

Entomology Day 2019 Insects and their Lifestyles

CHAIR: GRAHAM HILL, REPORT: SUSAN LIMBREY



From left: Peter Creed, Zoë Randle, John Bingham, Liam Crowley, Mike Averill, Rosemary Winnall, Graham Hill

This year's Entomology Day gave us the genesis and content of an important new book, an exploration of insect-rich sites few of us had visited, research of significance in relation to climate change, beetles surviving from ancient woodland, news of migrating dragonflies and damselflies, and a demonstration of the value of filming insects to understand their behaviour.

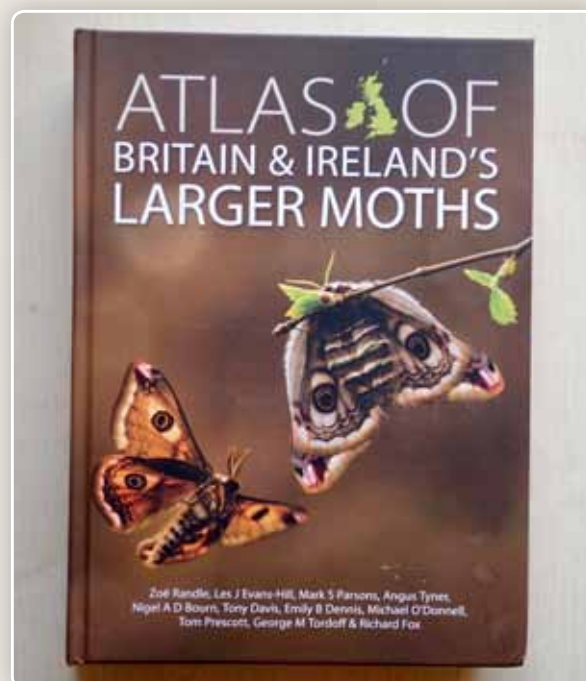
Dr Zoë Randle got the day off to a flying start by announcing the imminent launch of the Atlas of British and Ireland's Larger Moths (Pisces Publications, 2019), explaining how the project was a partnership between Butterfly Conservation and MothsIreland. Data were submitted to Butterfly Conservation's National Moth Recording Scheme via the network of County Moth Recorders. Funding came from sponsors, businesses and trusts. A bright idea, moth auctions, had people bidding to sponsor their chosen species: 173 species were reserved in advance and 602 bought, with bidding wars for popular species.

A verification panel included regional experts and Butterfly Conservation staff, and MothsIreland's panels. As records accumulated and were mapped, quality control to check 'dodgy dots' and missing records showed up about 10,000 dubious records, and 482 species were referred back to County Recorders. 4,500 records were retained, 2,500 rejected, with no response for 3,000. Missing records were chased up for 80 species. Dodgy dates were checked, showing up mismatches in date format, life stages and sampling methods. Zoë estimates that possible errors might now affect only 0.05% of dates, 0.04% of distribution.

Records from the NMRS were fed into occupation modelling which produced robust long term distribution trends for 511 species and aggregates, and short term ones for 559. Abundance data from the Rothamsted Insect Survey light trap network were used to calculate long-term population trends. The Irish data were too sparse to produce distribution

and abundance trends so the trends are for GB only. Phenology charts showed, for the periods 1970-1999 and 2000-2016, the proportion of records by flight period, and latitude by flight period.

Zoë showed us that, with two species to a page, the result is a miracle of book design and data presentation. Varying somewhat according to numbers of records and statistical significance of data, each species has a photograph (with attribution), a map colour coded with pre-1970, 1970-1999, and 2000-2016 distributions, numbers of records for each period, conservation status (GB and Ireland), percentages changes in GB distribution for the periods 1970-99 and 2000-2016 and in GB abundance for 1970-2016, a phenology chart, a succinct text focussed on status, habitat and significant changes, and the names of people who sponsored the species. Some photos were not easy to obtain: the Minsmere Crimson Underwing, has only one record and this moth was eaten in the trap by a hornet, leaving only the wings.





