Entomology Day 2021: A Sting in the Tail

CHAIR: GRAHAM HIIL, REPORT: SUSAN LIMBREY

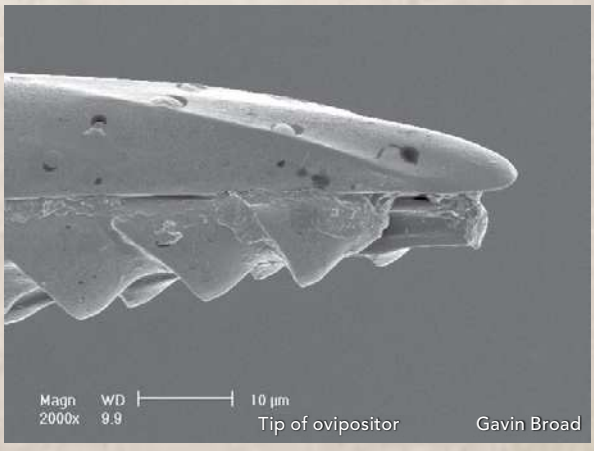
Brett Westwood, Gavin Broad, Richard Lewington, Jean Young, Bob Kemp, Mel Mason, Graham Hill

After losing Entomology Day 2020 to Covid-19, it was with great pleasure that we welcomed people to Rock Village Hall for 2021's event. The programme included an enthralling account of parasitoid wasps, an insight into the techniques used in illustration of insects; it introduced us to work being done to improve the habitat for butterflies, showed us what can be revealed by close attention and patience in a small area, and gave us an entomologist's treasured 'Magic Moments'.

Gavin Broad's keynote presentation showed us *A Wonderful World of Wasps*, and in particular the diversity of the parasitoid wasps all around us. He showed the place of wasps in the classification of Hymenoptera, with woodwasps and sawflies appearing first, the parasitic Apocrita emerging later, closely followed by the ants, bees and social wasps, saying that a large majority of wasp species were parasitoids. They are often small, brightly coloured and of very varied morphology. There are wasps that attack other parasitoid wasps; there are moths that have different wasp parasitoids for every life stage. Nearly all hosts die. Even within the same family, for example the Ceraphronoidea, there are ectoparasitoids and endoparasitoids, and several groups that have independently evolved to mummify their hosts. Among the Diaprionoidea there are tiny wasps that swarm over beach pebbles to parasitise kelp flies. He told us of his handbook to British Ichneumonidae (Broad, Shaw and Fitton 2021) which was published in 2018.

Mariette picta Gavin Broad

Gavin then concentrated on the two families of ichneumonoids, the Braconidae, with 1,350 species in 28 subfamilies, and the Ichneumonidae, with 2,450 species in 33 subfamilies. He described the structure of the ovipositor, explaining how it worked as a modified sting to immobilise the host: the three interlocking sections, with saw-tooth detail, reciprocate with a powerful pulling action both to drill and to move the egg along. Flexibility and curvature (inspiring design of medical instruments), and a notch to stop further penetration at the host's skin, indicate what the structure has evolved to do. The tip gets worn, and is hardened by zinc in some species. The sabre wasp *Rhyssa persuasoria* can penetrate hard wood, which can take a long time, so birds watch for an easy meal. Some species show polyembryony, laying eggs which divide into up to 1000 larvae. Where mummification is involved, a chemical change hardens the skin of the host to form a cocoon; in the case of some aphids, the larva emerges to form a cocoon underneath the insect's now empty body.



Tip of ovipositor Gavin Broad

New species are being described: Gavin said that five in southern England were about to be published. An enthusiastic group of people were re-assessing species hiding under old names. For Worcestershire's nocturnal species there only 63 records of 31 species, so there is

great potential for more recording.

