime observations of adult beetles to be fewer than the end of the previous summer, owing to loss of some individuals during winter hibernation. However, iRecord shows a much larger peak of observations in the springtime, almost triple that of late summer. It is possible therefore that *A. alni* is bivoltine in Britain, with a second generation produced in early spring and overlapping with overwintered adults from the previous summer. With the species reportedly being bivoltine in other parts of its range, confirmation of this hypothesis may help to further understand the origins of contemporary populations here.

## Insects as Food and Feed SIG

30<sup>th</sup>–31<sup>st</sup> October 2024  
Thinktank Museum, Birmingham

Convenors: Peter Smithers, Mark Ramsden, Gary Needham and Rachel O'Connor

Report by Kieran David Robertson (Queen's University Belfast)

IAFF24 was a hybrid event which brought together 75 delegates comprising researchers, legislators, industry leaders and the public to discuss key themes related to insects as food and feed, insects as biowaste convertors, and methods to improve insect welfare during rearing and processing.

### 1. Feeding the Future: Using Insects as Food and Feed

that there is a clear potential for the inclusion of insects in human diets. Larry explained that insects could be used in organic waste management systems as a way to deal with surplus and waste foodstuffs.

It was noted that legislation is a major limitation, due to strict regulations regarding insect proteins in diets. Great Britain has some of the strictest agricultural legislation worldwide, and is

explained that the Food Standards Agency (FSA) is reviewing the possibility of insects as food and feed in post-Brexit Britain, but legislators currently do not see it as a viable option, labelling it as a 'novel product'. Larry supported these statements, suggesting that the use of whole insects has political issues which can limit human consumption, but protein powders may be more acceptable.

Melanie asked if there are any additional nutritional benefits to using insects. Nick explained that insects are eaten as entire organisms, giving a great variety of nutrients. They contain chitin, high levels of lauric acid and a variety of antimicrobial peptides, which have the potential to reduce antibiotic dependence in agriculture.

While the industry is currently more eco-friendly than economical, companies like Flybox hope to reduce rearing costs by using byproducts to feed to insects. In the meantime, Ralph and Larry suggest that the pet industry can best support insect-based feed due to its higher disposable income and demand for quality alternative proteins.



Feeding the Future was a public debate supported by the Insect Bioconversion Association (INBIA) and chaired by BBC Radio 4 journalist, Melanie Abbott. It brought together a panel of four key stakeholders to debate the opportunities and challenges we face across this sector. The panel comprised Rachel O'Connor, a Partner of the Agriculture Team at Michelmores; Nick Jonsson, Professor of Animal Health and Production at the University of Glasgow; Larry Kotch, Co-Founder and CEO of Flybox; and Ralph Bishop, Poultry Nutrition and Innovation Manager at Premier Nutrition.

The first question came from Melanie Abbott: *Where do you think the future lies for insects as food and feed?*

Rachel responded: "There is an ongoing struggle for sustainability within the agricultural sector. We need low-cost, sustainable protein alternatives for food and feed". Panel members explained

restricted to using several insect species in aquaculture only, leaving us far behind the European Union (EU) and Northern Ireland, which permit eight insect species for fish, poultry and pigs. Rachel



IAFF SIG 2024 Debate Panel. From left to right: Nick Jonsson, Ralph Bishop, Melanie Abbott, Rachel O'Connor, Larry Kotch.



## Audience engagement

*What would you consider the primary socioeconomic barriers in insects as food and feed?*

Nick stated that the main problem is that insect products vary greatly, as nutritional value is dependent on external factors. This makes it harder to predict outcomes, making farmers and investors hesitant to make the change. Ralph said that there needs to be a change in consumer behaviour, with Larry agreeing, suggesting that changes in marketing are needed to further promote the benefits of insects. Rachel and Larry then discussed the use of byproducts and wastes. The current regulations are a barrier, which can drive rearing costs.

*What is the best approach the industry should take to get the public on board?*

Larry suggested that the public need to see research which explains the problems of current diets, such as high processing. This would make the demand for natural produce greater. Rachel agreed, thinking that the public are disconnected and do not understand the trade-offs which go into producing cheaper meats. Larry suggested that industries need to sell benefits that are more easily measurable by the consumer than terms currently used, such as 'sustainable'. It would be useful to remind people that insects are a part of the natural diet of some of our food species, such as chickens.

*How can we direct our approach to regulators, and how may we convince them?*

Rachel, a legal expert, suggested that government is not unwilling to pass key legislation. Previous research by leading NGOs such as WWF shows that insects are safe and nutritious. Parliamentary timetables are more of an issue. We need to encourage legislators to review the case soon. Nick suggested that we need to show the data which reveal issues with current nutrient sources, such as highly processed meats, highlighting the impact on health, as this will urge regulators to seek and approve alternatives.

A drinks reception followed the debate, closing a successful first day of IAFF24.

## 2. Insects as Food and Feed Conference 2024

The IAFF conference commenced its tenth year with a welcome by convenor, Mark Ramsden, and Peter Smithers, who is the current chair of the RES IAFF SIG. This event was run in partnership with Michelmores and supported by the Insect Welfare Research Society (IWRS).

### Session 1: Integrating insect protein as part of our food and feed systems Chair: Rachel O'Connor, Michelmores

#### David Tavernor, Fly2Feed (keynote speaker)

David described learnings from his Nuffield Farming Scholarship. The scholarship rewards those in the agri-food industries and seeks to improve knowledge on international systems. David visited more than 50 insect farms across four continents. He found that the Americas are now working together to improve efficiency and output. This collaborative network is something which was initially lacking, resulting in the early demise of some key producers. In Europe, automation is a primary focus to reduce labour and maximise profits, though it can lead to greater risks, which can deter investors. African farms stood out for resourcefulness, using regenerative circular farming and the natural behaviour and physiology of the insects to their advantage. Overall, there's a demand for high-quality protein in the UK, and we should take opportunities where regulation permits. This, however, comes with challenges, as it is currently not cost-efficient. We need to improve our processing before we can have a seamless transition.

#### Arthy Surendran, Scotland's Rural College

Arthy explained that the protein yield-to-frass ratio is high (1:3) for Black Soldier Fly (*Hermetia illucens*) larvae (BSFL), and thus, we need to find ways to utilise this byproduct. Frass is rich in key nutrients which promote plant growth but is unstable in mass production due to fast bioconversion, resulting in immature compost prone to

change. Trials have analysed frass as a fertiliser for cabbage, with results showing increased plant growth in supplemented groups, apart from those groups with the greatest frass-to-soil ratio, suggesting phytotoxicity at high concentrations. Composting frass enhanced nutrient levels but also increased phytotoxicity, highlighting the need for further research.