To demonstrate the four different types of phenology chart, Zoë selected the Riband Wave *Idaea aversata* for which proportion of records against flight period showed little change, the Brimstone Moth *Opisthograptis luteolata* with latitude by flight period showing at least two generations in the south with only one in the north, the Swallow-tailed Moth *Ourapteryx sambucaria* for which comparison of latitude by flight period in the two periods shows a new second generation, and finally, a bespoke chart for the single record of the Cameo Moth *Crypsedra gemmea*. Picking out species which showed particular trends, we saw that the Great Prominent *Peridea anceps* peaks earlier, while the Scarce Umber *Agriopsis aurantaria* peaks later and the Pretty Chalk Carpet *Melanthia procellata* has an extended period and a broader peak. The Red Carpet *Xanthorhoe decoloraria* showed little change, while the Spruce Carpet *Thera britannica* has its second brood increased in the north compared with its first, and has spread further north. Straw Dot *Rivula sericealis* has increased in distribution and numbers and now has two generations much further north than in the 1970s. Dotted Clay *Xestia baja* has decreased greatly, and has gone from parts of southern, central and eastern England; it is not clear why, but Zoë noted the parallel with losses of the Wall Brown butterfly. The Chamomile Shark *Cucullia chamomillae* has increased in numbers, spread further north, and appears earlier.

Assessing recording activity Zoë showed how it had

increased strongly with time, the most well recorded 10km square in Britain is in the Isles of Scilly and in Ireland it is in Co. Wicklow. In Britain species density was highest in a 10km square in Kent and in Ireland it was a square in Co. Wicklow.

Considering the overall results of the project, occupancy modelling showed that between 1970 and 2016, of 390 species distribution had gone down for 42% and up for 58%, with statistically significant results showing 46 species experiencing losses of more than 50% and 36 species more than doubling their distribution. Abundance trends for 397 species showed 62% species going down and 38% going up, with statistically significant results having 108 species becoming fewer by at least 50%, and 35 at least doubling; an extreme example was the Buff Footman *Eilema depressa* gaining by an extraordinary 84.589%. Phenology results of 405 single-brood species showed average mean flight dates being 4.8 days earlier between the two periods, with 81% flying earlier and 19% later.

After talking about drivers of change, Zoë said that distribution data underpinned conservation efforts, targeting agri-environment schemes, habitat restoration on a landscape scale, and the designation and management of sites. Further use of the data accumulated in the project will bring improved understanding, scientific research, awareness and education.

Finally Zoë expressed the project's gratitude to everyone who had contributed.

Peter Creed, in telling us about his Insect studies around Cothill, Oxfordshire's 'Breckland', described sites near Abingdon where the geology of Corallian Limestone and Sand yields calcareous water into four small reserves, managed by the Berks, Bucks and Oxon Wildlife Trust. An adjacent abandoned airfield extends the protected area. Wetland and heathland vegetation, with open sandy areas, both base-rich and acid, and quarry faces, giving shelter and warmth, provide a wide range of habitats, and attract a great diversity and abundance of insects, including some more usually seen in warmer locations and even coastal sites.

After giving us a tour of the sites, with their rich and varied flora, Peter picked out some of the rare, local and unusual insects he has recorded in the range of habitats the 'Cothill Fens' provide. Wetland hosts the very rare Southern Damselfly *Coenagrion mercuriale* on two of the reserves, together with abundant Keeled Skimmers *Orthetrum coerulescens*, a heathland species. The Great Green Bush-cricket *Tettigonia viridissima* is



found on brambles, and the Slender Ground-hopper *Tetrix subulata* in fen areas. The tiny Forget-me-not Shieldbug *Sehirus luctuosus* occurs in the early spring, the equally small Knobbed Shieldbug *Podops inuncta* can be seen in sandy areas, and the Crucifer Shieldbug *Eurydema oleracea* shows its colour variations.