Turning to dichotomies in life history, Gavin explained that laying eggs into the ganglion to paralyse the host enables it to escape the immune system. There are endo- and ecto-parasitoids, idiobionts, usually external on an immobilised host, and koinobionts, keeping their hosts alive and growing. An aquatic species, *Agriotypus armatus*, parasitises caddis fly pupae, deploying a silken ribbon into the water which functions as a gas exchange to supply oxygen. *Xorides fuligator* taps on wood with its antennae, detecting the echo with its feet, to locate cavities containing host larvae. *Podoschistus scutellaris* has very flexible tips to its antennae, for exploring cracks in wood. *Netelia fuscicornis* is a relatively common species which is very seldom reared; it is a koinobiont ectoparasitoid of noctuid moth larvae, only ovipositing on last instar hosts and then consuming the host when it has cocooned. *Adelognathus* species are koinobiont ectoparasitoids of sawfly larvae, but some of them are also idiobionts. *Stauropoctonus bombycivorus* is a parasitoid of the Lobster Moth, but with a much more restricted distribution than its host. *Ophion slaviceki* is a common and widespread species but for a long time its host was unknown; the host was deduced to be the Heart and Dart Moth, among others, and was proved to be this only quite recently. Cocoon production by the wasp larvae involves spinning a lot of silk. In the Campopleginae, koinobionts which form their cocoons often in exposed places, the silk of the cocoon is patterned to look like bird droppings, and some cocoons can jump. In most Hymenoptera silk is produced from the mouth, whereas *Euplectrus* species, as with some other chalcid wasps, produce silk from anal glands. *Euplectrus* lay several eggs on one host larva, which hatch to feed externally. *Euplectus* defacate only once in their lifetime, the hind gut only conects to the mid-gut in the pre-pupa, adults can only excrete liquid.

Euplectrus defecation Gavin Broad

Talking about specialised structural features of these wasps, Gavin said that mostly their purpose was unknown, but the 'wasp waist', formed from the first tergite, gave flexibility. Some species are very distinctive in appearance, and have different strategies for approaching hosts: *Hybizon* species search, whereas the related *Ghilaromma* ambush ant columns carrying larvae, and *Euceros* are hyperparasitoids on other ichneumons, laying eggs with stalks, the emerging larvae waiting for passing secondary (caterpillar) host larvae.

Mummified caterpillar Gavin Broad

Gavin then talked about the genome work being done in the Tree of Life project, describing the formal procedures for collection, recording, identification, sampling and photo voucher retention, before samples are sent for genome sequencing: the head is used for RNA, the thorax for DNA, and the legs for barcoding. He said that only three Ichneumonoids had been sequenced so far, 0.12 % of British species, compared with 37% of British *Bombus* species. Sequencing is necessary to see what changes have occurred and to build up a picture of the mechanisms behind their amazing natural history. Barcoding (sequencing a short fragment of a gene on the mitochondrial DNA) is used to verify identification, but it has its pitfalls, with only 57% of Ichneumonoid barcodes giving straightforward matches, the rest being to genus only, or mismatches, or matches to outdated species concepts. To help with problems, a rearing facility should be set up, to get wasps from known hosts, as this is the only realistic way to find many species, to deal with all the little things looking the same, and to overcome the shortage of expertise.

Gavin finished by saying that some species were not rare, but we have no idea what they were doing.

Reference

Broad, G. R., Shaw, M. R., Fitton, M. G. (2018) *The ichneumonid wasps of Britain and Ireland (Hymenoptera: Ichneumonidae): their classification and biology.* Handbooks for the Identification of British Insects vol 7, Part 12. Royal Entomological Society and Field Studies Council, Telford.

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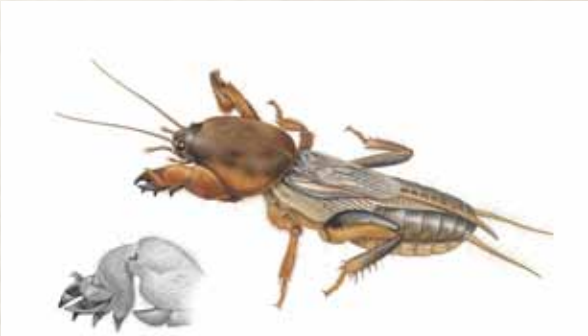
In conversation with Brett Westwood, **Richard Lewington** talked about *Illustrating Insects – New Projects*, referring to the books he was working on: Bumble Bees and Orthoptera. Only in recent years had there been specialised books on Bumble Bees, of which there are 27 species in Britain. They have difficult identification features, and effects of lighting and positioning mean that photographs cannot show the detail which it is possible to illustrate by using different examples to create the 'perfect specimen' in a painting. When producing the postage stamp series, as art, some artistic licence had been allowed, and Richard showed us both the originals and finished versions of the Bilberry Bumble Bee and the Great Yellow Bumble Bee. Brett asked about colour forms of species, and fading of individuals, and Richard said that finer details could compensate for these, and that pages showing comparative aspects were used.

Great Green Bush Cricket (male) Richard Lewington

For Orthoptera, museum specimens were not well preserved, so field collection was essential, and Richard showed his illustrations of the three native Cockroaches, and the introduced American one. Brett said that the Earwig page took illustration to a new level compared with older books. A picture of the introduced Stick Insect now found in SW England showed the importance of texture, with the prickles all over its body.