#### Thomas Farrugia, Beta Bugs Ltd.

Thomas explained that Beta Bugs Ltd specialises in the breeding and genetics of the Black Soldier Fly (BSF) to increase industry yield and revenue. Beta Bugs Ltd can provide manufacturers with eggs or larvae, relieving the sector's efforts in breeding, which can be difficult at large-scale. This is further supported by Beta Bug's tailored genetics, which improves growth performance and maintains consistent growth in different climates.

#### Maureen Wakefield, Fera Science Ltd (keynote speaker)

Maureen selected four waste streams to feed to BSFL in trials, and results were compared to larvae and frass samples from Better Origin, which are reared on permitted substrates. Testing of insects, frass and substrates revealed no breaches of UK regulations for animal diets. However, high calcium, phosphorus and cadmium levels, though within limits, could still affect animal growth and production.

Targeted microbiological testing found no *E. coli* or *Salmonella spp.*, but staphylococci bacteria were found in some substrates. Lack of staphylococci in insects is evidence that it cannot be transmitted through BSFL. Enterococci levels exceeded livestock feed limits in insects and frass but were reduced through processing, with processed larvae from Better Origin meeting requisite standards.

Non-targeted toxic screening detected RNA from plant viruses in frass, which poses risks as a fertiliser. Interestingly, though, no RNA was detected in the substrate. Although RNA was detected, it is unclear whether the virus was active. More virology research is needed to explore these findings.

Testing of larvae, frass and substrates for 115 pesticides and drugs detected eight compounds in substrates and five in larvae, mostly cleaning chemicals. While fungicides and herbicides lack regulatory limits, pesticidal residues exceeded permissible levels for vertebrate animal feed. These results will be useful for industry and legislators to make key regulatory decisions based on insect substrates.

### Session 2: Where are we now? Insect production and supply chains across Europe Chair: Mark Ramsden, ADAS & RES Food & Feed SIG convenor

#### Taun Veldkamp, Wageningen University & Research (keynote speaker)

In 2023, 1.29 billion tons of animal feed were produced, with demand expected to rise. Taun began exploring insects as livestock feed at Wageningen in 2012, analysing their potential as a soybean alternative.

Insects could be a viable source of nutrition for poultry as insects are a natural dietary source in the wild. In a 2019 trial, 10 % of poultry diets were replaced with BSFL and the results showed that insects provided a great enrichment source and reduced adverse behaviours such as feather plucking in turkeys, showing potential to improve welfare. Later studies showed increased laying in insect-fed hens, being further evidence of improved welfare.

Another study provided a poultry group with live larvae, and another with larval meal and oil, with results showing that insect provision improved broiler performance and reduced feed conversion ratio, suggesting that insects could be an economically viable nutritional source.

There is much variation in insects for feed due to great changes in nutritional profile and properties due to diet, environment and life stage. We should work on producing standard operating procedures to maintain consistency.

#### Nick Rousseau, UK Edible Insect Association

Nick introduced the UK Edible Insect Association (UKEIA). In 2024, UKEIA brought together 45 academics and industry experts



Chris Jiggins.

to report on key challenges this sector faces, and to develop a directory of researchers to maximise collaborations. Phase 2 of UKEIA is currently developing and prioritising research projects to support funding applications to leading bodies such as UKRI.

#### Chris Jiggins, University of Cambridge

Chris, a professor of evolutionary biology, presented his research on the genomics of BSF. Chris sequenced the BSF genome, identifying two main genetic populations. This work advances our understanding of BSF DNA, enabling selective breeding for desirable traits. A PhD project under Chris has demonstrated that pupa size is hereditary, supporting efforts to breed BSF for production and health benefits.

#### Bolajoko Adewoye, Yaba College of Technology

Nigeria faces inflation, with the agricultural sector undergoing economic strain as feed costs have increased dramatically, driving demand for cheaper alternatives which can also maintain production efficiency. Bolajoko investigated the feeding parameters and nutrient and mineral compositions of BSFL fed on ram and poultry faeces, and watermelon and pawpaw substrates. Poultry faeces showed the greatest weights, bioconversion rates and ratios, but ram faeces showed the greatest crude fibre/protein.

#### Bernardo Antunes, Freie Universität Berlin

Bernardo studied the mealworm (*Tenebrio molitor*), known for its high nutritional value and bioconversion properties. Mealworms were reared on spinach and beetroot fermented at different timepoints and fortified with zinc. Results showed that longer fermentation times increased concentrations of *Lactobacillus*, a microbe found in fermented produce. Both beetroot and spinach reduced *Pseudomonas spp.* concentrations, while fermented spinach led to lower weight gain.

### Session 3: Looking forward: How can understanding developments in invertebrate welfare help insect farmers in the UK?

#### Chair: Gary Needham, RES Insect Rearing SIG convenor

#### Andrew Crump, Royal Veterinary College (keynote speaker)

As of now, insects are defined as non-sentient, with no legislative consideration, yet they are the most slaughtered animals worldwide. Some 1.2 trillion insects are killed each year, totalling a loss of life greater than all other animals combined. Andrew considered that we should investigate methods to improve welfare and produce guidelines for caring for and slaughtering insects. Research shows that some insects meet half of the criteria for sentience with high confidence.





(Left to right): Chris Jiggins, Nick Rousseau, Taun Veldkamp and Mark Ramsden, convenor; (screen) Bernardo Antunes and Bolajoko Adewoye.

#### Craig Perl, Insect Welfare Research Society

Craig said that insects are the most farmed organisms worldwide, with BSFL dominating the food and feed industry due to its great bioconversion ability. BSFL meet more than half the criteria for animal sentience based on models produced for decapod crustaceans; therefore, Craig said that we should consider the slaughter methods to enhance industry-wide welfare. He measured the influence of larval body size and meat grinder pore size on the effectiveness of BSFL slaughter, showing that smaller pore sizes promote instantaneous death in insects, thereby indicating a good contender for an ethical slaughter method.

#### Femi E. Benny, University College London

More than 2,000 insect species are eaten across 180 countries. India rears over 600 species for consumption. Femi researches hornet farming in India and documented the current knowledge on edible insects in North-Eastern states through interviews with locals. She then

evaluated the market value of insects in Nagaland, a state where insects are produced commercially. The insects which have the largest market value in Nagaland are Hymenoptera species, of which hornets (*Vespa* spp.) are most preferred. Often, locals will source hives from the wild, relocating them to a place for easy harvest.

#### Benjamin Kennedy, Invertivet Bearded Vets Ltd.

Benjamin, a veterinarian in small exotics, specialises in invertebrate medicine and care. He shared his findings on gregarine-infested Desert Locusts (*Schistocerca gregaria*). Locusts were sourced from a well-established colony which had started to diminish in production. Insects were euthanised and the intestinal tract was homogenised. An intestinal parasite count was made, showing that the insects had around 3,000 organisms per gram of intestine. Gregarine parasites were detected across the colony, in all instars. Further, microscope slides showed inflammation in the cardiac lumen, showing multi-organ impact, which could have been

the cause of reduced production overall.