Calcareous areas provide hunting grounds for a beetle *Ablattaria laevigata*, and the rich flora hosts flower beetles, including the tiny *Anthocomus rufus*, a wetland specialist with colours that can be bright, subdued or dark. The Fairy-ring Longhorn Beetle *Pseudovadonia livida*, with its hairy elytra, finds the fungi it needs in the calcareous grassland, where its rather short antennae contrast with the very long ones of the Golden-bloomed Grey Longhorn Beetle *Agapanthia villosiviridescens*. Also on calcareous grassland, the Marbled White butterfly *Melanargia galathea* is very abundant. Nearly every year the Six-belted Clearwing moth *Bembecia ichneumoniformis* turns up, and the Brassy Longhorn moth *Nemophora metallica* is seen nectaring on scabious.

The Cothill Fens are a well-known parade ground for the army of Soldier Flies, ranked by size in their colourful uniforms. The nationally rare Clubbed General *Stratiomys chamaeleon*, known only here and in Anglesey, and the similar but commoner Banded General *S. potamida*, both favour wild parsnip. The rare Orange-horned Green Colonel *Odontomyia*



angulata, lurks in the base of fen vegetation over water, while the Silver Colonel *O. argentata* is easier to see with its reflective silver abdomen. The little Three-lined Soldier *Oxycera trilineata* is common here but hardly ever seen.

Flies abound: among them, the Dotted Bee-fly *Bombylius discolor* now occurs and is spreading, as we see in Worcestershire, and among the hoverflies which Peter mentioned was the uncommon *Cheilosia chrysocoma*. Other flies included the rare Tachinid *Mintho rufiventris*. One of the quarries, Hitchcose Pit, has big sandy areas which are brilliant for ants and wasps and bees, it has the very local Small Velvet Ant *Smicromyrme rufipes*, and digger wasps including the rare *Gorytes laticinctus* and the Bee-wolf *Philanthus triangulum*. Arriving in 2009, the Ivy Bee *Colletes hederæ* is now abundant. The Large Yellow-face Bee *Hylaeus signatus* is seen on weld and mignonette, and the very local Large Scabious Mining Bee *Andrena hattorfiana* with its pink pantaloons stuffed with scabious pollen. The Wood-carving Leafcutter Bee *Megachile ligniseca* loves woolly thistles; its parasite, the Dull-vented Sharp-tail Bee *Coelioxys elongata* is present but not often seen.



Peter finished with a recent arrival, the very rare Armed Nomad Bee *Nomada armata*, which, perhaps coming from Salisbury Plain, was seen in Dry Sandford Pit in 2018, on the same day that one was recorded at Princes Risborough, and it turned up at the same spot in 2019.

In *Bees, Bugs, Carbon and Trees: Woodland Insects and Climate Change*, **Liam Crowley** told us about his PhD research as part of the team carrying out experiments to quantify the impact of insects on the carbon cycle in a forest. The Birmingham Institute of Forest Research has set up a Free Air CO₂ Enrichment (FACE) facility in a Staffordshire woodland which has 200 years of continuous cover, characterised by 150-year old oak standards with a hazel understory. Six arrays have been carefully built to bathe experimental



plots in elevated CO₂, three with +150ppm CO₂ and 3 control plots with ambient air. Liam emphasised the key role that insects play in the carbon cycle, and how the enhanced CO₂ may indirectly affect them via the impact on photosynthesis and plant chemistry. They should be the first group to respond to changing CO₂ levels, because of their abundance and short generation time, and can have a big impact, turning entire ecosystems from a carbon sink to a carbon source through tree mortality, so, Liam asks, are insects the key drivers of change in woodland ecosystems under climate change?

Herbivorous animals need nitrogen, tissues with lower N/C ratio being less nutritious, and different groups have different feeding strategies. Liam chose leaf-miners for his research because their whole feeding history is within the mine and so open to quantification, and he set up three hypotheses, by which enhancement of CO₂ would lead to rise, fall, or no change in herbivory.