Richard used his illustration of the Great Green Bush Cricket to show how he built up the picture, starting with a pencil drawing at three times life size and adding colour washes and detail in stages, using scans and then adjustment. Asked about tiny marks, he said he would blow up the painting, add the marks and then reduce it again, and some details were done in pencil on the final version. He commented that bristles had to be counted, and long antennae needed a very steady hand. Some species required larger detailed paintings, such as that of the front leg of the Mole Cricket; this illustration was of the specimen in the Hope Department collection in Oxford as he hadn't seen a live one. Brett marvelled at the way Richard's technique brought out the velvety texture of the Mole Cricket's thorax. For Grasshoppers, the range of colour forms and details of the thorax were essential. The Blue Winged Grasshopper now found in the Scilly Isles has remarkable hind wings, with venation that had to be shown accurately.

Brett asked how much time was taken over one illustration, Richard said it would be a matter of days.



Mole Cricket Richard Lewington

Mel Mason asked '*What Have Lepidoptera Ever Done for Us?'*, and he answered 'butterflies and moths are good pollinators, the basis of many food chains, excellent indicators of a healthy environment, important to our mental well-being, and one has recently saved millions of lives - the Fall Army Moth, a pest of maize, is used to manufacture a protein to make the Novovax Covid19 vaccine'. His subtitle '*Is Conservation Working*' then led us for answers into two projects giving different answers: the Malvern Grayling project and the Malvern Hills Lost Fritillaries project.

Malvern Grayling Mel Mason

Mel showed data on the history of butterfly recording on the Malvern Hills indicating a decline in species from 46 in 1886, 40 by the 1960s, 37 by the 1980s to 33 today, all the Fritillaries being gone, but with the good news of the Essex Skipper colonising from 2001. Currently, there are 15 butterfly transects around the Malverns generating up to 40,000 records per year, at sites from Blackhouse Wood and the Knapp and Papermill north of the hills, through sites high on the hills from North Hill down to Chase End Hill at the south, and lowland sites on commons and meadows to the east.

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The sunny eastern slopes of North Hill support one of the most remote inland colonies in Britain of the 'Vulnerable' Grayling *Hipparchia semele*. Habitat management by volunteers on these precipitous slopes is aimed at cutting back scrub to maintain bare rock, where sheep's fescue grows in crevices and provides food for the caterpillars. Timed counts of adults every other day during July have shown fluctuations on a downward trend, and the population crashed in 2020 with even fewer sightings in 2021. A warm day in January 2020 saw an invasion of *Ichneumon xanthorius*, so parasitisation could be partly to blame, but was it cause or correlation? So: should the Malvern Grayling be allowed to go extinct? Had management been too cautious? Should they be re-introduced after five years, to break a cycle of parasites and contamination? Or should Natural England's 'Strategic Direction', *being prepared to take risks and sustain some losses in order to secure greater gains*, be the guiding principle to support an emergency top-up and perhaps prevent an inevitable extinction?

Thirty years ago, there were still three Fritillary species breeding on the hills: Pearl-bordered *Boloria Euphrosyne*, Small Pearl-bordered *B. selene*, and High Brown *Argynnis adippe*, but it was clear that management to sustain their populations was a harder task than had been thought. Data from the South Malvern transect by Digby Wood showed numbers of all three collapsing in 1988, with some recoveries of Pearl-bordered and Small Pearl-bordered until persistent failure from 1993, while High Brown had strong recoveries in 1991 and 1995 before collapsing in 2002. At the same time, avid collectors may have contributed to the decline of these populations. Important questions for a re-introduction project were: why did these species become extinct? Is it a habitat problem? Which should be the receptor sites and the donor sites? Is there support from partner organisations? Can better understood habitat modification begin without delay? With positive answers, and with over £15,000 raised, the project was approved by Butterfly Conservation and Natural England and could go ahead.