#### Emily Witter, Anglia Ruskin University (Writtle)

Emily described her work on consumer attitudes towards insect production and their inclusion in pet food. Insects are sold as a sustainable nutrient source for pets nationwide, but research into insect welfare is lacking. Emily distributed surveys to dog owners in Britain. The majority were not currently giving insect-based feed to their dogs but believed that insect welfare should be considered. Further analysis showed that over half of dog owners believe that insects feel pain. This provides evidence that insect welfare is important to the majority of owners.

Many thanks to all who made this event possible. Special thanks to Peter Smithers, who has announced his well-deserved retirement. Peter has been the lead convenor of the IAFF SIG since its beginning, and we would not be where we are today without his hard work and dedication.



## HONORARY FELLOW INTERVIEW



# Bert Hölldobler

Interviewed by Juliet Turner  
University of Oxford

When I began my DPhil around three years ago, I faced the daunting challenge of taking my first steps into the vast subject of social evolution in insects. My plan was ambitious; to undertake a comparative study of ants by gathering data on as many species as possible, aiming to reconstruct the evolution of their fascinating and diverse social traits. In some of my earliest days, I heard about a book simply titled *The Ants* by Bert Hölldobler and Edward O. Wilson and decided it would be a good place to start. It was the first book I purchased, and its 3-kilogram weight matched the intellectual heft of its contents. This comprehensive textbook became an invaluable resource that I returned to countless times throughout my research, and I think I am not alone in viewing *The Ants* as a myrmecological equivalent of the Bible.

In December 2024, I had the privilege of speaking to one of its authors, Bert Hölldobler, and was astonished to learn that all 732 pages were originally handwritten, drafted, redrafted, then meticulously transcribed. Despite this monumental achievement,

Bert humbly describes himself as “a lousy entomologist”. I was eager to speak to such an experienced and respected figure in my field, to learn about his career journey, and to see if he had any advice for someone just starting out. After exchanging a few emails, we met online on a December morning just before the winter holidays.

#### What first sparked your interest in entomology?

“Though I was not trained as an entomologist (I studied biology, majors in Zoology and Chemistry) from boyhood on I was interested in insects. I collected beetles and butterflies and cultured ant colonies which I raised from founding queens I collected after nuptial flights. However, as a boy I also kept other animals including fish, amphibians, mice, Guinea pigs, a tame fox, and I grew up with dogs, especially dachshunds. My father was a medical doctor, but he also had studied zoology and published papers in myrmecology, so he was an early inspiration, and my mother was very patient and even helped catching flies to feed my frogs.”

#### How did this develop into a lifelong passion?

“Although in my advanced university studies I began to specialise in forest entomology for my first thesis (which is about equivalent to what is nowadays called a master’s thesis), I soon realised that my real interest was in ethology and behavioural physiology. Of course, ants play a significant role in forest ecosystems, so I had already started working with ants with an applied entomological perspective. But I was fascinated by the diversity of their social organisations and wanted to better understand how insect societies work.

For my doctoral thesis I stayed with two ant species that are relevant in forest entomology, the carpenter ants *Camponotus ligniperda* and *Camponotus herculeanus*. These species construct their nests in the core wood of tree trunks. They do not eat the wood like termites do but nevertheless cause much damage to the tree they occupy. I had published several forest entomological papers on these carpenter ants, but what really fascinated me was their remarkable life cycle, which was different from most ant species I knew. It was known that ant males generally do not exhibit social behaviour. They usually have only a short life inside the nest, because a few weeks after they hatch out of their pupal cocoons they take off for the mating flight. Not so the *Camponotus* males. During my



Bert about 14 years old on a butterfly hunt in Bavaria.





Hölldobler in virgin forest in southern Finland 1960-2.



Bert and E.O. Wilson 1993.

studies I discovered, using radioactively labelled ant food, that *Camponotus* males exhibit social behaviour, actively taking part in food distribution inside the nest. This finding was only part of my doctoral thesis, but it illustrates why I became so fascinated by sociobiological questions and abandoned forest entomology”.

#### How has the field – and your interests and approaches to it – changed during your career?

“The questions we ask, and the methodologies, have changed tremendously. When I started, the analysis of communication mechanisms in ants, the methods and techniques were relatively simple, although some of the findings of our predecessors were very intriguing and stimulating. However, with modern histology and ever more sophisticated tools in natural product chemistry, our generation was able to rigorously advance the field of chemical communication in ants and other social insects.

Communication is the key to any form of collaboration and division of labour that is so characteristic for advanced insect societies. Without communication there is no cooperation, whether between organelles within a cell, between organs within an organism, or between organisms in a society. Therefore, the study of communication is key to understanding life, and how insect societies work. But communication is not only significant within an insect society, also competing societies within a population communicate. They pursue specific territorial strategies that are adapted to the distribution of resources for which the ant colonies compete. This is a field which is still rich with unanswered questions.

Of course, organismal biologists, even those that are experimental behavioural physiologists studying behavioural mechanisms, should always discuss their findings in the light of modern evolutionary theory. Our understanding of the evolution of social behaviour has significantly changed during my career, mainly due to the pioneering theoretical work of the late William D. Hamilton who revolutionised our understanding of evolutionary processes and

*Carebara urichi* Costa Rica (Photo: B. Hölldobler)*Myrmecocystus mimicus* tournamenting workers (Photo: B. Hölldobler)*Myrmecocystus mimicus* honey pot storage ants (Photo: B. Hölldobler)*Lomechusoides strumosus* and *Formica sanguinea* (Photo: B. Hölldobler)

developed the concept of inclusive fitness. This idea has by now been widely accepted, although the question concerning the operational target of selection remains controversial, especially in insect sociobiology. Major advances were achieved by employing sophisticated molecular genetic methods which led to a much deeper understanding of genetic relationships within and between insect societies.”

#### Of all your work, what do you feel most proud of?

“I have been asked this question several times but have to admit that I have no good answer. It is often the new project I was working on which I found most exciting. I cannot pick a specific one.

Perhaps one or two special discoveries come to mind. Most ant species are territorial, and often such territorial interactions involve physical fighting and casualties on both sides. I discovered that Honey pot Ants (*Myrmecocystus mimicus*) rarely engage in physical combat ending in injury or death. Instead,

they use a tournament, an elaborate display in which workers from opposing colonies attempt repeatedly to intimidate and chase away their rivals. The ants walk about with legs stretched out in stilt-like postures while lifting their heads and abdomen and occasionally inflating their gaster to a slight degree. When two antagonists encounter, they perform a *pas de deux*, turning their bodies about to face one another head-on, then standing side by side while straining to raise their bodies even higher, and then often circling each other slowly while drumming their antennae on the opponent's body and kicking out at her with their forelegs. Occasionally, one leans against the opponent as though to push her over. After several seconds one of the displayers yields. The two ants then strut off on stilt legs in search of other rivals. Whenever one meets a nest mate instead of an enemy, she briefly antennates her, exhibits a brief body jerking and walks on. Many ants are involved in these ritualised territorial tournaments.