The methodology involved determining which species were present on oak and hazel, how many there were, and how much they were eating. Four key species of leaf-miner were identified on both oak and hazel, all micromoths. For two years, 2017 and 2018, he looked at 1200 leaves from each tree species in ambient air and under CO₂ enhancement, observing that 40% were mined, and for 120 leaves from each he used imaging to determine the areas of the mines. A rough calculation came up with a figure of 2 square metres of leaf being eaten per tree. Showing us his results for oak, he said that there was no difference in abundance of miners, although there was a consistent decrease in feeding under elevated CO₂, particularly in the second year. Liam is awaiting the results from leaf biochemistry experiments to see if this is caused by a decrease in nitrogen or an increase in defensive compounds.

This article is an extract from the Wyre Forest Study Group annual Review 2019



Liam's more recent research in the wood saw him spending a lot of time watching bluebells. In the control and the CO₂ enhanced arrays, he recorded the phenology of the bluebell flowering and the insects which visited them. Six hoverflies, six bumblebees, and one butterfly species (*Pieris rapae*) recorded the most visits, plus a number of other insects, such as beetles, flies and wasps, which visited in smaller numbers, nectaring and perhaps eating pollen but not moving much of it about, or just resting. Weevils and shield bugs were amongst the less convincing pollinators still, often sitting on the plant but not entering the flower. He collected fruit from early, middle and late in the flowering period, and, measuring pollination success by the number of seeds per fruit, he found that the middle stage produced more seeds, and that at all stages more CO₂ meant more seeds. Asking how phenology of flowering under climatic change might affect pollination, he suggested that with bud-burst earlier there could be a mismatch between flowers and pollinators, but maybe other species would move in.

Liam finished by showing us a rare find from the site, the tiny solitary wasp *Embolemus ruddii*, which parasitizes root-feeding planthoppers. This was only the 21st record of the species in the UK and the first since 1997. He had brought the specimen with him.



Wyre Forest Study Group

John Bingham started his talk Introduction to Saproxyllic Beetles by explaining that to qualify as saproxyllic, invertebrates must, for at least part of their life, be dependent on dead or decaying wood, directly or by depending on other organisms that are. Among the beetles are fungal red-rot feeders and white-rot feeders, those that eat sap wood, cambium or bark, those that exploit dead animals inside trees, those eating fungi and predators of other wood-boring beetles. He told us we have to search among ancient trees, in forests, parkland, wood pasture, traditional orchards, looking at dead standing and fallen timber, stumps, fungi and structural habitats such as hedges, flowering plants, and use traps and nets, beat, stare at tree trunks, in sun, using a torch at night, using binoculars, and scrabble in litter and soil at the base of trees.

Asking why Britain is special within Europe for these beetles, John focussed on ancient oak trees for their crucial role in the continuity of the habitat, saying that our saproxyllic fauna is a kind of fossil of the ancient landscape of open forest. Sub-fossil beetle faunas from 9500-6000BC are mostly those of pasture woodland, but by 4000BC they come from open landscapes and have a lot of dung beetles. England has 3,400 ancient trees, 117 being older than 600 years, while the rest of Europe has only 2,000, with only 85 over 600 years. We have, however lost many thousands since the Forestry Commission was founded in 1918 and with the spread of commercial forestry, especially in the 1950s to 1970s, 200 years later than other European countries. 55% of our ancient trees are found in 10 counties, including Worcestershire and Shropshire, with Herefordshire being top with 366 oaks older than 400 years.

John explained the ranking of BAP habitats by the Saproxyllic Quality Index, SQI, on the number of key species, and the Ecological Continuity Index, IEC, on habitat continuity over time. Top sites by SQI are New Forest, Windsor, Bredon Hill, Langley Park and Richmond Park, and by IEC are Windsor, New Forest,

Moccas Park, Bredon Hill and Sherwood Forest. Top local SQI sites are Croome, Moccas, Longdon Marsh, Hanbury Park, and Brockhampton; Wyre Forest, with 131 species, ranks 51 out of 210 sites.