Pearl-bordered Fritillary on Birdsfoot trefoil Mel Mason

The 'Endangered' Pearl-bordered Fritillary (PBF) was deemed most appropriate for re-introduction. Mel explained how the project focussed on connectivity of habitat along the Malvern Hills. Recent surveys of former strongholds found plentiful Common Dog-Violet *Viola riviniana*, the larval food plant, but also identified problems with habitat management on the bracken slopes. The Malvern habitat was similar to the Ewyas Harold Fritillary site in Herefordshire, where appropriate management of bracken and scrub had led to sustainable and recent increases in the PBF population, and similarly in the Wyre Forest. The adult butterfly is on the wing from April to June, 1st to 4th caterpillar instars feeding from June to July, then diapause from August to February under bracken and oak leaves, and finally 4th and 5th instars emerging the following Spring to feed again before pupation. This is a Spring butterfly taking advantage of the warm surface temperature of bracken litter on south facing slopes, when air temperatures can still be cool. Nectar sources include Bugle, Ground-ivy, Bird's-foot Trefoil, Violets and Dandelions. Good habitats have violets growing under the bracken, in partial shade, not too much grass and not too much bracken litter.

Mel described captive larval breeding, in the 'Pearl Hotel, with 5 instar accommodation': a gazebo on his terrace. Volunteers raised hundreds of violet seedlings, then transferred into pots, under nets, with predators and parasitoids removed. Four gravid females collected in the Wyre Forest were introduced, eggs and all larval stages were seen and successful progress to diapause under oak leaves was achieved, ready for 5th instars to emerge in Spring 2022.

Returning to his initial questions, Mel asked: 'Is it important?', answering that, 'It is essential to engage with landowners who are willing to modify their habitat management and help to decrease the decline in biodiversity. Butterflies are very good indicators of the health of our environment and if we successfully reintroduce the PBF, one of our most at-risk UK species, then chances are that we are getting it right for rest of our wildlife too'.

Pearl-bordered Fritillary on Bluebell Mel Mason

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He listed some successes of habitat management on the Malvern Hills: Silver Washed Fritillary increasing in numbers along managed woodland corridors; Common Blue, Brown Argus and Six-spot Burnet numbers increasing on wider margins left uncut around floral-rich meadows; while maintaining habitat for less common species including Grayling, Dingy Skipper, White-letter Hairstreak, Purple Hairstreak, Green Hairstreak, Small Heath and Emperor Moth. Of those butterflies and moths that had disappeared from the Malverns, he could report recent new sightings of Grizzled Skipper, Wall, and this year the first sighting of Purple Emperor since the 1970s, plus the first ever record for the West Midlands of the Dark Crimson Underwing moth.

Mel then introduced us to the Butterfly Conservation's five-year strategy from 2021 to 2025, which aims to halve the number of threatened species, improve the condition of 100 important landscapes, transform 100,000 wild places and raise over £8 million per annum.

Jean Young, in talking about *Little Things, Dead Things and the odd Pile of Poo*, said that she had only recently taken to such close observation of the natural world, but with her Olympus TG camera in hand and concentrating on her immediate surroundings in South Worcestershire she had been looking at the details of insect structures and at their behaviour.

Starting with feet, Jean showed us a view from below of the flightless ectoparasite of House Martins, *Crataerina hirundinis*, with structures that enable them to clamber through feathers. Looking at the undersides of insects on windows, she noticed the hairy pads on the Green Dock Beetle's feet, which combined with secretions, help them to walk on smooth surfaces. A close-up of the Poplar Hawk Moth larva showed the detail of its prolegs as well as spikes all over its body.

Turning to the ways in which bugs pierce their foodstuffs, Jean drew attention to the broad flat rostrum of a Bronze Shieldbug *Troilus luridus* nymph impaling a ladybird, the segmented rostrum of a Dock Bug feeding on a blackberry and, back to the window again, the way the long stylet of the Green Shieldbug *Palomena prasina* hinges back under the body, with a front view showing the jointed labium which sheathes the stylet.

Head-on views of bees showed the details of their mouth parts to give a scissor action, and a view of the back of a dragonfly showed the spines on its legs and the articulation of the wings into the massive musculature housed in the thorax.

Jean then showed us her extended observations of Jet Black Ants *Lasius fulginosus* and giant aphids *Stomaphis graphii* on a sycamore tree. The giant aphids occupy crevices in the bark of maples and have rostra which can be several times the length of the body with which they pierce through thick bark. As the juveniles move about and feed, and as they take a long time to pull the rostrum out from its resting position underneath,


Green Shieldbug Jean Young

they are vulnerable, and wouldn not survive without the ants clustering over them. In some areas the ants create piles of debris on the bark of the tree to protect the aphids. Using the video function of the Olympus TG camera, Jean recorded the ants using their antennae to stimulate the aphids to secrete honeydew, and moving on other insects that get in the way or threaten their 'livestock'. *S. graphii* is very rare, with Paul Whitehead's 1993 Worcestershire record on Bredon Hill, not far from Jean's site, being the only one until recent records in Cambridgeshire and possibly Middlesex, associated with *Lasius brunneus*. The other giant aphid, *S. quercus*, is also rare, formerly known mostly in East Anglia. Jean showed us her probable record, on an oak tree, attended by *L. fulginosus*. She encouraged us to search next year, looking for the piles of debris at the bases of trees near ant pathways and searching tree trunks for clusters of ants over cracks and crevices.