Certain colonies, especially those with the greatest number of large-sized workers, dominate neighbouring colonies, and in the extreme the considerably larger colony may conduct a raid on the much smaller neighbours, pillaging pupae, honey storage workers, the so-called honey pots, and eventually killing the foreign queen, and thereby eliminating a competing neighbour.

From many observations and recordings, we concluded that during the tournaments the combatants are able to assess the collective strength of the opponents. Together with the theoretical biologist Charles Lumsden, we developed several algorithmic models that might suggest how the ants achieve this task. This revealed that so-called reconnaissance ants play a key role. They move through the tournament and make the assessments. They are also the ones that run back to the nest and recruit reinforcements. Most of the tournament ants serve just as display ants, signalling the ‘resource holding potential’ of their colony.



Let me mention one other example of my favourite studies, which dates back to the early years of my scientific career in the mid 1960s and early 1970s, which I recently revisited, because together with my former postdoc Christina Kwapich, I authored a book on this subject titled *The Guests of Ants*. There are many arthropods which during their evolution have broken the communication code of their host ants and are thereby able to be adopted and cared for by the ants, despite the fact that these parasites (so-called myrmecophiles) not only are fed and nursed by the ants, but also prey on the ants' brood. It is a long story, in fact our book has in total more than 550 pages, which cover of course the work of many entomologists around the world.

These are just two examples of my favourites, but honestly, I would not label them as 'I am most proud of'. In fact, I am most proud of the doctoral and postdoctoral students in our group, many of whom have professorial positions in academia around the world, and some of them have already reached retirement age. As we say, 'the torch has to be passed on'."

#### Do you have any favourite memories of your career?

"The moment when I learned that our book *The Ants*, which I co-authored with Ed Wilson, was honoured with the Pulitzer Prize for non-fiction writing. It was, and to my knowledge still is, the only purely scientific book that was recognised by this prestigious award. This was totally unexpected".

#### Who were your mentors or major influences in the field, and what lessons did you learn from them?

"Here I have to name first Martin Lindauer, the most successful of all students of Nobel laureate Karl von Frisch. Lindauer was an exceptionally creative behavioural biologist and a superb mentor. Once he sensed talent in his young collaborators, he let them off the leash and encouraged them in many ways. Through him I got to know personally Karl von Frisch, whose popular biology books I had read as a high school and first year university student. From Lindauer and Karl von Frisch I



Watercolour painting of Cave Creek with Cathedral Rock Portal Arizona.

learned how to address questions to your study animals, and specifically, when to address them. You need first to find out the time frame and motivational state when the animal is ready to respond. During my first scientific steps at the university in forest entomology, Karl Gößwald was my advisor, albeit, as I mentioned above, that was not the kind of science I wanted to pursue. However, I have also to mention Hans-Jochem Autrum, a pioneer in sensory and neurophysiology whose didactically superb, yet demanding, lectures I admired. I attended his lectures and seminars in my first semesters as a student. His teaching opened a window for me and left a lasting impression."

#### What interests do you have outside of research?

"My interests have changed over the years, but from school years

on I was interested in painting, and in particular abstract painting. Though I do not make abstract paintings myself, I enjoy visiting galleries and museums of modern art. In my youth I tried myself all sorts of techniques, pencil, ink, oil, acrylic and aquarelle, but later I just made watercolours of all my field study sites around the world. These landscapes I remember much better than any photographs I have taken. Besides painting, I also enjoy music, from baroque to classical, but also jazz, and genuine Bavarian folk music, American folk, bluegrass, good genuine country music, and in general folk music around the world. In fact, in 1954 my friend and I made a bicycle tour in southern England; very unusual just 9 years after this horrible war that Germany had brought over the world. I travelled with a sketch book in my pocket and my guitar

on my back. We had a great time in the Youth Hostels."

#### What unsolved questions in insect research do you find most exciting or pressing today?

"In behavioural biology and in particular insect behaviour we have most likely underestimated the insects' 'mental' abilities, such as learning, memory, mental associations, advanced cognition, and perhaps even a kind of conscience. A group of researchers has begun designing new ingenious experiments that reveal mental abilities in ants and in social bees and wasps that are truly astonishing. I am sure this will significantly change our attitude towards these little creatures that play such an important role in our ecosystems. They are, as E.O. Wilson has phrased it, 'the little creatures that run the world'."

#### Do you have any advice you would give to young scientists entering the field now?

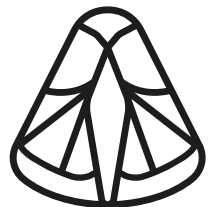
"Find a species or a group of species you consider most fascinating. Learn everything you can about them, find and explore their natural history. If you do this, unanswered questions will appear 'automatically'. However, you can also take the approach to ask questions for which you do not find good answers in textbooks. Your task is then to identify the suitable species in which you may discover the answer to your question. The study of biology must be a passion for you. If you see it as a burden, it is most likely not your field."

Bert and I talked for around three hours over a video call during which we were disconnected several times and then interrupted by my cat marching around the room, loudly announcing his presence. Bert stayed through these interruptions with great patience and humour, and I thoroughly enjoyed our conversation. We shared our enthusiasm for the remarkable diversity of ant behaviours and lifestyles: from the specialised food-storage workers of *Myrmecocystus* ants, whose abdomens swell into gleaming golden orbs of nectar, to the incredible strength and collective problem-solving abilities of species capable of subduing prey hundreds of times their size. We also marvelled at the mystery of

the 'ancestral ant' and the insights offered by ancient insects preserved in amber for millions of years. Our discussion deepened as we delved into the concept of the colony as an extended phenotype of the queen and her mate. I was particularly intrigued by Bert's perspective on the role of relatedness and the frameworks best suited to understanding insect societies — topics that continue to spark debate among experts in social evolution. Bert generously shared his insights on the academic cultures of institutions worldwide, and his enthusiasm for Arizona's beauty left me thoroughly convinced of its charm. Bert's artistic talents were also influential. When he showed me his watercolour paintings of field sites he had worked at, I was inspired to start creating similar artwork myself.

Towards the end of the call, as my app threatened to disconnect us once more, I asked Bert if he was fully retired now. He explained that, although he officially retired in 2004, he continued working as a research professor with Arizona State University for many years after. Now 88 years old, Bert has moved back to Germany with his wife but remains involved in the scientific world. Smiling, he told me, "As you may learn one day, in this field, you never really retire". His passion for ants remains as strong as ever. He keeps two living colonies — *Temnothorax* and *Lasius* — in his home, hoping to pass on his enthusiasm to his grandson.