John then went through species of particular significance, starting with Rove beetles. The Hornet Rove Beetle, *Velleius dilatatus*, whose larvae feed on detritus in hornet nests, is not much looked for as it flies at night, but adults are attracted to Goat Moth sap runs; the fungivorous *Scaphidium quadrimaculatum* is widespread in rotting timber and the very small *Gyrophana transversalis* feeds on bracket fungi. At Grimley, Denise Bingham found only the third one recorded in Britain. The Stag Beetle and the Lesser Stag Beetle, *Lucanus cervus* and *Dorcus parallelepipedus* are dead wood feeders, the former in moist decaying wood near or below the soil surface, and flying at dusk, and the latter developing in white-rot decayed heart wood and often flying on summer evenings. The very local Oak Jewel Beetle, *Agilus biguttatus=pannonicus* increased after the 1987 storm. They favour trees under stress, larvae tunnelling under thick oak bark; like another jewel beetle, the nationally scarce B A. *laticornis*, they are wood borers. Of the click beetles, the BAP species *Ampedus nigerrimus* is found only in Windsor Forest, its larvae developing in large red-rot decaying oak; it hibernates as an adult. *Ampedus balteatus*, developing in red-rotted stumps, occurs locally in south Worcestershire, Shropshire and Herefordshire. The False Click Beetle, *Melasis buprestoides*, uses rather hard standing and fallen dead trunks of various species. The very small net-winged beetle, *Platycis minutus* is very local, its larvae feeding in soft, decaying heartwood, especially of beech and ash, mostly in closed-canopy ancient woodland.

The extraordinary hairy, bristly larva of the Cobweb Beetle *Ctesias serra* avoids being eaten by spiders as it steals their prey in webby spaces under bark, and the Furniture Beetle, *Anobium punctatum* uses





Thanasimus formicarius

John Bingham

sapwood and heartwood of many dead trees. The Spider Beetle, *Ptinus fur* can exploit a wide range of dry organic debris. The Chequered Beetle *Tillus elongatus* is a predator on other beetles, its larvae hunting at night on and under bark, and another predator on beetles, in dead wood, is the Ant Beetle *Thanasimus formicarius*, a mimic of wood ants. The Sap Beetle *Soronia punctatissima* is attracted to sappy stumps of oak and alder and trees attacked by goat moths and clearwing moths, and the Root Eating Beetle *Rhizophagus dispar* is found under bark of dead trees and in bracket fungi. Fungus beetles include the Hairy Fungus Beetle *Mycetophagus quadripustulatus* whose adults are found under fungoid bark and on soft bracket fungi, while Nationally Scarce B M. *piceus* is found in red-rot decaying oak in ancient woodland and wood pasture, and the Pleasing Fungus Beetle *Tritoma bipustulata* live in wood-decay in fungus especially on beech. The Bark Beetle *Bitoma crenata* is a beetle of ancient wood pasture where it is found under bark of dead beech and oak early in their decay, the Flat Bark Beetle *Silvanus unidentatus* also found under bark of dead wood, and the Darkling Beetle *Prionychus ater* is a nocturnal species whose larvae live in black mould in tree hollows, often where birds have nested.

Wood borers include the Oak Pinhole Borer *Platypus cylindrica*, the female being attracted by the smell of fermenting sap and fresh-cut timber and boring deep



Platypus cylindrica

John Bingham

into heartwood, larvae eating fungal growth. A minute Tree Fungus Beetle, *Cis boleti* develops in expanded bodies of *Trametes versicolor*, and the Hide Beetle *Megatoma undata* is a scavenger on cast skins and cocoons in nests and burrows of other insects. The Cylindrical Bark Beetle *Colydium elongatum* lives under the bark of dead trees preying on larvae of *Platypus* and *Xyloterus* beetles. The black-headed Cardinal Beetle *Pyrochroa coccinea* is also a predator, hunting other insect larvae under bark of newly dead timber mainly in ancient woodland and wood pasture, and the False Darkling Beetle *Phliotrya vaudoueri* is another denizen of ancient wood pasture, in relatively soft dead sapwood of boughs of beech and oak. The Longhorn Beetle *Anoplodera sexguttata* is very much a relic old forest species, developing in dead branches of beech and oak, and the very local Fungus Weevil *Platyrhinus resinosus* develops in the cramp-ball fungus on ash or beech.