More little things included the tiny Chalcid wasp *Ormyrus nitidulus*, a parasite of larvae in galls. Turning to dead things, Jean recommended collecting dead insects and showed that the exuvium of the Hairy Shieldbug *Dolycoris baccarum* retains fine details such as hairs. On a dead honeybee, she photographed the hooks which link the wings. Dying things included a parasitized aphid, the wasp larva emerging and making a 'volcano' to pupate in. Then there was the horror-fest of fungified flies, with mycelium and spores emerging, and sometimes behavioural changes such as making the insect climb to a high point so that spores could spread further. Beetles get fungified too: finding a dead 24-spot ladybird which she thought had been parasitized, Jean found that it was in fact host to a fungus which Helen Roy and a Danish authority thought might be new to science. Looking at the eggs of the Green Dock Beetle *Cassida rubiginosa* on the underside of a leaf, she noticed some pale ones among the normal yellow

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eggs, and on consulting Rosemary Winnall and Brett Westwood who referred her to an article in British Wildlife, she realised they had been parasitized by the rare hoverfly *Parasyrphus nigritarsis*, whose larvae hatch first and eat the beetle eggs and larvae, and she was able to watch the gruesome process. More little things included lots of the little Fairy Ring Longhorn beetles *Pseudovadonia livida*, which are unusual in breeding below ground on the fungi of fairy rings, rather than in wood.

Turning to piles of poo, Jean notes the evidence they provide as to what has been passing by, and she likes to poke around to see what was eaten, finding both poo and pellets good sources of beetle remains. Some insect larvae look like bird droppings; others, such as those of lacewings, disguise themselves with their own poo. The larva of the Thistle Tortoise Beetle *Cassida rubiginosa* makes a 'parasol' which it sticks to spines on its rear and which includes undigested toxic substances derived from its food plant; if it loses this it gets eaten.

After being enthralled by Jean's detailed and patient observation, more of us should be enthused to follow her example.

Beetle larva being eaten by fly larvae Jean Young

Bob Kemp said we all treasure *Magic Moments*, defined as 'a brief experience perceived to be special in some way and indelibly etched on the memory'. For naturalists these may be new or unique encounters or special ecological or behavioural observations. Bob's selection included 'mini moments' of recent butterfly encounters, one that was the result of someone else's diligence, and an encounter with a large damselfly in Nepal with interesting behaviour.

Some of Bob's butterfly mini moments came about because of their attraction to dung: a cluster of Small Blues, a Chalkhill Blue, and a Purple Emperor. With patience, he eventually had each posing for more aesthetically pleasing photographs on a flower or on rocks. There was also a lovely Silver Washed Fritillary, an aberrant Common Blue with black spots on the underside of the forewing, and an aberrant Peacock with smudged markings and lacking the blue bits.

Bob had long searched for the rare Phantom Hoverfly *Doros profuges*, and he joined a field trip to the limestone area around Morecambe Bay, one of its few known locations. A long day's recording among the grassland and ancient woodland produced such rarities as the hornet mimic *Conops vesicularis*, and two limestone specialists: the hoverfly *Microdon mutabilis*, which is associated with *Formica lemani*, and *Aricia Artaxerxes*, the Northern Brown Argus, this one the *Salmacis* form. It was only towards the end of the day that another member of the group, in a woodland ride which Bob had already traversed, found the elusive Phantom at rest on a bramble leaf, giving Bob his magic moment through another's diligence.

Among specimens sent to the UK by ex-pats and locals involved in the Nepalese Dragonfly Project, which had begun in the 1980s, was a very large robust Damselfly *Philoganga montana*, known in forested areas of Northern India but then new to Nepal. Bob wanted to see it, and 21 years ago he and another Odonatologist went to Nepal and explored the margins of Pokhara Lake, its known site. After searching lakeside vegetation without any sign of it, only when they got to a promontory where trees overhung the water did they find their quarry, lots of them, and realised that it is an arboreal species, living high in the canopy and ovipositing in tree bark, the larvae either dropping into the water or climbing down. He showed us video footage of this remarkable insect. Truly a magic moment.

Doros profuges Bob Kemp