# Royal Entomological Society Insect Identification Service 2024

Jim Hardie <sup>1</sup>  
Andrew Whittington <sup>2</sup>  
and Rowland Furse <sup>3</sup>

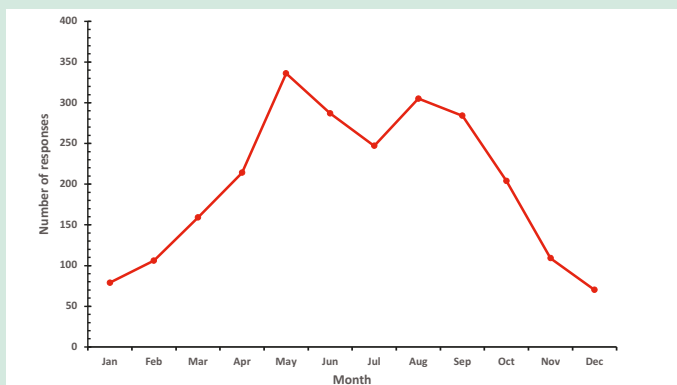
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The Insect Identification Service continues to educate those who choose to follow up sightings that have intrigued or concerned them in a wide variety of localities and situations.

During January to December 2024, we made 2,400 responses to enquiries, an almost identical number to 2023 (2,399; Hardie *et al.*, 2024). The distribution of replies differed from recent years with the lack of a distinct peak in June and July. With most queries coming from the UK, it is possible that the cool, wet weather at that time kept both insects and people hunkered down.



Monthly responses to insect identification queries during 2024.

## Some fine and unusual insects submitted in 2024



***Tremulicerus fulgidus* (Leafhopper)** (5.5–6 mm)  
Photo: Chris Hilling

The year got off to a splendid start when Chris Hilling submitted this photograph on New Year's Eve 2023 of a leafhopper that he had seen in October 2023 in Millhoppers Reserve, Hertfordshire. He couldn't locate a matching UK species, but Auchenorhyncha specialist Alan Stewart identified it as *Temulicerus fulgidus*, a nationally scarce UK species with just 4 records on the NBN Atlas, and it's also rare on the continent. This species feeds mainly on Black Poplar, *Populus nigra*, but also on related tree species. The adults overwinter.

***Ctenochares bicolorus* (Ichneumonidae)** (20 mm)  
Photo: Alexandria Drysdale

Not long afterwards, on January 3, Lorraine and Alexandria Drysdale sent in this image of *Ctenochares bicolorus* in Ayr after opening a bag of Iceberg lettuce from Spain, and Gavin Broad confirmed the identification. This is perhaps the only UK record since Richard Jones', in 2001.

The species is found in southern Europe, Atlantic Islands and Africa, where it parasitises noctuid moth pupae. The main host reported is the Golden Twin-spot, *Chrysodeixis chalcites*, which is regarded as an immigrant in the UK, but adult wasps have also emerged from the resident Silver Y, *Autographa gamma* (Mifsud *et al.*, 2019).



***Megacyllene caryae* (Hickory Borer or Painted Hickory Borer)** (10–20 mm)

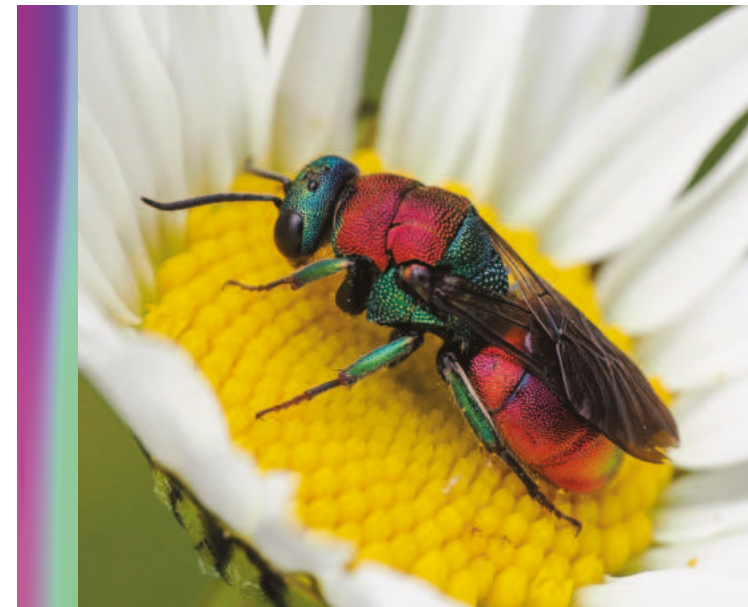
Photo: Andrew Branson

In mid-March, Andrew Branson spotted a number of these longhorn beetles in a shipping container near Coventry, where he had stored some barbecue smoking wood chips imported from North America. The image indicated either Hickory or Locust Borers but probably the former, as they emerge in spring, and wood from locust trees is not used for smoking. The entomologists at Forest Research were contacted and confirmed that the majority of the beetles sampled were *Megacyllene caryae* although other cerambycid species were present including *Neoclytus mucronatus*, another American hickory specialist, and Tanbark Borers, *Phymatodes testaceus*, which are native to the UK. Although none were listed as quarantine species, Andrew was encouraged to continue to collect and destroy any further emerging beetles.

***Hedychrum nobile* (Cuckoo wasp)** (10 mm)

Photo: Graham O'Sullivan

Graham O'Sullivan took this fine photograph in his garden near Kidderminster in July and recognised it as a cuckoo wasp – but which species? The distinction between *Hedychrum nobile* and *H. niemelai* was made in the 1940s, and *H. nobile* was only reported present in the UK in Surrey in 1998 but has expanded its range (Baldock & Hawkins, 2016). Although the taxonomic features used to distinguish the species are not visible in the image, the location tends to indicate that this is *H. nobile*.



***Tettigometra virescens* (Planthopper)** (4–5 mm)

Photo: Norman Marchant

This insect caught the eye of Norman Marchant as it crawled up a glass patio door in Lower Rainham, Kent. He thought it unusual and online searches suggested *Tettigometra virescens*, although this species did not appear in books on UK insects – not surprising, in fact, as it is a new species to the UK with a few sightings also in Kent (A.J.A Stewart, *pers. Comm.*, 2024). It is found in Europe, Northern Africa and Asia and feeds on juniper and pine species. *Tettigometra virescens* is only the second species in the family Tettigometridae to be found in Britain, joining the nationally scarce *T. impressopunctata*.