Mike Averill: Dragonfly News! Mike started by giving us an idea of the range of distances dragonflies could travel, as context for his news about arrivals and movements in Britain and in Worcestershire. The remarkable ability of the world-wide Wandering Glider to exploit high altitude winds to travel 14000 km in four generations, with tagged individuals found to get from India to Africa and back, was contrasted with endemic species in Madagascar whose lack of such wanderlust puts them at risk of extinction. He then showed how the British fauna has been shaped by movements in the last hundred years, speeding up in recent years: of the 57 recorded species, 42 breed here, with up to 15 immigrating regularly, some reaching Worcestershire. 3 species have gone extinct since 1950, though one of these has been re-found.

Some unusual species have arrived in Britain: the Yellow Spotted Emerald Damselfly *Somatochlora flavomaculata* arrived in 2018; the Banded Darter Dragonfly *Sympetrum pedemontanum* appeared in Brecon in 1995, and the Large White-faced Darter *Leucorrhinia pectoralis* has been recorded a few times,



Club-tailed Dragonfly

Mike Averill

the last in 2012. 2018 and 2019 have been spectacular years, the first for migrant and dispersive species, the second for numbers, so what might come next? Of the species which might hop the channel, Mike said the Southern Skimmer *Orthetrum brunneum* was poised in northern France and the Netherlands.

Turning to Worcestershire, we have records of 20 Dragonfly species and 10 Damsels, showing a steady increase over the years, 20 species breeding regularly. The Hairy Damselfly *Brachytron pratense* was recorded again in 2012, after being absent from 1977 to 2011. In 1995, the Yellow-winged Darter *Sympetrum flaveolum* was the first new species for 20 years, but in spite of breeding was not seen again after 1996. The Scarce Chaser *Libellula fulva* came up from Hampshire in 2004, is doing well on the Avon and now on a pond in Hartlebury rather than its usual riverine habitat. The most successful new arrival is the Small Red-eyed Damselfly *Erythromma viridulum*, in Essex in 1998 and Worcestershire since 2006. There was one record of the Downy Emerald Dragonfly *Cordulea aenea* in the county in 2015, and the adventurous Red-veined Darter *Sympetrum fonscolombii*, always pushing at the limits of its range from the Mediterranean, arrived in 2019. The Lesser Emperor Dragonfly *Anax parthenope* has been expanding since the 1990s, with five records in the county. What turned out to be a Vagrant Emperor *A. ephippiger* was recorded in 2019, with a pair seen in tandem, but at a site which dried out, and a Lesser Emperor was later seen egg laying at Ripple, and another at Pirton.



So what next for the county? Mike predicts five arrivals: the Keeled Skimmer *Orthetrum coerulescens*, tenacious of its western bogs and mires, is on the Cleve Hills; the Scarce Blue-tailed Damselfly *Ischnura pumilio*, which tends to be dispersive and favours the temporary and disturbed sites which the county can offer; the Variable Damselfly *Coenagrion pulchellum*, gaining ground, scattered and mobile, on fens,

including those in Shropshire; the Willow Emerald Damselfly *Chalcolestes viridis*, which lays eggs in to the bark of willow tree branches, new to UK in 2000 and spreading strongly from 2008, in Warwickshire in 2019, so likely here in 2020; and the Southern Migrant Hawker *Aeshna affinis*, with breeding colonies already established in the South East England, should be here in 5 years if the climate warming carries on as it has.

Summarising his records of the Club-tailed Dragonfly *Gomphus vulgatissimus* in their stronghold on the Severn, with his counts of exuvia on a 100m stretch, Mike then showed their breeding success on the Severn and Teme in Worcestershire, but that they have gone from the Avon. He then turned to the factors affecting continuing success of dragonflies and damselflies in the county, saying that 50% of our wetlands have been lost in 100 years, leaving less than 1% of the county area as aquatic, but unlike many insects, their mobility means they cope well with fragmented habitats.