***Dendroxina quadrimaculata* (Silphid beetle)**  
(12–15 mm) Photo: Helen Valentine

Whilst widely distributed in England, Wales and central Scotland, this nationally scarce but unmistakable carrion beetle was found in an alley in north London by Helen Valentine. Unlike most carrion beetles, the adults and larvae are predatory and usually found in trees, where they feed on caterpillars. There is a preference for oak, and it is more likely to be found in ancient woodland than the city.

***Rhynchium oculatum* (Mediterranean Potter Wasp)** (25–30 mm)  
Photo: Ian Spilsbury

We have had two previous enquiries about this wasp species, one in 2019 from the Greek island of Zakynthos and one in 2020 from the Kas Peninsular in Turkey. The image shown, however, was taken by Ian Spilsbury towards the end of August 2024 in Penkridge, and this may be the first sighting in the UK.

*Rhynchium oculatum* is a Mediterranean species, mainly reported in southern Europe but as far west as the Canary Islands and as far east as India (iNaturalist, 2024a).

Mud-lined nests are created in hollow reeds and cavities and are provisioned with paralysed caterpillars prior to egg laying.



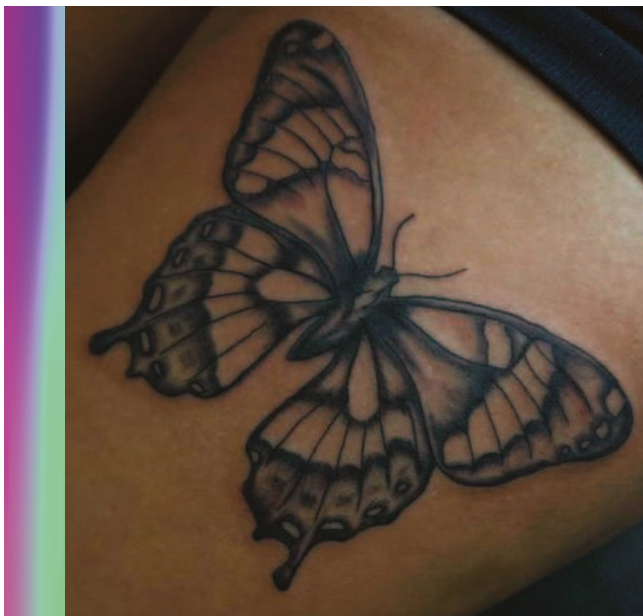
***Papilio homerus* (Homerus or Jamaican Swallowtail)**

Tattoo of *Papilio homerus*.

Photo: Chloe Weatherilt

In 2022 Chloe Weatherilt sent in a request that remains unique in the Insect Identification Service. Chloe lives in the UK but has Jamaican heritage and wanted us to suggest a moth or butterfly species on which she could base a tattoo. The insect was to have a strong connection to Jamaica and one species sprang to mind – the Jamaican or Homerus Swallowtail, *Papilio homerus*. The species is endemic to the island but also endangered, and is strongly emblematic of conservation efforts in the Caribbean. Chloe thought this perfect.

In April 2024, Chloe emailed to say that she was delighted with the finished tattoo, created by Annabel Mobley, and attached a picture.



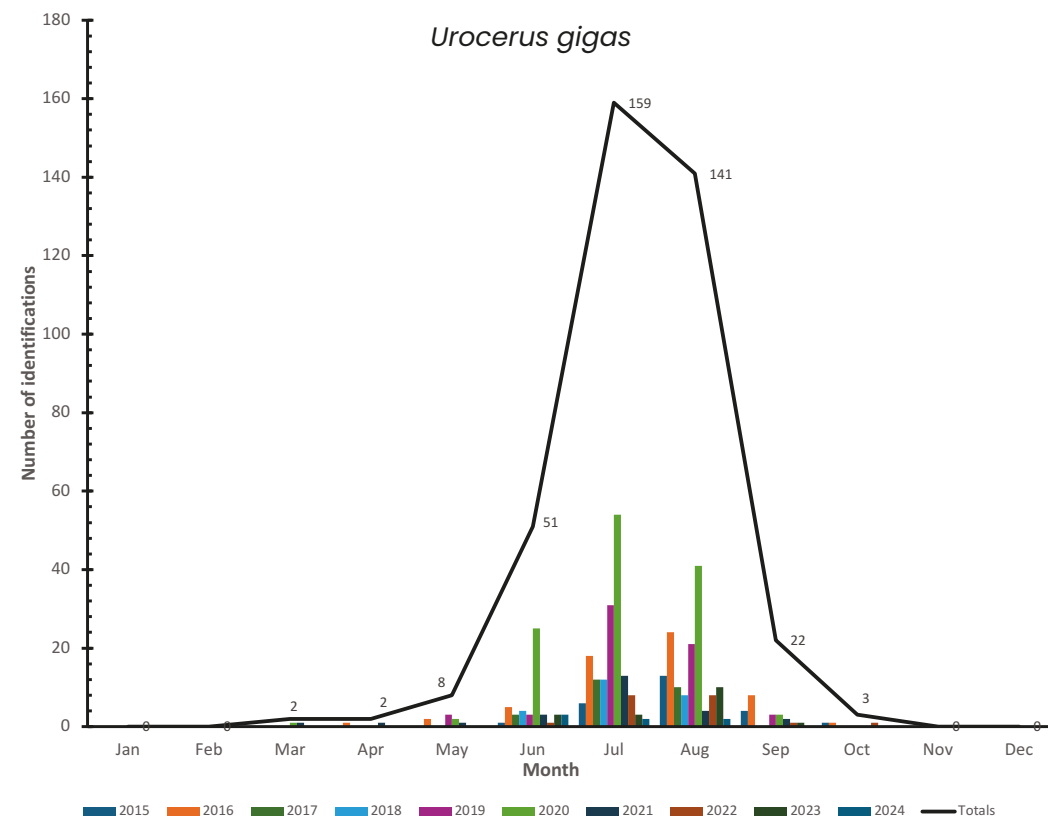
**The phenology of queries about *Urocerus gigas* (Giant Woodwasp/Greater Horntail)**  
(20–40 mm)



*Urocerus gigas* female. Photo: Geoff Bovingdon



*Urocerus gigas* male. Photo: John Shewan



Annual phenology of the Greater Horntail/Giant Woodwasp, *Urocerus gigas*, showing identifications of both sexes per month over 10 years, 2015–2024.

It is the UK's largest and, perhaps, most impressive species from the suborder Symphyta (sawflies and woodwasps). Although there are numerous species in the suborder, they are mainly sawflies (c. 540) with just nine woodwasps from two families.

*Urocerus gigas* tends to be found near pine forests as the dead trunks/logs of a number of conifer species host the larvae. Mated females lay individual eggs along with a symbiotic/wood rot fungus (*Amylostereum* sp.) in pine wood, using the sturdy ovipositor which is much longer than the terminal extension (cornus) to the last abdominal segment that gives rise to the name 'horntail', and is characteristic of the woodwasps. The larvae burrow

and feed on the timber, assisted by the fungus, taking 2–3 years to develop. They build a pupal chamber below the surface, and after pupation the adults create a circular exit hole 4–7 mm in diameter and emerge. Mating takes place in the tree canopy.

The species is widespread in the UK from Cornwall to the Orkneys and Northern Ireland. Overall, it is native across the Palaearctic, in Europe, northern Asia and into northern Africa. It has also been reported in South America (CABI Digital Library, 2024).

*Urocerus gigas* is also associated with another impressive hymenopteran, the magnificent Sabre Wasp, *Rhyssa persuasoria*, where adult females can

reach 100 mm including the long ovipositor. These parasitoids are the largest in the UK and drill into pine trunks to locate the main woodwasp larval hosts, including *U. gigas*.

As far as the submitted images allowed finer detail to be examined, none were any of the other five *Urocetus* species that can occasionally be imported, or *U. augur* which may be breeding in the UK (The Sawflies (Symphyta) of Britain and Ireland, 2024).

Enquiries to the Society about *U. gigas* over the latest 10 years show a distribution across 8 months of the year with a peak in July. The generally accepted season is May to October (Brock, 2019) but there were occasional sightings in March and April. The two earliest observations were submitted on the last day of March in 2020 and 2021, while the latest observation was made on 22 October 2022; all were female. These

observations are in close agreement with those reported in iNaturalist (2024b) with the main peak in July (mainly across April to October), but we had the two females reported in late March while iNaturalist reports a single female as late as December.

By far the majority of the 389 reports were females (94.6%). Males were less frequently observed (5.4%) as they tend to be territorial and stay in the pine-forest-canopy mating sites. These figures are again similar to those of iNaturalist (2024b), reporting 95.3% females and 4.7% males. Most of our sightings, 126 (32.4%), were made in 2020.

Although not a wasp, the yellow markings and females up to 4 cm long with two 'stingers' can prove daunting to the uninitiated. Several enquirers promised not to offer violence next time they see one of these harmless insects.

We thank Members and Fellows who have helped during the year, in particular Liam Crowley, Alan Stewart, Mike Wilson, Mick Webb, Helmut van Emden, Judith Marshall, Ed Baker, Max Blake, Anna Platoni, Dave George, Sarah Facey, Gavin Broad, Richard Harrington, Peter Barnard and Fran Sconce. We continue to receive appreciative comments, increasingly accompanied by donations:

"Thanks so much for your very interesting reply. I was convinced it was something way more sinister! We do have a lot of fuschias in the same part of the garden and willow herb too. I will now know not to panic if I see another hawk moth caterpilllar. What a great service you provide".

"Many thanks – yep that looks like the one! Yes, it was in a medjool date from Jordan, so makes sense. I assumed it was not UK native, and it all fits now! I'd never heard of the fruit beetle. Thanks for sending the link! Thank you very much for your time".

"That is so kind of you to respond to my query so promptly, and in such a detailed way. I wasn't aware that the identification system existed and will make a donation to the society for its excellent work. I can now share this information with friends and colleagues who felt that the plume moth was an alien species, Thanks again".

"Thank you so much for that quick response, it has put our minds at rest as we thought it might be a cockroach, so panic over. We do have logs and woodburner too, so your analysis is spot on. Thanks again".

"Many thanks for your speedy reply, identification of this insect and accompanying information. It so useful to have such a resource as this".

"That's very useful and interesting info – many thanks for your help".

"Thanks for providing this identification service – I've made a donation to the Society in appreciation".

"Thank you so much for your prompt response...greatly appreciated. I shall report it, as you suggested in case it helps with distribution patterns. Good to know that you and your team are there to help. Thank you".

"I've just submitted a record to iRecord. I noticed in my copy of Brock that the distribution doesn't include the Angus Glens so hopefully this record will be useful to the distribution maps. Thanks again to you and to the Royal Entomological Society for providing this service".

"Thank you very much for your reply. I am most grateful. I have looked at other pictures of the beetle on the internet and have found pictures of exactly what I saw. I am very impressed that you should hit the target from my very sketchy description".

"Thank you for that identification. I am really pleased, as the Comma is my favourite butterfly, so they are welcome to eat my gooseberry leaves!"

"Thank you so much for your quick response and explanation. I feel so much better now, such a relief".

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## RES at New Scientist Live 2024

Fran Sconce, RES Senior Outreach & Learning Officer

Collaborations with Seedball and Aardman Animations were featured on the Royal Entomological Society's stand at New Scientist Live, at ExCel London from 12<sup>th</sup> to 14<sup>th</sup> October 2024. The RES was a partner exhibitor at the event, which had over 26,000 visitors over three days.

Emily Attlee and the team from Seedball led an activity combining seed mixes from the RES's three matchbox products, peat-free compost, clay and water. Visitors learnt how seed balls can reduce predation of seeds by predators and increase overall germination rates.

*Lloyd of the Flies* television show characters appeared as life size cut outs on the stand, promoting the augmented reality trail at the RES garden in Stratford Cross, East London. In a stage show for 7 to 11-year-olds as part of the schools programme, Erica McAlister, Principal Curator at the NHM and consultant on the Aardman production, and Matthew Walker, Creator of *Lloyd of the Flies* at Aardman Animations, shared their favourite episodes and exciting entomological facts about the characters.

On the stand, ten energetic and knowledgeable RES Members and

Fellows supported activities, with visitors viewing insects under microscopes, meeting live insects including leaf insects, Zompro's Stick Insects and Madagascar Hissing Cockroaches, and observing a Buff-tailed Bumble-bee hive donated by Koppert Biological Systems. Visitors asked about supporting insect diversity in their own gardens and green spaces, species identification and insects in the home. RES mini-insect guides and other resources were available to take away for further information.



RES stand at New Scientist Live 2024 (Photo: Alistair Veryard)



Erica McAlister and Matthew Walker watch *Lloyd of the Flies* during a stage show at New Scientist Live 2024 (Photo: Anne Weinhold)



Emily Attlee, Anne Weinhold and Fran Sconce on the RES stand at New Scientist Live 2024 (Photo: Ashleigh Whiffin)



# 2024 Photography Competition

The winning images in the Royal Entomological Society's Photography Competition 2024 have been announced. The annual competition showcases the very best amateur insect photography and was supported this year by OM Systems, who provided prizes of an OM-5 Camera for the 18 and Over winner and an OM-D E-M10 Mark IV Camera for the Under-18 winner, plus a one-hour online call with an OM Systems Technical Expert. Entries are received from around the world with images submitted from 44 different countries in 2024, from keen photographers of all ages, helping to bring the often-overlooked miniature world of insects into sharp focus. Photographers were able to submit up to three entries into an Under-18 category or 18 and Over categories of insect portraits, insects in their environment, insect behaviour and smartphone images, which were then judged based on the image alone.