Mike turned to contributions that his favourite insects are making to research: the tiny pointed pillars on dragonfly wings, which impale and kill bacteria, are being replicated in polymers being developed to restore vision; in drone design, the 'Skeeter' flies by copying the movement of the four dragonfly wings instead of using rotors; the dragonfly brain has neurones that enable them to focus on small objects against a moving background and anticipate movement of prey, which could lead to innovation in robot vision. Italian scientists have found that male *Ischnura* Damselflies use scent to distinguish males from females, and, finally, Chinese scientists have found amber from the mid-Cretaceous period in Myanmar with Dragonflies trapped in the course of a mating dance.

Rosemary Winnall brought the day to an end by demonstrating her use of Movie to Record Insect Behaviour. She showed us how using simple cameras and deploying a lot of patience, filming insects going about their business can inform our understanding of their use of habitat and resources.



Wyre Forest Study Group

Rosemary started with a female Pantaloon Bee *Dasypoda hirtipes* excavating its nest burrow, all six legs busily distributing sand behind it, and male Ivy Bees buzzing around the nesting site waiting for females and forming a ball when one arrives to start digging. We watched a pair of Welsh Oak Longhorn beetles *Pyrrhidium sanguineum*, the male still holding on, for protection or prevention of access by other males, as the female explored crevices in bark to find suitable ones and then oviposited in each. The tiny Shining Guest Ant *Formicoxenus nitidulus*, something of an obsession of the Wyre Forest Study Group, was watched scrambling over nests of Southern Wood Ants *Formica rufa*, in and out of the holes, ignored by and ignoring its giant hosts, getting us no further in knowing what they are up to but observing that the ones we see seem all to be males. We then watched a Black Oil Beetle *Meloe proscarabaeus*, abdomen swollen with eggs, searching the grassy boundary between bare sand and flowery bank to find a site where her tiny triungulin larvae could emerge to climb onto a flower and wait for a lift on a bee. She dug out short burrows, turned and dipped her hind end in to lay in each one.

Turning then to aquatic sites, Rosemary had recorded a dipper in the shallow edge of the Severn in Bewdley, so that we could see that it was flipping stones over and eating what it found under them. Filming with her Olympus TG4 camera under water, River Nerites *Theodoxus fluviatilis* were found to have had their shells scraped by something, perhaps because of a need for calcium, and freshwater sponges and an alga *Denbrandia rivularis* were seen in their vivid colours. Use of the portable aquarium that Rosemary made from glass let us see mayfly larvae, water scorpions, caddis flies, beetles and water stick insects moving about and interacting in ways that cannot be seen from the surface or when deposited in shallow trays. The most amazing of these observations was the 6cm Duck Leech *Theromyzon tessellatum*, swimming around with



Duck Leech carrying young

Rosemary Winnall

her clutch of young in depression on her underside. In her own garden pond, Rosemary found water lily aphids *Rhopalosiphum nymphaea* on duck weed together with tiny aquatic springtails *Sminthurides* sp. and more of these on the edge of the pond lining, marching about in procession and springing in and out of view, with the smaller 0.5mm males and larger 1mm females clearly distinguished.

Returning to dry land, Rosemary had spent a long time watching a Red-banded Sand Wasp *Ammophila sabulosa* bringing a large moth caterpillar to its nest hole site from a long way away, re-paralysing it when necessary, checking that a hole was free of obstructions before manoeuvring its prey into position to drag it down and lay an egg. The hole was then covered with sand and small stones, and it was clear that she had several other closed nest holes close by. Finally, we saw a Large Pied Hoverfly *Volucella pellucens* waiting in the entrance to a wasp nest in the ground as wasps, ignoring it, flew in and out, till she went inside to lay her eggs.

At the end of the day, Graham Hill thanked all who had contributed to its success, including committee members who had got the programme together, dealt with bookings, registration, car parking and the sound system, people who provided and served refreshments, and above all our superb speakers.



Graham Hill introducing Zoë Randle, Entomology Day 2019