The 2024 overall winner in the 18 and Over category is Benjamin Salb for his image *Detailed Gnat Ogre* that depicts a miniature robber fly *Halcocephala* sp.

that hunts gnats. Speaking about the image he captured, Benjamin, based in Maryland, U.S., said: "I love photographing gnat ogres because they're such a challenge. They're ridiculously small and very flighty. This is my most successful attempt so far, and I am very pleased with how the detailed eyes came out".

The Under-18 category overall winner is Alexis Tinker-Tsavalas for his image *The Intruder* that shows a ladybird larva feeding on a colony of Large Walnut Aphids. Alexis, from Berlin Germany, said: "While on a photo walk, I noticed that several leaves of a young Walnut tree had groups of aphids on them. After searching a few of the leaves, I noticed a small black ladybird feeding on these aphids. Although it was moving slightly, I was able to get a small focus stack".

The images were judged by zoologist, broadcaster and photographer Dr Tim Cockerill, conservationist Lucia Chmurova, and a new judge for this year, award-winning macro photographer Matt Doogue. As an experienced judge for major photography competitions, Matt brings years of expertise and a discerning eye to evaluating exceptional photography.

All images are available to view on the Insect Week website <https://insectweek.org>. The 2025 RES Photography Competition is now open for entries from all amateur insect photographers, the deadline for entries is 31 October 2025. Visit <https://insectweek.org/art-and-photography> for full details.



**Under-18, 1st place, Alexis Tinker-Tsavalas**

*The Intruder.* A Harlequin ladybird larva, *Harmonia axyridis*, feeds on Large Walnut Aphids (*Panaphis juglandis*).



**18 and Over, 1st place, Benjamin Salb**

*Detailed Gnat Ogre.* A miniature robber fly (*Halcocephala* sp.) in U.S.



**Under-18, Runner Up, Alexis Tinker-Tsavalas**  
**Jagged Ambush Bug.** Jagged Ambush Bug (*Phymata americana*) on a Tansy flower head in Canada.



**Insect Portraits, Specially Commended, Thomas Barbin**  
**Western Tiger Beetle Larva.** A Western Tiger Beetle (*Cicindela oregona*) waiting at the entrance of its burrow, in Victoria, British Columbia, Canada.



**Insects in their environment, Specially Commended, Gustav Parenmark**  
**Desert's Hidden Hunter.** An antlion larva in its pit ready to receive prey, along the north coast of Fårö, Sweden.



**Under-18, Specially Commended, Anton Poon**  
**Milionia.** A pair of *Milionia* sp. moth larvae hanging on a silken thread, in Icon Park, Hong Kong.



**Insect portraits, Specially Commended, Tyler Redford**  
**Hold on.** A Violet Leaf Beetle (*Chrysolina* sp.) holds on to a grass stem, in Chichester, UK.



**Insect behaviour, Specially Commended, Thomas Barbin**  
**Common Water Strider with Prey.** A Common Water Strider (*Aquarius remigis*) feeding on a mayfly at the edge of a river, in Victoria, British Columbia, Canada.

**Insect**  
week



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# EVENTS

Details of the meetings programme can be viewed on the Society website ([www.royensoc.co.uk/events](http://www.royensoc.co.uk/events)) and include a registration form, which usually must be completed in advance.

Offers to convene meetings on an entomological topic are very welcome and can be discussed with the Chair of the Meetings Committee ([richard@royensoc.co.uk](mailto:richard@royensoc.co.uk)).

## March 2025

Mon 31 31 March–1 April  
[RES Student Forum](#)

## June 2025

Mon 23 23–29 June  
[Insect Week 2025](#)

## September 2025

Tue 9 9–11 September  
[Ento25](#)

## October 2025

Tue 9 13–17 October  
[XII International Symposium on Aphids](#) (external event)

## November 2025

Wed 5 5 November  
[Orthoptera Special Interest Group \(SIG\) 2025](#) (hybrid event)

For full details on all RES meetings please visit

[www.royensoc.co.uk/events](http://www.royensoc.co.uk/events)



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# Antenna Reviews

If you wish to recommend a book for review, please contact: [antenna@royensoc.co.uk](mailto:antenna@royensoc.co.uk).

The following reviews have been added to the *Antenna* website:  
[www.royensoc.co.uk/publications/book-reviews/](http://www.royensoc.co.uk/publications/book-reviews/)



**The Good Slug Guide**  
**How to tackle the slugs and snails in your garden and help save the planet**  
Jo Kirby  
Published by Gemini Books Ltd  
ISBN 9781914902253 (hardback)  
Reviewed by Richard Harrington



**Death's Final Sting**  
Tracy Buchanan  
Published by Embla Books  
ISBN 9781471416446  
Reviewed by Dee Harrington



**Venom in the Blood**  
Tracy Buchanan  
Published by Embla Books  
ISBN 9781471416361  
Reviewed by Dee Harrington



**Pocket Guide to British Spiders**  
Richard Lewington  
Published by Bloomsbury Wildlife Guides  
ISBN 97813994 0698 7  
Reviewed by Peter Smithers

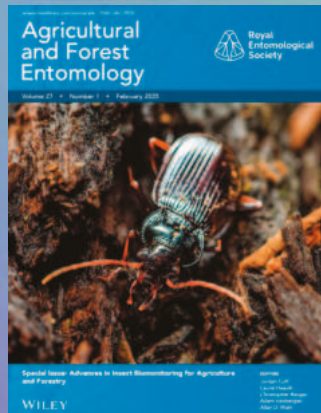
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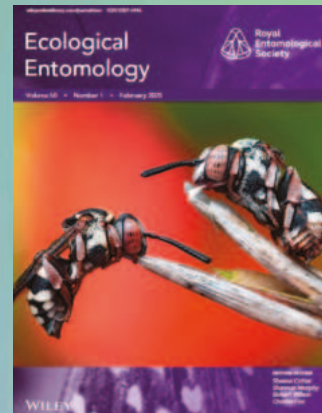
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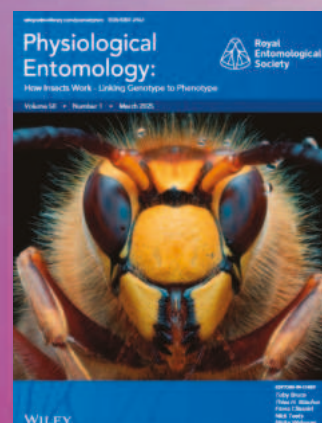


**RES Insect Identification Handbooks**  
Most species available, from aphids to wasps!

[royensoc.co.uk/publications/handbooks/](https://royensoc.co.uk/publications/handbooks/)



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